首届慧湖青年博士发展大会
暨2023年西交利物浦大学博士生论坛

THE FIRST WISDOM LAKE POSTGRADUATE RESEARCHER DEVELOPMENT CONFERENCE & 2023 XJTLU POSTGRADUATE RESEARCH SYMPOSIUM

2023年12月13日-15日

DECEMBER 13-15, 2023

江苏苏州工业园区

SUZHOU INDUSTRIAL PARK, JIANGSU

CONTACT

XJTLU GRADUATE SCHOOL

E: GraduateSchool@xjtlu.edu.cn

T: +86(0)512-81889001

L: Room 1117, 11th floor of Central building

Xi'an Jiaotong-Liverpool University

苏州独墅湖科教创新区
Suzhou Dushu Lake Science And Education Innovation District

Xi'an Jiaotong-Liverpool University
西交利物浦大学

ABOUT THE FIRST WISDOM LAKE POSTGRADUATE RESEARCHER DEVELOPMENT CONFERENCE & 2023 XJTLU POSTGRADUATE RESEARCH SYMPOSIUM

The First Wisdom Lake Postgraduate Researcher Development Conference & 2023 XJTLU Postgraduate Research Symposium is dedicated to providing an international academic forum for exchanging and discussing research ideas among doctoral researchers from a wide range of disciplinary areas.

Postgraduate research (PhD) students from universities and institutes all over the world are warmly welcome to showcase their latest research through poster and oral presentation sessions at XJTLU, engage in discussions, and receive feedback from academics, industry experts, and fellow students. In addition, all participants will have the opportunity to directly communicate with industry experts and visit prominent companies within Suzhou Industrial Park (SIP) to gain firsthand insights into technology implementation and explore potential collaborative opportunities.

ADVISED BY

Suzhou Industrial Park Administrative Committee

HOSTED BY

Suzhou Dushu Lake Science and Education Innovation District Administrative Committee
Xi'an Jiaotong-Liverpool University (XJTLU)

SUPPORTED BY

UK-Jiangsu World Class University Consortium
Suzhou Dushu Lake Universities and Colleges Development Union

Event Schedule

13 December 2023

9:00-17:00	Registration	XJTLU Graduate School Help Desk (CB 1117, Central Building, XJTLU)
13:00-17:00	SIP and Companies Visits	Suzhou Industrial Park

14 December 2023

9:00-11:00	Opening Ceremony & Keynote Speeches	CB G13W, Central Building, XJTLU
13:00-14:30	Poster Presentation Sessions	
15:00-17:00	Oral Presentations (parallel sessions I)	International Academic Exchange and Collaboration Centre, XJTLU

15 December 2023

9:00-11:00	Oral Presentations (parallel sessions II)	International Academic Exchange and Collaboration Centre, XJTLU
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3	Optimisation of low-rise lightweight steel-framed residential building design in the hot-summer-cold-winter region of China by life cycle analysis	XJTLU	Yang Yang
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8	Tumor-promoting roles of the chromatin-associated DEK oncogene in metastatic melanoma	XJTLU	Gongjie Wu
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10	m6ACali: Machine learning-powered calibration for accurate m6A detection in MeRIP-Seq	XJTLU	Haokai Ye
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286	Soil metabolome impacts the formation of the eco-corona and adsorption processes on microplastic surfaces	CAS	Shi Yao
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291	The effects of China's supporting policy for resource-exhausted cities on local energy efficiency: An empirical study based on 284 cities in China	XJTU	Yiwen Peng
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350	Soil-transmitted heavy metal exposure and cognitive decline in the elderly: A seven-year cohort study in China	XJTLU	Bingjie Qu
351	Evaluation of multiple organophosphate insecticide exposure in relation to altered thyroid hormones in NHANES adult population	NJMU	Massira Ousseni Diawara
352	Study on the mechanism of Celastrus Orbiculatus extract inhibiting gastric cancer metastasis through the regulation of lactylation by splicing factor PTBP1	YZU	Miao Zhu
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356	Does social support moderate the effect of pandemic shocks on NSSI? Evidence from the post-lockdown period in China	XJTU	Ziwei Qiang

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361	Governance of public-private partnership megaproject(s) in the changing conditions in China: The case of Jiangsu Province	XJTLU	Po Shan Yu
362	Getting public transport networked: How to improve theimplementation of this "wicked" problem	XJTLU	Shaohua Hu
363	Spatio-temporal evolution of key areas of territorial ecological restoration in resource-exhausted cities: A case study of Jiawang District, China	CUMT	Shuai Tong
364	Evaluating and developing the child-friendliness of public open space in residential aresa	XJTLU	Suyuan Tong
365	Accessibility, congestion, and air pollution in residential location choice	XJTLU	Xiaohan Yu
366	The measurement of 15-minute community life circle: Analysis of the spatial pattern and social equity issues – a case study of Suzhou, China	XJTLU	Zhonghui Jiang

INSTITUTION	ABBREVITATION
Anhui University of Science and Technology	AUST
Beijing University of Chemical Technology	BUCT
Chinese Academy of Sciences	CAS
Capital Normal University	CNU
Communication University of China	CUC
China University of Mining and Technology	CUMT
East China Normal University	ECNU
Hunan Agricultural University	HUNAU
University of Leicester	LE
Northeast Normal University	NENU
Ningbo China Institute for Supply Chain Innovation	NISCI
Nanjing Medical University	NJMU
Osaka University	OU
Renmin University of China	RUC
Shanghai University of Finance and Economics	SUFE
Southwest University	SWU
Shenzhen University	SZU
Tongji University	Tongji
University of Chinese Academy of Sciences	UCAS
University of Nottingham Ningbo China	UNNC
University of Science and Technology of China	USTC
Westlake University	WU
Xi'an Jiaotong-Liverpool University	XJTLU
Xi'an Jiaotong University	XJTU
Xiamen University	XMU
Yangzhou University	YZU
Zhejiang University	ZJU

ABSTRACTS

001

ConvoSurface: Conversational architectural surface system for working environment: Artificial intelligence application in designing human-computer interaction-based architecture

Lok Hang CHEUNG (PhD)

SUPERVISORS Juan Carlos Dall'Asta, Giancarlo Di Marco (XJTLU)
Asterios Agkathidis (UoL)

ACADEMY/SCHOOL Design School

Human-computer interaction (HCI) has been explored in the architecture discipline since the 1960s. It stated humans and architecture (as machines) are both designers. However, essential HCI elements such as interactivity, complexity, and physicality are lost despite thriving technological development. The "Conversational" properties which Pask (1969) envisioned have not been developed practically. By introducing AI into the architecture discipline, this research proposes ConvoSurface: a Conversational architectural surface (including building facade, ceiling etc.) system for the working environment. A new parametric tool (Grasshopper plug-in) would be developed for designing HCI-based architecture.

002

Research on the collective characteristics of the fifth generation of Chinese architects —Data analysis based on the media horizon

Xiaoxi GUO (PhD)

SUPERVISORS Wenjun Zhi

UNIVERSITY/INSTITUTE Tongji University / College of Architecture and Urban Planning

In the context of rapidly changing times, the fifth generation of Chinese architectshas brought about a great number of architectural practices and ideological changes. It is diffcult to see the characteristics of this group in the traditional wayof induction and interpretation. The article is basedon a media horizon and the data mining of 100 groups of the fifth generation of Chinese architects, adopting the methods of Knowledge Mapping and SNA to analyzeand visualize the "Group Knowledge Evolution and the"Group Interaction" of the selected architects, as well as to demonstrate the characteristics of architect's thoughts by word-cloud analysis. By quantifying the data and visualizing the results, it attempts to outline the picture of the collective characteristics of the fifth-generation architects.

003

Optimisation of low-rise lightweight steel-framed residential building design in the hot-summer-cold-winter region of China by life cycle analysis

Yang YANG (PhD)

SUPERVISORS Marco Cimillo, Jianli Hao (XJTLU)
David Chow (UoL)

ACADEMY/SCHOOL Design School

According to China's policies and plans, the number of low-rise steel-framed residential buildings in the country will keep increasing, particularly in the hot-summer-cold-winter (HSCW) region. On the other hand, the reduction of carbon emissions from the steel industry and the building sector is critical to fulfilling China's pledge to peak carbon emissions by 2030. Life Cycle Assessment (LCA) is an efficient tool for controlling energy-related emissions in buildings, avoiding burden shifting among different stages of the building's life cycle. However, there is limited research focusing on how the design of LSF houses can be optimised from its early stages and contribute to energy saving and the reduction of buildings' impact over their entire life cycle. Thus, this research aims to identify and optimise the most significant design variables of low-rise LSF residential buildings in the HSCW region of China by using LCA.

004

Making new heritage: Cultural event-driven regeneration of post-industrial spaces in Shenzhen

Yifei LI (PhD)

SUPERVISORS Yiping Dong (XJTLU)
Soumyen Bandyopadhyay (UoL)
Teresa Hoskyns (External)

ACADEMY/SCHOOL Design School

Industrial heritage regeneration in China faces challenges in evoking place and cultural identities due to the rigid interpretations of the cultural policies, and existing academic research lacks a perspective that contextualizes these issues. This paper aims to fill the gap by examining the unique industrial heritage regeneration practice in Shenzhen. Firstly, this paper sets the scene to elucidate its uniqueness by telling the narrative this migrant city. Using case study and architects' interviews, it then explores Shenzhen's innovative approach of integrating urban planning and spontaneous urban practice, driven by a cultural event, to revitalize its industrial legacy. Lastly, this paper applies the theory of cultural capital to explain the role of the architects in engaging with multiple stakeholders to enhance the value of post-industrial spaces. The paper argues that Shenzhen's unique urban curation practice not only accelerates the production of a "new heritage" identity among its citizens but also achieves local consensus and social inclusion.

005

Investigation of the underlying mechanism of E3 ubiquitin ligase TRIM31 in triggering the inflammation-carcinoma transformation and progression of esophageal squamous cell carcinoma

Aidi GAO (PhD)

SUPERVISORS Mu Wang (XJTLU)
Sonia Rocha (UoL)
Jundong Zhou (External)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

The precancerous lesions of esophageal cancer are believed to be closely associated with the early occurrence of esophageal cancer. The E3 ubiquitin ligase TRIM31 has been reported to be involved in the inflammatory response of the digestive system. We found that TRIM31 is highly expressed in clinical specimens of esophageal lesions and early esophageal cancer. Subsequently, we simulated the process of esophageal cancer development in mice using carcinogen and found that TRIM31 expression increases during the development of esophageal cancer in mice. Knocking out the TRIM31 gene significantly reduces the incidence of esophageal cancer in mice. Furthermore, TRIM31 promotes proliferation, invasion and metastasis of esophageal cancer cells. TRIM31 may serve as an effective predictive and therapeutic target for esophageal cancer.

006

Regulation of microglial migration and purinergic signaling by synaptotagmin-11

Dong YANG (PhD)

SUPERVISORS Xi Zhang (XJTLU)
Jeff Barclay (UoL)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Microglial cells are the critical immune cells in the brain and play crucial roles in physiology and neurological diseases. Previously we reported that synaptotagmin-11(Syt11), which is associated with neurodegeneration diseases such as schizophrenia and Parkinson's disease, regulates microglia activation through inhibiting cytokine release and phagocytosis. Our preliminary data suggested that Syt11 also modulated microglial migration. In this report, we performed transwell assay and scratch wound assay using MACS-isolated primary microglia and initiated the study of the interaction between Syt11 and dynamin.

007

Root methanol extract extract of Bobgunnia madagascariensis (Desv.) J. H. Kirkbr & Wiersema, a plant used in Malian traditional medicine induces apoptosis and cell cycle arrest in HepG2 cells

Mahamadou FOFANA (PhD)

SUPERVISORS Qizhan Liu

UNIVERSITY/INSTITUTE Nanjing Medical University / School of Public Health

Medicinal plant-based therapies can be important for the treatment of many diseases due to their high efficiency, cultural acceptance, low cost, cultural acceptance and minimal side effects. Various parts of Bobgunnia madagascariensis are used by traditional practitioners in many African countries for their medicinal and therapeutic properties. Through a purposive sampling strategy, 95 herbalists and traditional practitioners surveyed in different parts of Bamako reported that this plant is used to relieve fourteen ailments such as malaria (34.35%), emetics (11.74%), gastritis and jaundice. Root methanol extracts of B. madagascariensis (BMME) show cytotoxic effects on HepG2 cells with LD50 205 µgmL−1. Moreover, BMME induced apoptosis and G0/G1 phase arrest in HepG2 cell lines using flow cytometry. This was supported by the attenuation of CDk2/6 and cyclin E levels. Overall, the cytotoxic effect of B. madagascariensis root extract is demonstrated for the first time, and its potential anticancer effect can be further investigated.

008

Tumor-promoting roles of the chromatin-associated DEK oncogene in metastatic melanoma

Gongjie WU (PhD)

SUPERVISORS Tatsuhiko Kadowaki (XJTLU)
Ferdinand Kappes (DKU: Duke Kunshan University)

ACADEMY/SCHOOL School of Science

DEK is a non-histone chromosomal protein that known to involve in global chromatin integrity. Previous studies has reported that DEK is phosphorylated by CK2 (casein kinase 2)in vitro and in vivo, and this phosphorylation weaken the interaction of DEK with DNA in vitro. It has also been found to be overexpressed in multiple tumorigenesis events, including metastatic melanoma. Yet the function of DEK in cellular system relevant to melanoma tumorigenesis remains to be established. Here, we describe a genome-wide binding profiles of DEK in different cell lines by utilizing Chromatin immunoprecipitation followed by next generation sequencing (ChIP-seq). And specifically, in a highly aggressive SK-Mel103 cell line, we demonstrate that CK2 inhibition by CX4945, a selective CK2 inhibitor, dephosphorylates DEK in Ser 287 and Ser 288 and restores DEK binding to DNA. These data lay grounds for further investigation of the biological mechanisms that regulates the chromatin binding of DEK.

009

OPTN cooperate Nrf2 to regulates tooth morphogenesis through controlling mitochondrial dynamics and apoptosis

Haojie LIU (PhD)

SUPERVISORS Shuyu Guo

UNIVERSITY/INSTITUTE Nanjing Medical University / School of Stomatology

Optineurin (Optn) is linked with Paget's bone disease, often associated with short root deformity. However, its role in tooth development remains unclear. Our single-cell sequencing of postnatal day 1 teeth highlights Optn's predominant mesenchymal expression, suggesting its influence on tooth development. Optn-/- mice exhibit short root deformities and dentin defects. In vitro, Optn downregulation increases SCAP apoptosis, inhibiting mitochondrial fission, leading to reduced mineralization and compromised dentinogenesis. RNA-seq analysis indicates Optn likely maintains SCAP capacity for tooth root development and odontoblast differentiation through nuclear factor E2-related factor 2 (Nrf2) interaction. Ex vivo validation supports these findings, and Nrf2 activation partially rescues tooth size in Optn-/- mice. This study illuminates Optn's crucial role in SCAP mineralization and apoptosis during tooth development.

010

m6ACali: Machine learning-powered calibration for accurate m6A detection in MeRIP-Seq

Haokai YE (PhD)

SUPERVISORS Zhen Wei, Jia Meng, Tenglong Li (XJTLU)
Dan Rigden (UoL)

ACADEMY/SCHOOL School of Science

We present m6ACali, a novel machine-learning framework aimed at enhancing the accuracy of N6-methyladenosine (m6A) epitranscriptome profiling by reducing the impact of non-specific antibody enrichment in MeRIP-Seq. The calibration model serves as a genomic feature-based classifier that refines the identification of m6A sites, distinguishing those genuinely present from those only detected in in-vitro transcribed (IVT) control experiments. We find that m6ACali effectively identifies non-specific binding peaks reported by exomePeak2 and MACS2 in novel MeRIP-Seq datasets without the need for IVT control. The model interpretation revealed that the off-target antibody binding regions commonly occur at short exons and mRNAs, and originate from regions sharing high read coverages and sequence contexts with true positives. The strategy also effectively calibrates base resolution techniques like miCLIP by fostering improved alignment with antibody-independent strategies. As a result, m6ACali offers a promising tool for the integration of m6A profiles by different techniques, elevating the benchmark for future omics-level m6A research.

011

The development and optimization of transdermal protein delivery systems for the treatment of chronic diseases

Huan XU (PhD)

SUPERVISORS Lei Fu (XJTLU)
Neil Liptrott, Dan Carr (UoL)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Transdermal administration has unique advantages over the commonly used oral or intravenous administration routes, such as no first-pass effect, non-invasiveness, painless, and better patient compliance. However, existing transdermal drug delivery techniques are mostly designed for small molecular drugs. Needleless transdermal delivery of macromolecules such as therapeutic peptides or proteins remains to be a great challenge. In this research, we plan to establish protein-binding delivery systems after appropriate modifications, perform in vitro and in vivo studies to evaluate their transdermal abilities and explore the mechanism through several classical permeation routes for transdermal delivery. In addition, we intend to test the transdermal delivery of therapeutic proteins like insulin in animal models, to achieve needle-free treatment of different kinds of chronic diseases, such as diabetes.

012

In vitro and in vivo pharmacological validation of APG-5918 (EEDi-5273) in hematologic malignancies

Huanshan GUO (PhD)

SUPERVISORS Lei Fu (XJTLU)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Aberrations of PRC2 components have been intimately implicated in the oncogenesis and progression of various hematological neoplasms. APG-5918 is a promising EED inhibitor that possibly reversals the effects of aberrational PRC2. The project aims to investigate the antitumor activity of APG-5918 as a single agent or in combination with other therapeutic drugs for the treatment of various hematological malignancies, explore the potential mechanism of action of the single-agent and synergistic antitumor activity, and ultimately provide guidance for the clinical development.

013

Post-transcriptional regulation of autophagy-related genes by Poly(A)-binding proteins during oocyte maturation

Huanyu YAN (PhD)

SUPERVISORS Xi Wang

UNIVERSITY/INSTITUTE Nanjing Medical University /
State Key Laboratory of Reproductive Medicine

Poly(A) binding proteins (PABPs) play a crucial role in post-transcriptional regulation during oocyte maturation. PABPs can dynamically regulate the translation of key genes by modifying the poly(A) tail length in the 3' untranslated region (UTR) of mRNAs. Inhibition of autophagy impairs the developmental competence of oocytes, and PABPs have been shown to play a key role in regulating autophagy. To investigate the role of PABPs in oocyte maturation, we generated PABP gene family knockout (KO) mice and observed infertility in KO females due to meiotic arrest at the germinal vesicle (GV) stage. Further analysis revealed mitochondrial and endoplasmic reticulum damage, as well as abnormal distribution, and widespread lysosomal degradation in KO oocytes. We also found numerous autophagic vesicles accumulated in the cytoplasm, and autophagic flux was completely blocked, as evidenced by autophagy detection probes, indicating that impaired cytoplasmic maturation was due to defective autophagy. Using three-generation RNA sequencing, we found that the poly(A) tail length of KO oocytes was globally shortened during the GV stage. Transcriptome and proteome analysis identified 3240 differentially expressed genes and 460 differentially expressed proteins, respectively. Notably, 101 genes displayed concurrent changes in poly(A) tail length, RNA level, and protein level, suggesting that PABPs play a pivotal role in post-transcriptional regulation. Furthermore, autophagy and macroautophagy were enriched in the omics analyses, and the poly(A) tail of autophagy genes, including Tubb2a, Mtmr14, Atg5, and Lamp1, was shortened, with concordant changes in RNA and protein levels, indicating that autophagy genes were also under post-transcriptional regulation by PABPs. In conclusion, our findings demonstrate that PABPs play a crucial role in regulating autophagy during oocyte maturation, ensuring proper cytoplasmic maturation and fertility.

014

Investigation of inhibitory cross interactions between renal URAT1 and OAT3 transporters

Jialin BIAN (PhD)

SUPERVISORS Lei Fu (XJTLU)
David Dickens, Bettina Wilm (UoL)
Hongjian Zhang (Viva Star Biosciences Co., Ltd.)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Dotinurad potently inhibits URAT1. The inhibitory effect of Dotinurad on OAT3 is relative strong. Since OAT3 plays a critical role in the renal excretion of many xenobiotics and drugs, the cross inhibition of OAT3 by URAT1 inhibitors may alter pharmacokinetics and safety profiles of drugs that are cleared via OAT3. Because glucuronide and sulfate conjugates are major metabolites of Dotinurad found in urine, it is thus interesting in knowing if UGT and/or SULT mediated metabolism of Dotinurad may affect OAT3 activity. The aims of the present study are to investigate if major metabolites of Dotinurad would alter OAT3 activity and whether Dotinurad metabolism would be linked to potential OAT3-mediated drug-drug interactions.

015

SDC-Net: Shallow and Deep collaborative network for Multiclass Fundus Lesion Segmentation

Jiaoli LIU (PhD)

SUPERVISORS Hui Liu

UNIVERSITY/INSTITUTE China University of Mining and Technology /
School of Information and Control Engineering

Diabetic retinopathy (DR) is the leading cause of blindness among people of working age. Fundus lesions are clinical signs of DR, and their recognition and delineation are important for early screening, grading, and monitoring of the disease. We propose in this work a fully automatic deep convolutional neural network method for simultaneous segmentation of four different types of DR-related fundus lesions. To exploit multi-scale image information, we propose an end-to-end segmentation framework that integrates shallow and deep networks. In the deep network, an attention mechanism based on wavelet transform is designed to fuse the obtained multi-scale context representation into the decoder. Moreover, a super-resolution auxiliary task is introduced to assist in the training of deep networks and improve the accuracy of lesion segmentation. Experimental results on three public datasets indicate that the proposed method is more effective than other state-of-the-art methods in the literature.

016

m5C-Atlas: A comprehensive database for decoding and annotating the 5-methylcytosine (m5C) epitranscriptome

Jiongming MA (PhD)

SUPERVISORS Jia Meng (XJTLU)

ACADEMY/SCHOOL School of Science

5-Methylcytosine (m5C) is one of the most prevalent covalent modifications on RNA. It is known to regulate a broad variety of RNA functions, including nuclear export, RNA stability and translation. Here, we present m5C-Atlas, a database for comprehensive collection and annotation of RNA 5-methylcytosine. The database contains 166 540 m5C sites in 13 species identified from 5 base-resolution epitranscriptome profiling technologies. Moreover, condition-specific methylation levels are quantified from 351 RNA bisulfite sequencing samples gathered from 22 different studies via an integrative pipeline. The database also presents several novel features, such as the evolutionary conservation of a m5C locus, its association with SNPs, and any relevance to RNA secondary structure. All m5C-atlas data are accessible through a user-friendly interface, in which the m5C epitranscriptomes can be freely explored, shared, and annotated with putative post-transcriptional mechanisms (e.g. RBP intermolecular interaction with RNA, microRNA interaction and splicing sites). Together, these resources offer unprecedented opportunities for exploring m5C epitranscriptomes. The m5C-Atlas database is freely accessible at https://www.xjtlu.edu.cn/biologicalsciences/m5c-atlas.

017

Strategies of NK cell engager design for targeting specific solid tumors

Mingxuan WAN (PhD)

SUPERVISORS Meng Huee Lee (XJTLU)
Christian Ottensmeier (UoL)
Zhe Zhang (Shanghai Hengrui Pharmaceutical Co.,Ltd.)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Natural killer (NK) cell-based immunotherapies have emerged as a promising approach, offering potent anti-tumor efficacy and good safety. NK cell engager (NKCE), targeting one or more activating receptors on NK cells and tumor antigens on cancer cells, is a new class of therapeutic molecules to enhance endogenous NK cell anti-tumor functions. Although success has been achieved in treating blood cancers, the therapeutic effects of NKCEs in solid tumors are limited. Herein, various Her2-specific NKCEs with different formats were generated, and some of these molecules have shown promising advantages in in vitro killing assays with EC50 in the picomolar range. The killing potency was further enhanced by Fc engineering or fusing IL-2 to the NKCE molecule. Intriguingly, the data suggested that the geometries and valence of NKCEs may affect the killing capacities especially in the CD16 negative scenario. By this means, the anti-tumor function of NKCE could be further improved by optimizing the design strategy.

018

Development of Metalloproteinase Inhibitors (Tissue Inhibitor of Metalloproteinase, TIMP) as biologics for tumor therapy

Pengyuan ZHANG (PhD)

SUPERVISORS Meng Huee Lee (XJTLU)
Simon Tew (UoL)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Programmed Death-Ligand 1 (PD-L1) is an immune checkpoint regulator expressed by cancer cells to suppress host immune responses by binding with Programmed Death Protein 1 (PD-1) on T cell surfaces. In previous research, the ability of ADAM10 and ADAM17 (A Disintegrin and Metalloproteinase) to cleave PD-L1 from cell surfaces was discovered. As endogenous inhibitors of metalloproteinases, we aimed to develop Tissue Inhibitor of Metalloproteinases (TIMPs) as therapeutic agents to suppress PD-L1 expression in MDA-MB-231 cells and investigate the underlying mechanisms. We also aimed to identify the protease responsible for MT1-MMP (Membrane Type 1-Matrix Metalloproteinase) shedding and release of soluble PD-L1.

019

A targeted HSD17B13 RNAi method For nonalcoholic steatohepatitis treatment

Qin MENG (PhD)

SUPERVISORS Mu Wang (XJTLU)
Sudeep Pushpakon (UoL)
Hui Feng (Shanghai Junshi Biosciences Co., Ltd.)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Non-alcoholic steatohepatitis (NASH) is the most severe form of non-alcoholic fatty liver disease (NAFLD) and is closely related to the triple epidemic of obesity, pre-diabetes, and diabetes. But its symptoms are often silent or non-specific to NASH, making it difficult to diagnose. As a result, NASH patients can remain unaware of their condition until late stages of the disease. No medicines have been approved to treat NASH. Considering NASH is a chronic disease, we plan to develop a siRNA drug for NASH treatment. The siRNA drugs are administered at long intervals with long duration of efficacy, and at the same time, they are easy to administer.

020

Profiling the transcriptome that initiates the organ formation in mouse embryo

Rui SONG (PhD)

SUPERVISORS Yiqiang Wang (XJTLU)

ACADEMY/SCHOOL School of Science

The development process of the early mouse embryo is extremely complicated. The amounting evidence shows that dramatic transcriptomic changes occur during the early mouse embryo development. Previous studies demonstrated that formation of three germ layers play critical roles in mouse embryo development. However, it remains largely unclear the during the left-right asymmetry establishment. Taking advantage of multiple cutting-edge spatial transcriptome sequencing technologies, this project will use a series of bioinformatic tools to analyze the RNA seq data, then profile the landscape underlying the fate commitment of LR asymmetry breaking and organ formation by using, which will allow to decipher the transcriptomic mechanisms underlying mouse mesoderm development. We anticipate that the acquired results will shed new light on the understanding of mammalian embryo development and treatment of human disease.

021

High capacity IgG purification matrix based on engineered Protein A and porous chitosan magnetic beads

Rujia QU (PhD)

SUPERVISORS Kim Lau, Mu Wang (XJTLU)
Gita Sedghi (UoL)
Mingxian Huan (Beaver Biomedical Engineering Co., Ltd.)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Antibody purification is growing more important for biotechnology research and biomedicine. Affinity matrix with high antibody binding capacity significantly help decrease the costs of the purification in biopharmaceuticals. Due to good bio-compatibility, non-toxicity, and bio-biodegradability, chitosan has been used in various biomedical applications. Therefore, the objective of this research is to develop porous-structured chitosan magnetic beads to improve the area of applications in antibody purification industry. Up to now, two types of magnetic chitosan particles were prepared. Chitosan/agarose composite magnetic microspheres were produced with a water/oil system. The other type were magnetic porous chitosan hollow semispheres cast by dropping acid-soluble chitosan with magnetites into NaOH solution. The synthesis of chitosan magnetic beads will continue to be optimized and modified protein A-based ligands will then be designed, synthesized and orientedly immobilized on the chitosan magnetic beads. The binding capacity of magnetic beads for antibody purification will be tested using human serum.

022

Safety, tolerability, pharmacokinetics, and antitumor activity of SHR-A1811 in HER2-expressing/mutated advanced solid tumors: A global phase 1, multi-center, first-in-human study

Shangyi RONG (PhD)

SUPERVISORS Mu Wang, Xin Liu (XJTLU)
David MacEwan (UoL)
Lianshan Zhang (Jiangsu Hengrui Pharmaceuticals Co., Ltd.)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Background: SHR-A1811 is an ADC comprised of a humanized anti-HER2 monoclonal antibody (trastuzumab), a cleavable linker, and a DNA topoisomerase I inhibitor payload. Here we assessed SHR-A1811 in HER2-expressing/mutated unresectable, advanced, or metastatic solid tumors. Methods: Pts were eligible if they had HER2 positive breast cancer (BC), HER2 positive gastric/GEJ carcinoma, HER2 low-expressing BC, HER2-expressing/mutated NSCLC, or other HER2-expressing/mutated solid tumors, and were refractory or intolerant to standard therapy. SHR-A1811 at doses of 1.0 – 8.0 mg/kg was given Q3W (IV). The primary endpoints were DLT, safety, and the RP2D. Results: From Sep 7, 2020 to Sep 28, 2022, 250 pts who had undergone a median of 3 prior treatment lines in the metastatic setting received at least one dose of SHR-A1811 in dose escalation, PK expansion, and indication expansion part. As of data cutoff on Sep 28, 2022, 1 pt experienced DLT. Treatment-related adverse events (TRAEs) were reported in 243 (97.2%) pts. Grade ⩾3 TRAEs, serious TRAEs, and treatment-related deaths were reported in 131 (52.4%), 31 (12.4%), and 3 (1.2%) pts, respectively. Interstitial lung disease (AESI) was reported in 8 (3.2%) pts. Exposures of SHR-A1811, total antibody, and the payload were generally proportional to dose from 3.2 to 8.0 mg/kg. ORR was 61.6% (154/250, 95% CI 55.3 – 67.7) in all pts. Objective responses were observed in pts with HER2 positive BC (88/108, ORR 81.5%, 95% CI 72.9 – 88.3), HER2-low BC (43/77, ORR 55.8%, 95% CI 44.1 – 67.2), urothelial carcinoma (7/11), colorectal cancer (3/10), gastric/GEJ carcinoma (5/9), biliary tract cancer (5/8), NSCLC (1/3), endometrial cancer (1/2), and H&N cancer (1/1). Subgroup analyses of ORR are shown in Table 1. The 6-month PFS rate was 73.9% in all pts. Conclusions: SHR-A1811 was well-tolerated and showed promising antitumor activity in heavily pretreated advanced solid tumors.

023

Essential microRNA identification in mice based on rotation forest and multiple feature fusion

Shuhao WANG (PhD)

SUPERVISORS Fei Chu

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Information and Control Engineering

MicroRNAs (miRNAs) play significant roles in various critical biological processes. With the increasing number of miRNAs, identifying essential miRNAs has become an important task that needs to be solved urgently. However, there are few computational methods for essential miRNA identification. Here, we proposed a novel method called Rotation Forest for Essential MicroRNA identification (RFEM) to predict the essentiality of miRNAs in mice. Experimental results showed that RFEM outperformed two previous models with the AUC (AUPR) of 0.942 (0.944) in 5-fold cross validation, which proved the model's reliable performance. Moreover, ablation study was further conducted to demonstrate the effectiveness of the novel miRNA functional features. Additionally, in the case studies of assessing the essentiality of unlabeled miRNAs, 7 of the top 10 predicted miRNAs were confirmed by experimental literature to have crucial biological functions in mice. Therefore, RFEM would be a reliable tool for identifying essential miRNAs.

024

Application of transformer and graph network architecture in drug screening

Tianjun WANG (PhD)

SUPERVISORS Xin Liu (XJTLU)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Deep learning models can represent the raw molecule information though a Graph Neural Network (GNN) method, TransformerConv. It converts atoms and chemical bonds to graph nodes and edges with specific features. Meanwhile, it assigns attentions on nodes and edges, convenient for explanations. Such encoder can provide extract chemical features for transformer decoder models, to generate chemical text strings, for example SMILES. As a result, it is possible to construct a pretraining task that model translate graph to chemical strings. During pretraining task, the encoder-decoder architecture needs to keep the most important features. Thus, the embedding ability is accessible for downstream virtual screen task by fine-tune. Here are also some examples of virtual screening for druggable properties by fine-tuned model.

025

Probing the underlying mechanism of the synergistic effects between CD3/TAA-targeting and CD28/TAA-targeting bispecific antibodies in cancer immunotherapy

Tingting LI (PhD)

SUPERVISORS Meng Huee Lee (XJTLU)
Christian Ottensmeier (UoL)
Zhe Zhang (Shanghai Hengrui Pharmaceutical Co.,Ltd.)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Bispecific antibodies that redirect CD3+ cytotoxic T cells to tumors are a promising immunotherapy for cancer treatment. While CD3 bispecific antibody therapy works well for treating hematomas, treating solid tumors presents a number of difficulties, such as low T-cell infiltration and decreased T-cell quality due to the tumor's immunosuppressive milieu. We speculated that the combination of costimulatory CD28-BsAbs and CD3-BsAbs could improve the quality of T-cell responses and promote T-cell proliferation. T cell activation activity induced by various combinations were tested using two report cell lines, Jurkat-IL2 and Jurkat-NFAT. We demonstrated that CD3-BsAbs and CD28-BsAbs worked synergistically to activate T cells, but the degree of activation varies depending on the combination of the BsAbs. Using an in vitro PBMC-tumor cell co-culture system, we found that CD28-BsAbs enhanced the tumor killing potency of CD3-BsAbs and promoted CD3-BsAbs induced cytokines release. Further study is required to find the optimal combination(s) and to explore the underlying mechanisms. Our data will provide insights for designing rational combinational therapeutics for the treatment of solid tumors.

026

Semi-supervised learning for cardiac segmentation via CNN and transformer

Wenzong LI (PhD)

SUPERVISORS Lin Zhang

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Information and Control Engineering

Recently, semi-supervised cardiac segmentation has been highly valued with limited annotations for training. However, most of the existing methods are implemented by convolutional neural networks, which limits the further improvement of segmentation performance. In this work, we present an efficient framework for semi-supervised cardiac segmentation. To utilize the difference in learning paradigm between CNN and Transformer, we employ both CNN and Transformer for feature extraction. For effective supervision, we introduce cross-teaching, where the prediction of a network is applied as the pseudo label to supervise the other network directly end-to-end. What's more, we choose deep supervision to learn the discernment and robustness of features, especially in the early training stages. Experiments on the public ACDC dataset show that our model outperforms 6 existing semi-supervised learning methods with a variety of metrics.

027

Community structure, function and degradation potential of the plastisphere microbiome

Xiaotian ZHAO (PhD)

SUPERVISORS Sekar Raju (XJTLU)
Mal Horsburgh, Alan McCarthy (UoL)

ACADEMY/SCHOOL School of Science

The accumulation of plastics in the natural environment, especially in aquatic systems, has emerged as one of the major issues threatening ecosystems and human health. Such plastics usually persist in nature for decades in the form of particulate debris, among which those with a diameter of less than 5mm are termed microplastics. In addition to the harmful impacts on aquatic life, microplastics could provide microorganisms and even pathogens with new microbial niches through biofilm formation on the plastic surface. Although the influences of microplastics on marine environments have been widely studied, their impact on freshwater systems have only been recognized recently. This project aims to assess the microbiome associated with microplastics of different plastic materials in freshwater systems with varying land use patterns. The functional diversity of the microbiomes and their abilities to degrade microplastics will also be determined.

028

The shift in key functional traits caused by precipitation under Nitrogen and Phosphorus deposition drives biomass change in Leymus chinensis

Xinran YANG (PhD)

SUPERVISORS Junfeng Wang

UNIVERSITY/INSTITUTE Northeast Normal University / School of Life Science

The trade-offs between key functional traits in plants have a decisive impact on biomass production. However, how precipitation and nutrient deposition affect the trade-offs in traits and, ultimately, productivity is still unclear. In the present study, we explore the relationships between biomass production and the aboveground and belowground keyvfunctional traits and their trade-offs under changes in precipitation and nutrient depositions in Leymus chinensis. Our results showed that moisture is the key factor regulating the effect of nitrogen and phosphorus deposition on increased biomass production. Under conditions of average precipitation, water use efficiency (WUE) was the key trait determining the biomass of L. chinensis. Conversely, under increasing precipitation, thevkey limiting trait changed from WUE to plant height. These findings indicate that the shift of fundamental traits of photosynthetic carbon gain induced by precipitation under nitrogen and phosphorus deposition is the key ecological driving mechanism for the biomass production of typical dominant species in semi-arid grassland.

029

Antibody conjugated Cytokine for nonalcoholic steatohepatitis treatment

Xujia WANG (PhD)

SUPERVISORS Mu Wang (XJTLU)
Christopher Goldring (UoL)
Hui Feng (Shanghai Junshi Biosciences Co., Ltd.)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Nonalcoholic fatty liver disease (NAFLD) or nonalcoholic steatohepatitis (NASH) is a prevalent metabolic disease, which has no effective treatment today. According to mechanism and data of clinical trials, we suppose a lowering low density lipoprotein antibody may have synergetic effect with lowering glucose and triglycerides cytokine for better NASH treatment and we will validate this hypothesis. During this process, we also use proteomics or genomics to identify potential prognostic biomarkers for disease monitoring and diagnosis.

030

The development of NanoBRET-based ligand binding assays

Yi SONG (PhD)

SUPERVISORS Zhiliang Lu, Rong Rong, Jia Meng (XJTLU)
David Fernig (UoL)

ACADEMY/SCHOOL School of Science

Kisspeptin is a key neuron-mediator of the mammalian reproductive system, primarily signalling via its cognate receptor GPR54. To facilitate the drug development and insight into the pharmacological properties between kisspeptin (KP) and GPR54, our newly developed NanoBRET-based ligand binding assays have been described for better monitoring of the binding between kisspeptin (KP) and GPR54 on living cells. This method is based on bioluminescence resonance energy transfer (BRET) technique. As a result, reliable binding curves could be obtained from both Nano-BRET-based saturation and inhibition binding assays and various ligand-receptor binding parameters such as the equilibrium dissociation constant (Kd) and inhibitor constant (Ki) have been determined, suggesting the feasibility of this format in determining ligand-receptor binding for GPR54 and applying potential in other candidates among GPCRs. Besides, it also shows as a robust binding format with low variability in BRET signals, which suggests its feasibility in a high-throughput drug screening strategy.

031

Comprehensive analysis of the lysine succinylome in fish oil treated prostate cancer cells

Yifan JIANG (PhD)

SUPERVISORS Mu Wang (XJTLU)
Sonia Rocha (UoL)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Fish oil can slow down prostate cancer by affecting mitochondria-related pathways, and our research is looking at how it impacts succinylation in PCa cells. This study used mass spectrometry to study succinylation in PCa cells, and following bioinformatics analysis identified GOT2 protein as important for PCa cell growth. Further analyses revealed the significance of GOT2 protein in regulating nucleotide synthesis by providing aspartate, which is critical for the survival and proliferation of PCa cells. Our findings suggest that FO-dependent GOT2 succinylation status has the potential to inhibit building block generation. This study highlights the potential use of FO as a nutrition supplement for managing and slowing down PCa progression.

032

Physiological and molecular functional characterisation of Drosophila melanogaster TMEM16O

Ying LEI (PhD)

SUPERVISORS Tatsuhiko Kadowaki (XJTLU)
Greg Hurst (UoL)

ACADEMY/SCHOOL School of Science

Transmembrane protein 16 (TMEM16) family members play key physiological roles, most subfamilies act as either calcium-activated chloride channels or phospholipid scramblases. TMEM16 is a membrane protein with 10 transmembrane segments forming the pore domain. This family has been characterised in mammals; however, their physiological and molecular functional roles in other species such as insects remain poorly understood. To fill the gap, we have studied an arthropod specific-TMEM16 family member, TMEM16O of Drosophila melanogaster, DmTMEM16O. By confocal live imaging, we found that DmTMEM16O is expressed in a few olfactory neurons but not the other ionotropic receptor expressing sensory neurons in the larval dorsal organ ganglion. In adult fly head, DmTMEM16O is expressed in a few cells of the third antennal segment and maxillary palp. These results suggest that DmTMEM16O plays roles to detect the specific odours. We will identify the specific olfactory receptors co-expressed with DmTMEM16O to uncover the physiological functions.

033

Single-particle fluorescence tracking combined with TrackMate assay reveals highly heterogeneous and discontinuous lysosomal transport in freely orientated axons

Yongyang LIU (PhD)

SUPERVISORS Qiangbin Wang

UNIVERSITY/INSTITUTE University of Science and Technology of China / Suzhou Institute of Nano-Tech and Nano-Bionics (SINANO)

Axonal transport plays a significant role in the establishment of neuronal polarity, axon growth, and synapse formation during neuronal development. Nowadays, the study of dynamic axonal transport in morphologically complex neurons is greatly limited by the technological barrier. Here, a sparse gene transfection strategy was developed to locate fluorescent mCherry in the lysosome of primary neurons, thus enabling us to track the lysosome-based axonal transport with a single-particle resolution. Hence, several axonal transport models were observed and the accurate single-particle velocity quantification by TrackMate revealed a highly heterogeneous and discontinuous lysosomal transport in freely orientated axons. By combining single-particle fluorescence tracking and Track-Mate assay, multiple physical factors, such as the axonal structure and the size of particles, were disclosed to affect lysosomal transport velocity. These promising strategies can serve as a facile tool for evaluating axonal transport in neuronal development and axonal transport-related diseases.

034

The role of dimethylguanidino valeric acid related metabolic pathway on carbohydrate and lipid metabolism

Yueyuan HAN (PhD)

SUPERVISORS Mu Wang, Ken Cheng (XJTLU)
Luning Liu (UoL)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Untargeted metabolomics-based epidemiological studies have shown that DMGV is an independent biomarker of several metabolic diseases, such as non-alcoholic fatty liver disease, cardiovascular disease, and type 2 diabetes and it is closely related to lifestyle. However, the role of DMGV in carbohydrate and lipid metabolism and insulin resistance remains unknown. In this study, we have successfully established a quantitative method for metabolites related to DMGV pathway based on liquid chromatography-tandem mass spectrometry (LC-MS/MS) and then applied this method to measure the levels of DMGV in plasma and verified the potential of DMGV as a biomarker of diabetes in a Chinese cohort. The mechanism of DMGV in carbohydrate and lipid metabolism and insulin resistance was investigated by conducted in vitro experiments on hepatocytes and islet cells. Understanding the mechanisms of DMGV in carbohydrate and lipid metabolism may provide a new perspective on potential treatments for metabolic diseases.

035

Applying third generation sequencing platform for modified mRNA vaccine design and analysis

Yuxin ZHANG (PhD)

SUPERVISORS Jia Meng (XJTLU)
Dan Rigden (UoL)
Guifang Jia (PKU: Peking University)

ACADEMY/SCHOOL School of Science

Messenger RNAs (mRNA), cooperating with dynamic chemical modifications on it, can regulate many important processes in vivo. In the past decades, chemically modified IVT mRNA has found its way into clinical applications, since those incorporated modified bases can reduce cellular immunogenicity and improve translation efficiency in patience. Current mRNA therapeutics involves complete replacement of normal bases with modified bases. Future manufacturing of therapeutic RNAs may prefer to have sub-stochiometric replacement of modified nucleotides, such as m1Ψ, to achieve optimal expression in patience. To this end, landscapes of modification on individual mRNA therapeutics are important for us to evaluate their qualities. By taking the advantages of Nanopore direct, single-molecule, long-read sequencing, we preposed NanoMUD, that utilized nanopore sequencing features to study the two promising substitutions for uridine in mRNA vaccines, namely pseudouridine and N1-methylpseudouridine. NanoMUD will make a powerful tool to facilitate the research on modified therapeutic IVT RNAs.

036

Transient receptor potential ankyrin 1-induced light aversion in mice involes trigeminal ganglion activation

Zhuoan HUANG (PhD)

SUPERVISORS Minyan Wang (XJTLU)
Aditi Kanhere (UoL)
Sulev Kõks (Murdoch: Murdoch University)

ACADEMY/SCHOOL School of Science

Background: Photophobia is one of the most common forms of migraine that can trigger eye pain and headache. We recently identified that, a stress-sensing cation channel, transient receptor potential ankyrin 1 (TRPA1) activator triggers an acute light aversion behavior in mice. Yet, it remains unclear about the molecular mechanism underlying TRPA1-induced photophobia. In this study, we investigated whether the acute light aversion involves the activation of trigeminal ganglion, a key brain region transmitting pain signaling and connecting the peripheral and central nervous system. Methods: The trigeminal ganglion of all mice (male) was immediately dissected after behaviour observation for subsequent assessment of trigeminal ganglion activation using RNA-sequencing and qPCR analyses. Alteration of the transcriptome and the mRNA-miRNA-lncRNA ceRNA network between the light aversion and vehicle control groups was constructed using online databases. Gene Ontology enrichment analysis was applied to predict the function of genes. Results: RNA-sequencing analysis showed that a total of 2928 genes were differentially expressed, 125 lncRNAs and 7 miRNAs were altered in trigeminal ganglion of photophobia mice, suggesting a profound activation of trigeminal ganglion. Among the above alteration, two up-regulated ceRNA networks and two down-regulated ceRNA networks were identified, including 152 mRNAs, 4 miRNAs and 2 lncRNAs. Key differentially expressed genes associated with light aversion are mainly enriched to ATP signalling, ion channels and intracellular enzymes involved in signal transduction. Conclusions: These data revealed the acute light averion is closely associated with trigeminal ganglion activation via profound alteration of the transcriptome.

037

Conditional unimodal property and cross-sectional momentum

Ao YANG (PhD)

SUPERVISORS Qing Ye, Jia Zhai (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

This study documents a conditional unimodal property of expected return of stocks: based on their past performance, those stocks with a higher likelihood of outperforming (or conversely, underperforming) their peer stocks in the cross-section exhibit a lower probability of underperforming (or conversely, outperforming) those same peers. Leveraging this property, the conventional momentum is reinterpreted, incorporating the likelihood of stocks' expected performance in subsequent periods as: "if stock returns are expected to either overperform or underperform in the cross-section with higher likelihood, then profitable trading strategies that select stocks based on their expected relative performance will exist". Utilizing this reinterpreted version, we design a novel momentum strategy mechanism, allowing for the seamless integration of diverse machine learning models in a "plug-and-play" manner. Our empirical study includes the deployment of four representative machine-learning models, ranging from simple to complex structures. The annual out-of-sample Sharpe ratio achieved falls within a range from a commendable 2.64 to an impressive high of 4.41. The aforementioned finding underscores the notion that the establishment of profitable momentum strategies does not inherently necessitate the utilization of intricate, tailor-made models. In exploring the source of the economic significance, we discover that the preservation of the monotonic relationship between ranks derived from the estimated likelihood and ranks based on actual returns, along with the elimination of certain overlapped stocks, contributes to attaining superior momentum performance.

038

How to promote economic growth in the CFA franc zone? Lessons from The People's Republic of China

Dorian-Christ Philippe OKEMBA (PhD)

SUPERVISORS Nimesh Salike (XJTLU)
Yavuz Arslan (UoL)

ACADEMY/SCHOOL International Business School Suzhou

The fiscal decentralization efforts of China over 1980-1988 period allowed local governments to have more control on tax revenue and expenditure. Further reform of 1994 resulted in continued rise in fiscal decentralization on the expenditure side (FDE) but reversed the upward trend of fiscal decentralization on the revenue side (FDR). This paper aims to determine whether fiscal decentralization reform had significant positive effect on Inward FDI in China and if domestic investment has played a mediating effect between fiscal decentralization and inward FDI. We do so by employing system- GMM (Generalized method of moments) to estimate the effect of domestic investment on inward FDI and its relationship between FDE and FDR, using data covering 31 Chinese provinces over the 1995-2015. Our findings suggest that China's FDE has exerted positive impact on local governments in attracting inward FDI through domestic investment but the inverse effect for FDR.

039

The impacts of buyers' ESG performance on suppliers' organizational resilience: Evidence from Chinese manufacturing industry

Fangxu YAN (PhD)

SUPERVISORS Lujie Chen, Cheng Xu (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

This study adopts a relational view and aims to empirically investigate whether a firm's better ESG performance will make its suppliers more resilient to supply chain disruptions. To address this issue, we collected 367 pairs of buyer-supplier samples in manufacturing firms from China Stock Market and Accounting Research (CSMAR) and performed both Ordinary Least Square (OLS) and Cox survival analyses. The results reveal that a buyer's ESG performance is positively related to its supplier's OR (in the form of stability and flexibility). We also found that these relationships are moderated by three characteristics in buyer-supplier relationships, which are relationship stability, ESG alignment, and geographical distance. In so doing, we provide theoretical contributions to the emergent stream of research on sustainability and operations & supply chain management (OSCM) realms in the context of the global pandemic. Our findings also offer valuable insights to focal firms on developing more favorable relationships with their supplier through sustainable practices.

040

Harnessing service-sales ambidexterity with mindfulness: A dive into the dual paths of cognition and emotion

Hanhong FENG (PhD)

SUPERVISORS Daniel Hampson, Li Pan (XJTLU)
Natasha Clennell (UoL)

ACADEMY/SCHOOL International Business School Suzhou

In today's service sector, achieving a balance between service and sales—termed 'service-sales ambidexterity'—is vital. Yet, its individual drivers are largely overlooked in the literature. Grounded in the Conservation of Resources Theory, our research posits that mindfulness serves as a personal resource for employees. It cultivates cognitive and emotional capacities, thus enhancing service-sales ambidexterity. Using a multi-wave, multi-data source research design with data derived from 11 hotels in Central China, we identified the positive relationship between mindfulness and service-sales ambidexterity. It is mediated by cognitive flexibility and positive affect and is further moderated by employees' communication styles. Our research provides a deeper understanding of service-sales ambidexterity and mindfulness while highlighting the confluence of cognition and emotion. It also sheds light on individual variances in resource allocation, enriching resource theory. Practically, we advocate for service organisations to prioritise mindfulness and communication styles to boost service-sales ambidexterity.

041

ESG incidents and managing investor relationship: The role of investor interactive platform

Jia LIU (PhD)

SUPERVISORS Rui Ding, Xudong Ji (XJTLU)
Charlie Cai (UoL)

ACADEMY/SCHOOL International Business School Suzhou

This study examines the use of an Investor Interactive Platform (IIP) by retail investors and the management of Chinese A-share listed companies following the announcement of ESG incidents. Employing Natural Language Processing (NLP) techniques, we analyze the characteristics of investors' questions and the corresponding answers from management. The study aims to understand: (1) how management responds to retail investors' questions posted on the IIP after an ESG incident; (2) the effect of management's responses on retail investors' assessment of ESG risks and firm value; and (3) the subsequent trading behaviors of retail investors. This analysis delves into the detailed 'interaction' process between the firms and retail investors and contributes to the literature on the role of IIP in enhancing retail investors' understanding of non-financial events and the impact of such events on firm value.

042

Unveiling the intricate interaction within an entrepreneurial ecosystem: Value propositions matter

Mingqing TIAN (PhD)

SUPERVISORS Xiao Wang, Xuanwei Cao (XJTLU)
Paul Ellwood (UoL)

ACADEMY/SCHOOL International Business School Suzhou

The entrepreneurial ecosystem is a complex system with geographical boundaries, centered around the cultivation of startups, the exchange of resources between companies, and the incubation of industry. Within an entrepreneurial ecosystem, companies exchange entrepreneurial resources and information to support each other's development. However, with the advent of a new technological revolution, some emerging industries are breaking traditional industry boundaries, such as autonomous driving, and simple resource interactions between businesses are no longer sufficient to support the development and market implementation of their products. Following an inductive approach, we conducted qualitative analysis research on Xiangcheng's entrepreneurial ecosystem located in Suzhou, China. We found that interactions among companies in this entrepreneurial ecosystem occur across three dimensions: resource exchanging, product prototyping, and the technological landscape shaping. Using the grounded theory research method, we uncovered the complex relationships between these three dimensions of interaction and the process of shaping core value propositions.

043

Exploring the influence of multisensory, flow, and social experiences in metaverse marketing on purchase intention: A structural equation modeling approach

Peiqi YAN (PhD)

SUPERVISORS Xiao Wang (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

This study employs the Stimulus-Organism-Response model and perceived value theory to explore how multisensory, flow, and social experiences influence consumer purchase intentions within the metaverse marketing campaign. The model's reliability was established via an empirical investigation among the people across the country (N=276). Using structural equation modeling in AMOS, the results highlight that multisensory experiences significantly enhance perceived value, while flow experiences primarily boost purchase intentions. Meanwhile, emphasizing the crucial role of perceived value, this research supports the SOR model and perceived value theory in metaverse marketing. By enriching the field through empirical exploration of the impact of experiential stimuli in metaverse marketing campaign on purchase intentions, the study offers valuable insights for retail companies, guiding them in leveraging the metaverse effectively and emphasizing the importance of experience quality and perceived value for enduring metaverse marketing success.

044

Unveiling spatial strategies: A comprehensive examination of Chinese rural tourism development policies

Rui TAN (PhD)

SUPERVISORS Linjia Zhang, Yingchan Luo (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

In recent years, the rural tourism market has emerged as one of the fastest-growing sectors within the Chinese tourism industry. Since 2019, the Ministry of Culture and Tourism, in collaboration with the National Development and Reform Commission, has actively been published a policy, working on the development of a national list of key rural tourism villages. As of 2023, 1399 rural tourism villages have received the designation of key rural tourism villages planning, with an emphasis on strengthening support in terms of, funding, markets, and talent for these key villages in each region. Within the framework of strategic spatial planning, our research aims to delve into the underlying spatial strategy guiding Chinese rural tourism policy. Our research makes a substantial contribution to the academic understanding and practical implementation of spatial planning in Chinese rural tourism.

045

End-to-end deep learning algorithms for inventory rebalancing strategies in capacitated micro-mobility systems

Ruicheng LIU (PhD)

SUPERVISORS Jianghang Chen, Jianyu Xu (XJTLU)
Guoquan Liu (NICE: National Innovation Center par Excellence)

ACADEMY/SCHOOL International Business School Suzhou

Shared micro-mobility has expanded rapidly around the globe and many operational research issues have risen. The nonhomogeneous and asymmetric demand causes the imbalance of the system. One approach to cope with this problem is to rebalance the system through relocating bikes between stations. Due to the characteristics of lost-sales, station capacity and non-monotonicity, rebalancing the inventory in micro-mobility becomes challengeable. In this study we propose an optimisation model to deliver the optimal rebalancing strategy. Meanwhile, an end-to-end (E2E) deep learning algorithm is developed to output the relocation quantity directly from input features without any intermediate step. By conducting several numerical experiments using real data from one of the bike-sharing programs, we show that the proposed E2E algorithm outperforms several predict-then-optimise benchmarks.

046

Empirical analysis on the relationship between the volatility of housing price increasing rate and the volatility of M2 supply growth rate in China

Runsheng RONG (Master)

SUPERVISORS Hao Lan (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

Housing price and money supply are both fundamental components of national economy. The volatility of their increasing rates can also impact the economy. This project performs empirical analysis on the relationship between the volatility of housing price increasing rate and the volatility of M2 supply growth rate in China, which takes VAR, DCC-GARCH and CCC-GARCH models in methodology, in order to fill in the blanks of empirical research in China.

047

Effects of norms and lifestyles on e-mobility adoption: A cross-country research on the adoption of electric vehicles and electric bikes

Ruzhen ZHANG (Master)

SUPERVISORS Gengyang Tu (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

The adoption of electrified mobility has been admitted as a current trend and an important step in the energy transition for the good of people, the environment, and society. Contributing towards this trend, individuals have taken actions such as adopting electric bikes (EB) and electric vehicles (EV). Though certain policies have been introduced by governments to promote EB and EV adoption, the current adoption level is still low. This study, with the large-scale data adopted from a project funded by the European Commission covering data from 31 countries (EU28 + Switzerland, Norway, and Turkey), investigates how injunctive norms, descriptive norms, and personal norms simultaneously affect electrified mobility adoption, and to what extent lifestyle factors relating to greenhouse gas reduction help explain electrified mobility adoption. Significantly, we adopted a categorical principal component analysis (CATPCA) to determine the dimensions of norms and went on to employ generalized structural equation modeling (GSEM), which is a highly advanced econometrical model, to measure the effects of three norms on EB adoption and EV adoption, when controlling for the impacts of factors such as lifestyle factors, socio-demographic factors, attitudinal factors, and mobility needs-related factors. Further, the originality of this research lies in uncovering country differences concerning electrified mobility adoption's responsiveness to relevant factors bconducting a cross-country analysis. For example, we have found a significant difference in income's effects between Western European countries and Eastern European countries. Such findings allow us to provide unique policies for EU and European governments, and to provide insights for policymakers in countries outside Europe such as China, for the mass adoption of electrified mobility. This research, for the first time, ascertained the positive effects of three norms simultaneously and clarified how greenhouse gas reduction-related lifestyle factors affect electrified mobility adoption, in general, and across countries, with notable country differences being explained in the paper. This paper will be submitted to a top journal in the field of energy.

048

Explore for self-concept clarity: Occupational stigma and career self-exploration

Tingxi WANG (PhD)

SUPERVISORS Yue Xu, Jie Li (XJTLU)
Yves Guillaume (UoL)

ACADEMY/SCHOOL International Business School Suzhou

Occupational stigma is often perceived as disgusting or degrading. Based on the stress as offense to self theory, we propose that the negative social evaluations of occupational stigma will impair employees' self-concept, blurring self-concept clarity. To maintain internal consistency and stability of self-concept, employees bearing occupational stigma will reflect on themselves deeply and further explore the meaning and relevance of their career life, namely, career self-exploration. In addition, for individuals with a high need for social approval, namely being sensitive to social evaluations, the aforementioned process will be stronger. A time-lagged field study with 264 full-time employees in China supported our hypotheses. Self-concept clarity mediates the positive relationship between occupational stigma and career self-exploration, which is strengthened by a high need for social approval. Theoretical and practical implications are also discussed.

049

Seeking the ideal design of new App icons: The influence of icon design congruity on users choice

Wenzhe LIANG (PhD)

SUPERVISORS Ou Liu, Rhonwyn Vaudrey (XJTLU)
Severina Cartwright (UoL)

ACADEMY/SCHOOL International Business School Suzhou

Daily life requires the use of various mobile applications, leading to an increase in the frequency and use time of mobile applications. Consumers also turn to mobile applications for entertainment, learning, and socialising, such that mobile applications have become indispensable to many of our lives. The proposed research is concerned with the role that visual information contained in the app icon plays in consumers' choice of mobile applications. This study examines the congruity between icon design elements to identify commonalities and differences between and within app categories. The content analysis is conducted on application icons shown in the Apple app store to identify the design attributes. The top 100 apps in each category of the app store form the data for analysis. The preliminary results show that navigation, music, and photography are more likely to use the icons to demonstrate function, while book, business and entertainment tend to use icons to represent app names or brands.

050

What influences customers' journey in the metaverse retailing? Results from meta-analytic structural equation modeling

Xiaowei FAN (PhD)

SUPERVISORS Jiyao Xun, Lin Xiong (XJTLU)
Les Dolega (UoL)

ACADEMY/SCHOOL School of Intelligent Finance and Business

This study aimed to examine the correlations and boundary conditions of the customer metaverse shopping journey within a comprehensive model, using a meta-analysis of 1,099 effect sizes (i.e., correlation coefficients) from 111 published research with 136 datasets and 547,415 sample sizes. The findings support existing theories of technology acceptance, such as the technology acceptance model and the unified theory of acceptance and use of technology, providing new insights into the metaverse shopping journey. Additionally, the study found significant moderating effects of technology and product types, offering valuable guidance for retailers in their integrated marketing strategies. This study provides managerial perspectives on linear and non-linear customer journeys by building upon AR/VR technologies' current utilisation in metaverse retailing. The study's generalisable conclusions shed light on retailers' systematic understanding of integrated marketing strategies and offer a foundation for future investigations.

051

Misallocation and capital market liberalization: Evidence from stock connect in China

Yimin SHAN (PhD)

SUPERVISORS Yang Chen, Yajun Xiao (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

We show that the natural experiment of the Stock Connect program reduces capital misallocation and improves productivity at the firm level in China. We find that the reform increases firms' capital overall. Capital for firms with ex-ante high marginal revenue products of capital (MRPK) rises by 21% while MRPK declines by 30% relative to firms with ex-ante low MRPK in connected versus unconnected enterprises. This economic outcome is stronger in SOEs with respect to POEs. Finally, we find that the mechanism behind the effect is driven by both the channel of increased credit of supply and reduced information asymmetry.

052

The impact of top management team characteristics on digital transformation: Evidence from China

Yinjie HAN (PhD)

SUPERVISORS Peng Cheng, Xiangyun Lu, Li Xie (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

Currently in China, most of the firms have completed their digital transformation, and the corresponding governance issues arising from it are the purpose of this research project. The current literature focuses on both society-level and firm-level determinants. Existing literature has studied corporate governance and digital transformation from the general level. Our research question is how top team characteristics affect digital transformation.

053

CEO awards, internal coalition and stock price crash risk: Evidence from China

Yudian FANG (PhD)

SUPERVISORS Jie Zhang, Stephen Gong, Li Xie (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

This paper is focus on how the awards-winning CEOs affect the stock price crash risk in the post-awards period in the Chinese market. Additionally, the awards-winning CEOs in the publicly listed companies cannot affect stock price by themselves. Therefore, this paper also presents that internal coalition could be a mediation effect between the relationship between awards-winning CEOs and stock price crash risk.

054

Rob Peter to pay Paul: How work connectivity triggers employee unethical pro-family behavior?

Yue ZHOU (PhD)

SUPERVISORS Nuno Da Camara, Chiachi Chang (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

Given that employees suffer a lot from blurred work-home boundaries, we explore the linking mechanism between work connectivity and employees' unethical pro-family behavior (UPFB). By adopting the social exchange theory and the work – home resources model, we contend that work connectivity positively relates to employees' UPFB through psychological contract breach. In accordance with a work-to-home process, we also focus on work-home segmentation preferences (WHSP) as a moderator that exacerbates dissatisfaction with negative organizational reciprocity and preservation of the family's interests, leading to UPFB. Using three-wave survey data from 268 full-time employees in China to test our predictions, we found that work connectivity triggers UPFB via perceived psychological contract breach, especially when individuals' WHSP was high. This study reveals the dark side of work connectivity and provides practical implications for organization management.

055

A product defect detection model for defective design detection in the new product development process based on product opportunity

Zhongyun LI (PhD)

SUPERVISORS Xiaobo Xu (XJTLU)
Guoquan Liu (NICE: National Innovation Center par Excellence)

ACADEMY/SCHOOL International Business School Suzhou

Identifying product defects is a central objective of the Product Defect Discovery (PDD) task, which is an important industrial application throughout the entire product lifecycle management. From the perspective of quality management, avoiding defective designs is an important subtask in the new product development (NPD) process. Conventional NPD methods have focused more on the entire process of new product design, with limited literature addressing product quality or defects in the design phase, and their approaches have not adequately considered the potential analysis of defective design opportunities. Therefore, this study proposes an opportunity mining approach based on the PDD through social media mining and sentiment analysis to identify product defective design opportunities. This approach utilizes aspect-level text classification to identify potential product defects discussed on social media, thereby quantifying the importance of each product defect. The proposed NPD method contributes to the systematic identification of product opportunities from large-scale social media data.

056

Does corporate environmental transparency help attract green-tech FDI? Evidence from Chinese cities

Zhuoran LIU (PhD)

SUPERVISORS Jie Li, Yameng Zhang (XJTLU)

ACADEMY/SCHOOL International Business School Suzhou

In the face of significant environmental challenges, such as climate change and loss of biodiversity, growing attention has been paid to foreign direct investment (FDI) with the green spillover effect, such as green-tech FDI, in emerging markets. International Business (IB) literature has extensively explored the attractive factors of all inward FDI in emerging markets. However, limited attention is paid to a specific type of FDI, green-tech FDI and it still remains unclear what kind of special location advantages will influence the location choice of green-tech FDI. Therefore, this paper draws from resource dependence theory and international business studies to investigate the effects of corporate environmental information disclosure (CEID) on green-tech FDI in emerging markets.

057

The impact of green credit on earning managements: Evidence from China

Ziyi ZHAI (PhD)

SUPERVISORS Mohamed Omran (XJTLU)
Charlie Cai (UoL)

ACADEMY/SCHOOL International Business School Suzhou

In recent years, green finance has become a hot topic in society and academia, but the relationship between green finance and earning management is less frequently discussed. This paper explores the impact of green credit policy on earnings management of green firms and highly polluted enterprises in China. This study uses the "Green Credit Guidelines" policy in China as a quasi-natural experiment based on a difference-in-differences (DID) model. This research contributes to the literature concerning green finance and earning management and provide a valuable reference for implementing green credit policies, improving the financing environment and policy making.

058

Humanistic leadership in organization: Exploring mechanisms and constructing theory

Boxiang LIN (PhD)

SUPERVISORS Pingping Fu

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / Nottingham University Business School China

The role of people is emphasized in Chinese entrepreneurs' humanistic practice to balance the advantage and disadvantage of technological development and deal with the social problems, which could not be solved by traditional economic based approaches. However, the current studies cannot explore the mechanism of humanistic leadership. This PhD dissertation will comprehensively adopt qualitative and quantitative research methods to explore the overall impact of humanistic leadership on employees, teams and enterprises level. This thesis will also analyse how leaders learn wisdom from traditional Chinese culture, continuously cultivate themselves, offer humanistic care, attach importance to humanistic education, and enthusiastically engage in public welfare activities. The humanistic leadership theory in the Chinese context and the measurement tool will also be developed based on the revealing of humanistic leadership intermediary mechanism. This research project will promote the practice of humanistic leadership in Chinese enterprises through exploring the new ways of leading by advancing instead of sacrificing employee wellbeing and corporate social responsibility. The potential outcomes of this project will also provide insights for humanistic leadership studies and practices in other cultural contexts.

059

How does word of mouth drive consumer searches? Evidence from the automobile market

Chengxi LI (PhD)

SUPERVISORS Fang Wu

UNIVERSITY/INSTITUTE Shanghai University of Finance and Economics / College of Business

This paper examines whether and how online WOM affects consumer search, a key action in the purchase journey. In the empirical context of the automobile market, online searches for a product tend to increase when consumers express positivity about it and when there is greater variance in WOM discussions. The authors further decompose WOM variance into user and attribute variances to capture its heterogeneity at the consumer and product attribute levels, respectively. They find that user-level WOM variance is more impactful than attribute-level WOM variance in generating online searches. This effect is particularly strong for high-end (i.e., high-price or high-quality) products. Moreover, broader product positioning (i.e., a larger price range within a product line) can strengthen user- and attribute-level WOM variance effects. Finally, WOM and advertising substitute each other in generating searches. We explore potential mechanisms for these findings.

060

The effect of shareholder pressure on stakeholder interests: Evidence from corporate tax avoidance

Hengmiao BAO (PhD)

SUPERVISORS Chaopeng Wu

UNIVERSITY/INSTITUTE Xiamen University / School of Management

Research on how shareholder pressure influences the interests of stakeholders has recently witnessed a sharp increase, but yields mixed findings. We revisit this question by investigating the impact of managers' attempts to meet or beat earnings expectations on corporate tax avoidance. Using a sample of Chinese listed firms during 2005-2020, we find that firms with earnings pressure are more tax aggressive. Furthermore, such a higher level of tax avoidance due to earnings pressure is associated with higher real activity management. Cross-sectional analysis shows that the effect of earnings pressure on tax avoidance is weaker among firms with better environment, society, and governance (ESG) performance, as these firms care more about other stakeholders' interests. We also find that the effect of earnings pressure is more salient for state-owned enterprises (SOEs), firms with greater economic importance, firms with higher financial constraints, and during periods when local officials lack promotion incentives.

061

Corporate social responsibility disclosure in mainland China listed companies: An in-depth analysis of quantity

Jiaxu DU (PhD)

SUPERVISORS Mahmoud Marzouk

UNIVERSITY/INSTITUTE University of Leicester / School of Business

Purpose: This research examines corporate social responsibility (CSR) disclosure levels of Mainland China firms listed on the Hong Kong Stock Exchange (HKEx) from 2013-2021. It delves into the effects of different legislative pressures on CSR disclosure, considering voluntary, semi-mandatory, and mandatory disclosure rules by the HKEx. Methods: A longitudinal approach reviews the CSR disclosures from 2013-2021, capturing changes in the HKEx's disclosure requirements. The study first gauges the volume of CSR data shared, then employs content analysis to ascertain disclosure themes. Findings: Revisions from voluntary to a 'comply and explain' regime boosted disclosure volume and altered their nature. Contrary to prior studies supporting the positive effects of mandatory disclosures on CSR volume, our results challenge this notion. Value: This study offers insights into CSR disclosure practices under various HKEx regimes, assisting future legislative design and company compliance. It uniquely highlights the influence of legislative shifts on Mainland China firms' CSR practices in HKEx.

062

Are all sustainability initiatives the same for consumers? Evidence from online experiments

Jishnu BHATTACHARYYA (PhD)

SUPERVISORS Yangyang Jiang, Yi Wang (UNNC: University of Nottingham Ningbo China); M S Balaji (RSB: Rennes School of Business)

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / Nottingham University Business School China

Service providers are enacting a range of sustainability initiatives as part of their corporate social responsibility efforts. To date, little attention has been paid to how these increasingly common elements of the servicescape impact consumer expectations of the service experience. In this context, we identified two initiatives: the Enhancement Initiative, which advocates for sustainable resource production and increases the positive environmental impacts of its operations (e.g., use of solar energy at the gym), and the Reduction Initiative, which focuses on minimizing negative environmental impacts of operations by minimizing resource use (e.g., efficient water use at the car wash). We argue that an enhancement (vs. reduction) initiative is more effective in raising consumers' service experience expectations. Moreover, perceived service inconvenience mediates the findings. Our results also suggest that brand positioning is the boundary condition. These predictions are tested in seven empirical studies. The implications relate to brand positioning strategy, resource allocation decisions, and effective communication.

063

The impact of Chinese foreign direct investment on Africa's sectors: The role of institutional quality

Rutendo Happy JONGA (PhD)

SUPERVISORS Yifei Cao

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / School of Economics

This research explores the influence of China's foreign direct investment (FDI) on the sectoral composition of Africa's seven basic industries namely; agriculture, manufacturing, mining, construction, services, transport and communication and other activities. The study employs the instrumental variable generalised method of moment's estimator (IV-GMM) on a country-level panel dataset of 47 African countries from the period 2004 to 2020. Initial estimations indicate that, FDI has a significant and positive effect on overall GDP, mining, construction, services, transport and communication, and other activities, although they are less sensitive to fluctuations in the FDI. On analysing the role of institutions on the FDI -sectoral composition relationship, the interaction of FDI with the institutions in Africa shows that control of corruption is the main mechanism through which all sectors except construction and services increase benefit from the FDI; and rule of law an important mechanism for agriculture, manufacturing and construction to also increase their benefits from Chinese FDI.

064

Content management policy and influencer marketing on social media platforms: A study of shopping links in sponsored content

Junni CHEN (PhD)

SUPERVISORS Qi Sun

UNIVERSITY/INSTITUTE Shanghai University of Finance and Economics / College of Business

Firms increasingly use social media influencers for brand promotion, yet the impact of platform content policies on marketing effectiveness remains unclear. This study leverages a quasi-experiment where a major platform banned shopping links in sponsored content, aiming to decrease commercialization and enhance user engagement. Using a difference-in-differences approach, we find that after banning shopping links, influencers adopted a more commercial style, and user engagement declined. Notably, without shopping links, users seldom saved content for later. Smaller influencers faced greater engagement drops than their larger counterparts. Our results suggest that merely reducing commercial elements might not boost engagement, emphasizing the need to understand influencer and user behaviors when crafting platform policies.

065

How does the digital economy affect solid waste management? Evidence from the provincial level in China

Mengge HAO (PhD)

SUPERVISORS Shichun Xu

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Economics and Management

The digital economy plays an important role in the field of environmental governance. This paper investigates the impact of the digital economy on solid waste management in China. The result indicates that the digital economy can promote solid waste management. The effect of the digital economy on solid waste management is nonlinear. As the level of economic development increases, the marginal promotion effect of the digital economy on solid waste management decreases and then increases. Only when R&D intensity reaches the threshold, the digital economy can contribute significantly to solid waste management. The digital economy promotes solid waste management by optimizing industrial structure. The digital economy significantly promotes solid waste management in the eastern and western regions of China, while the promoting effect is insignificant in the central region of China. The present study provides new ideas for sustainable waste management in emerging developing countries such as China.

066

A cross-national meta-analysis of the relationship between transformational leadership and public service motivation

Mengxiao DING (PhD)

SUPERVISORS Chengli Wang

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Public Policy and Management

The relationship between transformational leadership and public service motivation (PSM) has attracted increasing attention in public administration. Still, we need insight into whether national culture influence this relationship and whether there are differences in the relationship between transformational leadership and the sub-dimensions of PSM. This study examined 34 quantitative studies from 14 countries using the Hofstede and GLOBE models and confirmed a positive correlation between transformational leadership and PSM. The cross-cultural validation results show that specific dimensions of individual cultural values (power distance, individualism/collectivism, long-term orientation/short-term orientation, and indulgence/restraint) and regional cluster configurations could affect the strength of the relationship. The study demonstrates that transformational leadership is a powerful predictor of subordinates' PSM and provides a theoretical explanation for studying their relationship from a cross-cultural perspective, offering valuable insights into public sector human resource management.

067

Optimisation and strategies for a reusable transport item sharing platform

Min GUO (PhD)

SUPERVISORS Hing Kai Chan (UNNC: University of Nottingham Ningbo China)
Xiang T.R. Kong (SZU: Shenzhen University)
Dimple Thadani (HKBU: Hong Kong Baptist University)

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / Shenzhen University

This study examines the challenges that arise in orchestrating the efficient recycling of reusable transport items (RTIs) within business-to-business supply chains. These items, such as pallets and boxes, are critical resources in manufacturing and logistics, but their management can present significant operational issues. The study focuses on recent transitions from third-party operated systems to RTI sharing alliances, which promise more balanced and efficient resource use but also face unique problems, particularly regarding the fair distribution of profits among diverse alliance members. By posing investigatory queries on optimal resource allocation considering service priorities and equitable profit distribution among members with varying contribution weightages, the study expands upon existing research within cooperative game theory, opening new discussions on RTI sharing alliances. The ultimate goal is to develop strategies that enable sustainable, cost-effective RTI management that benefits the whole alliance. It also provides significant insights for practitioners in managing RTI sharing alliances.

068

Exclusive broker, institutional polycentrism, and firm innovation: Evidence from co-patenting activities of listed Chinese firms

Qinjie YANG (PhD)

SUPERVISORS Cong Cao

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / Nottingham University Business School China

Shared and exclusive broker draw attention from network research community, while substitution relationship between a focal broker and its potential competitors (called "shadow ego") and preconditions of achieving broker's innovation advantage have rarely been further discussed. Combining the network brokerage and institutional polycentrism theory from resource competition perspective, this paper examines that the moderating effects of sub-national institutions on the association between exclusive brokers and exploratory innovation. The listed companies' co-patenting network of Chinese manufacturing industries during 2010-2019 provides empirical evidence to support our study. Specifically, higher exclusivity of a focal broker is beneficial for subsequent exploratory innovation. In addition, IPR protection and social trust that facilitate information inflow boost exploratory innovation produced by enterprises occupying more exclusive broker. Supplementary effect exists between IPR protection and social trust and the moderating role of social trust works once IPR are protected well. Furthermore, policy certainty and mature factor market that contribute to the focal broker's knowledge absorbing, utilization and recombination strengthen innovation performance of enterprises bridging structural holes. State ownership plays a substitute role in either policy certainty or mature factor market. Policy certainty and developed factor market come into play in the relationship of exclusive brokers and exploratory innovation once less state ownership existed.

069

Does the COVID-19 pandemic change the hedging and safe haven functions of gold and Bitcoin for U.S. financial assets?

Qiuying CHENG (PhD)

SUPERVISORS Xinyu Wang

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Economics and Management

This paper examines the role of gold and Bitcoin as hedges and safe havens for U.S. financial assets before and after the COVID-19 outbreak. We apply the quantile-on-quantile regression and causality-in-quantiles test to capture the nonlinear and asymmetric dependence and causality of gold and Bitcoin with U.S. financial assets. Our results reveal negative dependence of the U.S. dollar, real estate, crude oil, and natural gas on gold and Bitcoin in some quantiles, indicating gold and Bitcoin act as the hedge and safe haven for these four assets during both periods. After the COVID-19 outbreak, the ability of gold and Bitcoin to hedge stocks and clean energy disappears, and Bitcoin can still hedge bonds in middle and high quantiles. Furthermore, the causal relationship in the mean and variance from U.S. financial assets to gold and Bitcoin is asymmetric and generally exists in the middle quantiles but not in the extreme quantiles.

070

Workload allocation between edge and cloud: Delay minimization, pricing, and free service

Sen LIN (PhD)

SUPERVISORS Bo Li (NISCI: Ningbo China Institute for Supply Chain Innovation)
Hing Kai Chan (UNNC: University of Nottingham Ningbo China)

UNIVERSITY/INSTITUTE Ningbo China Institute for Supply Chain Innovation / University of Nottingham Ningbo China

Besides adding powerful cloud computers, it is now possible to improve the quality of digital services by incorporating edge computing, an emerging computing paradigm. This prompts organizations to consider an integrated model that augments existing cloud computing systems with edge computing. However, this model requires an appropriate workload allocation between edge and cloud, which makes it challenging to make associated capacity and strategy decisions. To address this issue, we consider a scenario in which a vendor operates an integrated edge-cloud service system. Using game-theoretic analysis, we study the three-way interplay among the capacity of edge computing, the workload allocation between edge and cloud, and the strategy for pricing and service offering. We also delineate the impact of adding an ad-supported free service and demonstrate its attractiveness. Our findings unveil how edge computing could shape computing services and may guide vendors' pricing and capacity decisions in various business and technical environments.

071

Dynamic mixed-frequency quantile regressions with mixtures of normals as errors to forecast value at risk and expected shortfall

Song SHI (PhD)

SUPERVISORS Xinyu Wang

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Economics and Management

Although the asymmetric Laplace distribution is commonly used in quantile regression, it heavily biases the true distribution of the actual financial data, being not an ideal choice. To overcome this drawback, we propose a flexible mixed-frequency quantile regression model to forecast Value at Risk (VaR) and Expected Shortfall (ES), in which the errors are presented by a dynamic two-normal mixture process. We forecast one- and multi-day VaR and ES of the European Union Allowance. The empirical results show that our model has a better forecasting performance compared to the benchmark models, especially for the multi-day forecasting ability. These results are robust to samples eliminating epidemic and the different widths of rolling windows.

072

Internal auditors and fraud detection in CAL-Bank

Jonathan TEYE (PhD)

SUPERVISORS Xiangqian Wang

UNIVERSITY/INSTITUTE Anhui University of Science and Technology / School of Economic and Management

This study investigated the role of internal auditors in preventing and identifying fraud at Cal-Bank Limited in Ghana using a descriptive survey research design with a sample size of 100 respondents . The study found that internal auditors play a vital role in identifying and preventing fraud and that inadequate fraud policies, training, auditing experience, weak book-keeping, and insufficient employee criminal background checks contribute to fraud. Despite using internal control systems and software to combat fraud, the audit department faced challenges such as a lack of audit manuals and frequent management override of internal controls. The study recommends implementing adequate criminal background checks before employing staff and providing the audit department with resources, training, and independence to combat fraud effective.

073

Legitimization of business model innovation from the perspective of evaluator categorization: A case study of the emergence of online car-hailing

Xiaoman JIN (PhD)

SUPERVISORS Fangcheng Tang

UNIVERSITY/INSTITUTE Beijing University of Chemical Technology / School of Economics and Management

Business model innovation faces the challenge of multiple legitimacy. Drawing on the micro perspective of evaluator categorization,we conduct a longitudinal case study of China's Online Car-hailing during 2012-2018 and try to analyze the legitimacy judgment process of stakeholders and thus conclude the legalization mechanism of business model innovation. It is found that the evaluators judge the legitimacy of business model innovation based on classification cognition. The legalization strategy of online ride-hailing platforms needs to achieve dynamic adaptation with different evaluation subjects, judgment models, and classification criteria.In this process, the stakeholders judge the Online Car-hailing business model according to prototype-based and value-based categorization, which presents a two-way interaction process of "cognitive guidance behavior"and"behavioral feedback cognitive". This study integrates legitimacy judgment and categorization theory,and identifies a series of legitimacy acquisition strategies based on categorization, thus explaining how individual cognition promotes the emergence of new categories from the micro perspective, which will provide practical inspiration for exploring the legitimacy realization of business model innovation.

074

You do good and I do good: Investigating how CSR fuels employees' calling and voice

Xue HAN (PhD)

SUPERVISORS Yuhui Li

UNIVERSITY/INSTITUTE Renmin University of China / School of Labor and Human Resources

The topic of corporate social responsibility (CSR) has received considerable attention from scholars and practitioners. Drawing from social information procession theory (SIP), we posit that calling, which reflects employees' cognitive evaluation of their work in terms of its meaning and purpose, mediates the relationship between employees' perceived CSR and voice. We also posit that empowering leadership strengthens this mediating relationship. Data collected from two studies, a scenario experiment (N = 119) and a time-lagged survey (N = 210), provided support for all our hypotheses. Specifically, our results suggest that employees who perceive their company as actively engaged in CSR practices have a higher sense of calling, in turn motivating them to voice more. CSR perception translates into higher levels of calling and more voice when employees are highly empowered by their leaders. Implications for research and practice are discussed.

075

Keeping distance! How infectious disease threat lowers consumers' attitude toward densely displayed products

Yanxi YI (PhD)

SUPERVISORS Sotaro Katsumata

UNIVERSITY/INSTITUTE Osaka University / Graduate School of Economics

Infectious diseases have been posing frequent and significant threats to us. However, research on how disease threat affects consumer behavior, especially sensory responses, is still limited. In this paper, drawing on the theory of compensatory consumption, we show that consumers under disease threat are less willing to buy products presented in a dense display. This is because disease threat activates a crowding avoidance mindset, which is carried over to the way products are placed. Moreover, this effect is reversed when disease threat originates from in-group members. A set of five studies, adopting both lab and field settings, using different manipulations and measures, provide convergent evidence for these effects. Specifically, Study 1 examines the main effect of disease threat on product display. Studies 2A and 2B test the mediating role of crowding avoidance mindset using the causal chain method. Study 3 proceeds to explore the moderating role of the source of disease threat. Finally, Study 4 provides real world evidence through a field experiment. Furthermore, in these studies, six alternative explanations were ruled out to further clarify the psychological process. Theoretical and practical implications are discussed.

076

An electrochemical PAH-modified aptasensor for the label-free and highly-sensitive detection of saxitoxin

Beenish NOUREEN (PhD)

SUPERVISORS Chunsheng Wu

UNIVERSITY/INSTITUTE Xi'an Jiaotong University /
The School of Life Science and Technology

Saxitoxin (STX), is one of the most dangerous and widespread paralytic shellfish toxins, causing a severe threat to the ecosystem and human health. So, it is important and highly essential to develop novel techniques for STX detection in a convenient, desirable, and low-cost manner. Herein, this study developed an electrolyte-insulator-semiconductor (EIS) sensor covered with a layer-by-layer prepared, positively-charged weak polyelectrolyte layer of poly (allylamine hydrochloride) (PAH) for the label-free detection of STX. The specific aptamer (Apt) sensitive to STX was electrostatically adsorbed onto the PAH layer. This leads to a preferentially flat orientation of the Apt within the Debye length, thus yielding a reduced charge-screening influence and a higher sensor signal. Each step of sensor surface modification, i.e. PAH adsorption, immobilization of Apt, and attachment of STX, was monitored by capacitance-voltage (C-V) and constant-capacitance (ConCap) measure-ments. Further-more, atomic force microscopy (AFM) was employed to characterize the surface morphology and roughness of the PAH layer. Fluorescence microscopy was used to confirm the effective immobilization of Apt onto the PAH-modified EIS sensor. The results showed that the detection range of this aptasensor for STX detection was 0.5 – 100 nM and the detection limit was as low as 0.05 nM. Furthermore, this aptasensor showed good selectivity and 9 days' stability. The mussel tissue extraction test suggested that this aptasensor can be used to detect STX in real samples. This aptasensor provides a convenient approach for moderate, rapid, and label-free detection of marine biological toxins.

077

Hybrid computational strategy of MOF based chemiresistive sensor for trace gas detection: A theoretical-experimental synergy

Chunyi YU (PhD)

SUPERVISORS Lifeng Ding, Qiuchen Dong (XJTLU)
Matthew Dyer (UoL)

ACADEMY/SCHOOL School of Science

Gas sensing technology is crucial for detecting harmful volatile organic compounds (VOCs). However, traditional gas sensors face limitations in operating temperatures and selectivity. This study explores the use of conductive metal-organic frameworks (c-MOFs) for advanced chemiresistive gas sensors. C-MOFs, with their large surface area and tunable functional groups, offer promise for enhancing gas sensing capabilities. Therefore, a multi-step screening process is employed to identify suitable c-MOF candidates. The first high-throughput screening, using force fields and Grand Canonical Monte Carlo (GCMC) simulations, shortlists potential c-MOFs. Secondly, Density Functional Theory (DFT) calculations is used to validate adsorption systems and select the most promising materials for experimental validation. Then in experiments, selected c-MOF materials are synthesized and applied as coatings on interdigital electrodes for gas sensing tests. Finally, DFT-simulated results also aid in understanding the sensing mechanism. This approach aims to improve VOC sensing systems, addressing environmental and health challenges posed by VOCs.

078

Phosphinic acids show favorable inhibitory activity toward HIV-1 wildtype protease in vitro

Danwen QIU (PhD)

SUPERVISORS Magdalini Matziari, Rong Rong (XJTLU)
Paul O'Neill (UoL)

ACADEMY/SCHOOL School of Science

HIV-1 protease inhibitory activity of the samples in different concentrations was measured using a fluorometric HIV-1 protease inhibitor screening kit. In order to determine drug-likeness prediction of phosphinic candidates, Lipinski's rule of five and absorption property of the phytochemicals were evaluated by the SwissADME online program. All candidate-protein pairs were docked against HIV-1 PR by using GOLD or Schrodinger. Results: The IC50 of PL (hydroxethylene group to phosphinic group in lopinavir) is 50.45uM, HPLC-MS further separate two diastereomers shows RRS conformation (IC50=35.86uM) is more favorable than RSS diastereomers (IC50=253.2nM). Other symmetric phosphinic acids with different precursor show good potency with Lipinski rule and molecular docking. PAC show a higher activity with a IC50 of 523.7nM. Conclusion: Phosphinic acids show a good potential with high activity to wild-type HIV-1 protease both in vitro studies and in-silico ligand docking.

079

Investigation on multi-stimuli for high photoresponsive azobenzene based nanoscale molecular switch

Jianbo LI (PhD)

SUPERVISORS Li Yang, Chenguang Liu (XJTLU)
Richard Nichols (UoL)
Yannick Dappe
(CAE: French Alternative Energies and Atomic Energy Commission)

ACADEMY/SCHOOL School of Science

This article employs IRI function (interaction region indicator) to demonstrate the strong pi-pi interaction between two neighboring azobenzene molecules during the SAMs formation, this intermolecular interaction is the major problem that leads to the low switching efficiency for such conformation altered molecular memory. To cope with this problem, this article decides to substitute the azobenzene part to weaken the pi-pi stacking and earn more packing area for each molecule, according to computation result, ortho position is the optimized solution and ethyl and isopropyl are tried. Three molecules are tested in this project, Azo_C4 works as the control group, ORTHO-ET and ORTHO-ISO are expected to be fabricated as the high quality molecular device. In addition, acid treatment is also applied to these three molecules, the triggering wavelength of Azo_C4 is totally reversed once it is protonated, this property let azobenzene has larger potential in commercial application. The problems such as light scattering and operational difficulty for common molecular memory array can be solved by acid treatment easily. However, protonated ORTHO-ET and ORTHO-ISO undergo unpredictable chemical reaction upon light irradiation and lost the ability to acid treatment, despite they possess high photo switching efficiency.

080

Investigation of interface modification and solid-state electrolyte for next-generation energy storage system

Jiawei REN (PhD)

SUPERVISORS Li Yang, Chenguang Liu (XJTLU)

ACADEMY/SCHOOL School of Science

In my work, we modified MXene using mercaptopropyl-trimethoxysilane (MPTS), which enabled the modified MXene to replace Cu as a current collector for anode-free lithium metal batteries. With 6M LiFSI in DME, the reaction between methoxysilane and hydroxyl groups on the surface of MXene generated a stable and dense Si-O-Si structure, which resulted in lower nucleation overpotentials and deposition overpotentials compared to conventional Cu collectors. Moreover, the deposition of Li on the MPTS-MXene surface is flatter and more stable than that of Cu, which significantly reduces the irregular deposition of Li. Moreover, Li||MPTS-MXene was able to obtain a high Coulombic efficiency of 98.62% after 500 cycles of stabilisation. Secondly, a higher efficiency of 99.15% was obtained under the large capacity battery test, which proves the infinite potential of MPTS-MXene as a current collector, which undoubtedly provides an alternative direction for the development of anode-free lithium metal batteries.

081

Research on the electromagnetic absorption ability of different morphological SiC and its composites

Jinyan WANG (PhD)

SUPERVISORS Li Yang (XJTLU)

ACADEMY/SCHOOL School of Science

Electromagnetic wave (EMW) pollution has grown with technological development and has become the fourth source of pollution after air, water, and noise pollution. To decrease the radiation and minimise harmful effects, researchers have increasingly engaged in finding various EMW absorption materials. Silicon carbide (SiC) is a dielectric absorber and can be applied in harsh working environments due to its high-temperature oxidation resistance and good chemical inertness. However, the electromagnetic wave absorption performance of pure SiC is poor. Morphology design and compounding with other materials are effective ways to improve the EMW absorption performance of SiC. In this project, SiC absorbers with different morphologies were prepared first. Then, MnO2 is covered with hollow SiC to form a core-shell hollow SiC@MnO2 composite. Finally, in order to take full advantage of the hollow spherical structure and synergism of dielectric loss and magnetic loss, we prepared hollow SiC@Ni composites with boosted absorption performance.

082

Single-atom iron anchored on 2-D Graphene Carbon to realize bridge-adsorption of O–O as Biomimetic Enzyme for remarkably sensitive electrochemical detection of H2O2

Juan LI (PhD)

SUPERVISORS Changming Li (USTS: Suzhou University of Science and Technology)

UNIVERSITY/INSTITUTE Southwest University / College of Materials and Energy

Single-atom catalysis is mainly focused on its dispersed high-density catalytic sites, but delicate designs to realize a unique catalysis mechanism in terms of target reactions have been much less investigated. Herein an iron single atomic site catalyst anchored on 2-D N-doping graphene (Fe-SASC/G) was synthesized and further employed as a biomimetic sensor to electrochemically detect hydrogen peroxide, showing an extremely high sensitivity of 3214.28 μA mM-1 cm-2, which is much higher than that (6.5 μA mM-1 cm-2) of its dispersed on 1-D carbon nanowires (Fe-SASC/NW), ranking the best sensitivity among all reported Fe based catalyst at present. The sensor was also used to successfully in situ monitor H2O2 released from A549 living cells.The mechanism was further systematically investigated. Results interestingly indicate that the distance between adjacent single Fe atomic catalytic sites on 2-D graphene of Fe-SASC/G matches statistically well with the outer length of bioxygen of H2O2 to promote a bridge adsorption of -O-O- for simultaneous 2-electron transfer, while the single Fe atoms anchored on distant 1-D nanowires in Fe-SASC/NW only allow an end-adsorption of oxygen atoms for 1-electron transfer. These results demonstrate that Fe-SASC/G holds great promise as an advanced electrode material in selective and sensitive biomimetic sensor and other electrocatalytic applications, while offering scientific insights in deeper single atomic catalysis mechanisms, especially the effects of substrate dimensions on the mechanism.

083

Anion-enhanerated chemiluminescence via bisindolylpyrrolo[3,4-c] pyrrole-1,3-dnced photoluminescence and electrogeione -based hydrogen bonding

Jun CHENG (PhD)

SUPERVISORS Ruiyao Wang (XJTLU)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Electrochemiluminescence (ECL) has been extensively applied in bioanalysis, clinic diagnosis and flexible optoelectronics. However, it is still very challenging to improve the ECL efficiency. Herein, anion-enhanced photoluminescence (PL) and electrogenerated chemiluminescence (ECL) are demonstrated for the first time via hydrogen bonding interactions. A bisindolylpyrrole derivative was designed and synthesized to induce the enhanced PL and ECL emission based on hydrogen bonding interactions with anion of H2PO4-. Remarkably, the ECL efficiency was discovered to increase up to 5.5-fold via this anion coordination. Mechanistic studies showed that the ECL processes were different with and without H2PO4- dopping, thus leading to the understanding of enhanced ECL efficiency in the bisindolylpyrrole derivative. These bisindolylpyrrole derivatives will find applications in anion-induced emission enhancement via controlled hydrogen bonding interactions.

084

Dual HepC hepacivirin and HIV-1 proteases phosphorus-based inhibitors

Komal HAYAT (PhD)

SUPERVISORS Magdalini Matziari (XJTLU)
Gemma Nixon (UoL)

ACADEMY/SCHOOL School of Science

Hepatitis C virus is responsible for Hepatitis C, a prominent infectious disease that induces liver inflammation and cirrhosis. Recently, the first generation of Directly-Acting-Antivirals has been developed, which inhibit specific virus enzymes, NS3/4A protease- being the main target. On the other hand, HIV/AIDS is one of the most devastating global diseases, with proteolytic processing of the viral polyprotein responsible for the generation of mature, infectious species. The high co-occurrence of HepC/HIV infection is significant enough to investigate the possibility of developing dual inhibitors for the HIV-I and NS3/4A proteases, i.e., targeting both diseases simultaneously. The PL1-phosphinic analogue of Lopinavir has already been found to be a promising candidate based on in-vitro studies for HIV. Based on these facts and given the remarkable properties of the phosphinic binding group, it is therefore aimed to develop enzyme inhibitors based on symmetrical phosphinic peptides, considering the enzyme-substrate specificity which would simultaneously target the NS3/4A protease of HepC and the HIV-1 protease. Furthermore, esterification of these acids with flavonoids and sugars is the crucial step to achieve the desired goal because it will not only reduce the acidity and increase the permeability and bioavailability of the drug in the cells but release the flavonoid moieties in situ, which are well-known for their protective effect in liver injury.

085

Computer-aided design and fabrication of conductive covalent organic framework-based sensors for detecting trace organic carbonates during an electrolyte leakage from lithium-Ion batteries

Liangdan ZHAO (PhD)

SUPERVISORS Lifeng Ding, Qiuchen Dong (XJTLU)
Andrew Cooper, Alessandro Troisi (UoL)

ACADEMY/SCHOOL School of Science

Lithium-ion battery (LIB) is one indispensable energy storage method widely utilized in different industries. Early detection of LIB electrolyte leakage will offer invaluable time to intervene in the leakage event and prevent accidents. This project aims to design a novel covalent organic framework (COF)-based chemo-resistive gas sensor to selectively detect the trace organic carbonates (OCs) during an electrolyte leakage from LIBs. The classical molecular simulation and density functional theory (DFT) methods will also be used to screen COFs and explain the adsorption behaviour of OCs at the molecular level. The COF-QA-4 that can selectively adsorb trace ethylene carbonate (EC) has been screened from the COF database using grand canonical Monte Carlo (GCMC) simulation. Then, the COF-QA-4 was synthesized and fabricated into the electrochemical gas sensor. The gas sensing experiments results indicated that the COF-QA-4-based gas sensor could selectively adsorb trace EC gas.

086

Development of Methodologies for the Synthesis of Glycerophospholipids

Mingjie HONG (PhD)

SUPERVISORS Lei Fu, Yi Li (XJTLU)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Glycerophospholipids (GPs) are a class of phospholipids, chemical structurally characterized by the presence of fatty acid side chains at sn-1 and sn-2 positions and phosphate or phosphonate group with nitrogenous base at sn-3 position of glycerol backbone, found abundant in nature and especially predominant in mammalian electrically active tissues. GPs, which can be divided into many subclasses, are very crucial in many biological processes. Therefore, pure individual GPs are required for deeper investigation. The project is aiming to develop novel methodologies, which are high-efficient, feasible and may overcome the disadvantages of other methods, to obtain plentiful pure GPs that can be used for the following studies of biophysical and biochemical properties, biological activity and disease mechanism.

087

Optimizing fuel transport and distribution in gradient channel anode of solid oxide fuel cell

Shilin WEI (PhD)

SUPERVISORS Lang Xu

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Chemical Engineering and Technology

This study examines the fuel transport and distribution and thus the SOFC performance by constructing various gradient channel anode (GCA) structures. The findings show that compared to the traditional un-gradient channel anode (un-GCA) cell, the GCA cell results in a more uniform gas distribution and better diffusion of fuel gases, particularly H2, CH4 and H2O. Because of the improved gas diffusion in the anode, the GCA (12μm) cell exhibits a 2.34% improvement in power density compared to the un-GCA cell at 800 °C and 0.6 V. Additionally, after increasing the mole fractions of H2 and CH4, the power density of the GCA (12μm) cell is improved by 2.42% compared with that of the un-GCA cell under the same condition. This study provides clear evidence that incorporating the gradient channel structure in the anode can effectively enhance gas transport, minimize localized gas aggregation, and improve the performance of SOFC.

088

Tuning physiochemical properties of somatostatin analog Lanreotide through crystallisation and co-crystallisation

Shuai WANG (PhD)

SUPERVISORS Ruiyao Wang, Guoxia Han, Xin Liu (XJTLU)
Haifei Zhang (UoL)
Minghua Chen (Crystal Pharmatech Co., Ltd.)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Lanreotide is an essential Somatostatin analog used for treating acromegaly and carcinoid syndrome. It is a synthetic cyclic peptide dosed by injection. The poor oral bioavailability and low solid-state stability constrain the development of an oral route. Crystallisation and co-crystallisation are known to be effective in modulating the properties of traditional small-molecule drugs. However, there are limited reports on their application on cyclic peptide-based drugs. Crystallisation and co-crystallisation studies were thus carried out on Lanreotide to explore novel crystalline forms with improved physiochemical properties. Although Lanreotide is known for its resistance towards crystallisation, p-acetamidobenzoic, 2-furoic, and benzoic acid co-crystals were successfully obtained. With advantageous hygroscopicity and stability, the three co-crystals provide more and better options for Lanreotide development. Moreover, X-ray single crystal structure analysis of stable hydrous Lanreotide was carried out for the first time, shedding light on the structural understanding and design of stable crystalline forms for pharmaceutical development.

089

Solvent-free and under vacuum O-Benzylation of carboxylic acids using a rotary evaporator

Weiding WANG (PhD)

SUPERVISORS Qian Zhang (XJTLU)

ACADEMY/SCHOOL School of Science

A rapid benzylation of carboxylic acids was achieved under vacuum conditions and assisted by a rotary evaporator using p-toluenesulfonic acid as a catalyst. Unlike the conventional method that utilizes the Dean-Stark setup, which typically takes several hours or longer, benzylation was completed in 30 minutes without a solvent. Furthermore, this method avoids using BnBr or acyl halide as starting material and generates water as the only byproduct. This protocol is featured by high yield, high atom economy, fast reaction, broad substrate scope, and easy operation. The rotary evaporator is commonly seen in chemistry labs, and there is great potential for exploring rotavap-assisted organic synthesis.

090

Synthesis of tetrathienoanthracene derivatives, and characterization of their application for organic photovoltaics

Weihao DA (PhD)

SUPERVISORS Yi Lin, Kim Lau (XJTLU)
Alessandro Troisi (UoL)

ACADEMY/SCHOOL School of Science

OPV (organic photovoltaic) has seen a burgeoning interest over the last few decades for the fascinating findings that promote the new energy revolution. NFA (Non-fullerene acceptor) for OPVs has been investigated by many researchers due to its competitive features, such as a wide range of mild reaction conditions, low-cost, strong absorption in the visible and near-infrared regions, optimizable for energy levels, and tunable morphological properties. 2D conjugation TTA (tetrathienoanthracene) species with three different acceptors as ending tails were designed and synthesized for NFAs, which feature the A-π-D-π-A framework based on the TTA backbone. Results of UV-visible absorption, photoluminescence analysis, and cyclic voltammetry show the red-shift and both deeper energy level of HOMO (highest occupied molecular orbital) and LUMO (lowest Unoccupied Molecular Orbital) from halogenated end groups. In addition, we see potential applications of our molecules across the fields of OPV, OTFT (organic thin film transistor), OFET (Organic field effect transistor), OLED (Organic light emitting diode), and more. Finally, testing our compounds within the arena of OPV for photovoltaic performance is promising work that lies ahead.

Key Words: Organic Photovoltaic, Non-fullerene Acceptor, Organic Synthesis, Power Conversion Efficiencies

091

Coal pore characterization in high-pressure methane adsorption: A revised DR-ρ approach

Xiaoxi CHENG (PhD)

SUPERVISORS Yuanping Cheng

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Safety Engineering

As the energy sector advances, understanding unconventional reservoirs like coalbed methane and shale gas becomes increasingly crucial. In-depth knowledge of their pore structure and adsorption characteristics is essential for fundamental research. Physical adsorption is a common technique for pore characterization, yet methane, the primary adsorbate in unconventional reservoirs, is seldom used as a molecular probe. To address this, we employ a modified DR-ρ method. By introducing a density ratio to replace the pressure ratio and explicitly defining the physical parameters in the equation, we consider the limit adsorption phase density involving micropore filling and surface coverage. This approach accurately describes high-pressure methane adsorption data and yields total micropore volume information. This research presents a viable path for methane as a molecular probe in pore characterization, providing robust support for a deeper understanding of pore structure and adsorption properties in unconventional reservoirs.

092

Fabrication S-scheme heterojunction for enhancing photocatalytic β-O-4 bonds in lignin model compounds and Lignin biomass

Xutang LIU (PhD)

SUPERVISORS Wei Zhao

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Chemical Engineering and Technology

Photocatalytic cleavage of the β-O-4 linkages between the natural aromatic units in lignin biomass is significant but challenging to obtain high-valued chemicals. To address these challenges, an efficient approach for promoting the one-step C_β-O bond cleavage in β-O-4 lignin model compounds and lignin by using g-C_3N_4/$Zn_4In_2S_7$ (CN/ZIS) photocatalyst with step-scheme (S-scheme) heterojunction was employed under visible-light illumination. This study elucidated the high-performance charge transfer mechanism of heterogeneous interfaces and provided an effective strategy to produce aromatic resources by utilizing both lignin and photoenergy.

093

Study on extraction of marine active substances by supercritical fluid technology

Yi WANG (PhD)

SUPERVISORS Lei Fu, Ken Cheng (XJTLU)
Christopher Goldring (UoL)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

The objective was to acquire active substance from ascidian using supercritical fluid technology. A two-step fractionation scheme was used to improve the extraction selectivity by firstly de-oiling the dried ascidian powder by neat CO2 and secondly extracting phospholipids by CO2 plus ethanol. During this step, extracts were collected and quantified for their content in phosphatidylethanolamine and phosphatidycholine(by Ultra Performance Liquid Chromatography). The extract was influence of temperature and pressure and extracting fluid composition on extract composition was analyzed HPLC.

094

The separation and analysis of active phospholipid components from ascidian

Yicen YUE (PhD)

SUPERVISORS Lei Fu, Yi Li (XJTLU)
Christopher Goldring (UoL)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

The marine samples contain high levels of plasmalogens, exhibit anti-ageing activity, and significantly improve neurodegenerative diseases. However, plasmalogen compounds have complex and similar structures, making their extraction and purification difficult and expensive. In this study, we have developed a simple but effective workflow for separating monomer phospholipid compounds from ascidian, such as Pls-PE and Pls-PC. In addition, combining phospholipase A1 enzyme reaction, hydrochloric acid reaction, photochemistry and tandem MS, we develop a method to enable a large-scale and near-complete ascidian lipid structure characterization with a powerful ability to identify phospholipid types, fatty acyl positions, and C=C positions simultaneously. The 204 lipid species in ascidian phospholipids, including 8 plasmalogens, have been successfully discriminated. Preparing monomer plasmalogen compounds by Preparative-LC separation can solve the lack of pure plasmalogens and be a substitute standard for quantitative analysis and studying the biological functions. Meanwhile, the structure specificity of lipid analysis will advance lipidomic studies.

095

Design, synthesis and evaluation of Aminoglycoside-Oxazolidinone dual-targeting hybrid antibiotics

Yinzhe CHEN (PhD)

SUPERVISORS Qian Zhang, Lifeng Ding (XJTLU)
Ishwar Singh (UoL)

ACADEMY/SCHOOL School of Science

The frequency of the advent of antibiotic-resistant bacteria has increased dramatically over the past several decades. Aminoglycosides have worldwide use for over seventy years as traditional Gram-negative antibacterial medications. Oxazolidinones is a relatively new antibiotic used to treat infections caused by Gram-positive bacteria. However, acquired resistance to these two antibiotics restricts their use in clinical treatment. The combination of two antibiotics with different antimicrobial mechanisms in one molecule proved a promising strategy to overcome bacterial resistance. The developed hybrid antibiotics in this project are hopeful to have a broad antibacterial spectrum, low toxicity, and low resistance frequency.

096

A novel monolithic porous media catalyst for low concentration methane catalytic combustion

Yunqi CAO (PhD)

SUPERVISORS Fang Liu

UNIVERSITY/INSTITUTE China University of Mining and Technology /
School of Low-Carbon Energy and Power Engineering

A monolithic porous media catalyst (Fe2O3/Al2O3) was developed by ultrasonic-assisted impregnation for low concentration methane (LCM) catalytic combustion in a four-layer porous media (PM) burner. The results indicated that Fe2O3/Al2O3 catalyst possessed exceptional catalytic activity and thermal stability at medium-to-high temperatures, which broadened the limiting equivalence ratio for CH4 stationary combustion to 0.43 with the CH4 conversion exceeding 99%. LCM enabled higher combustion stability with a gradually-varied configuration, achieving steady combustion more than 120min under the lean combustion conditions. The high-quality flue gas with the average temperature over 600℃, lower CO (< 150ppm) and NOx emissions (<10ppm) could serve for the comprehensive utilization of power generation, heating and cooling. The catalytic oxidation of LCM on Fe2O3 surface was primarily divided into four steps with the second-step CH4 dehydrogenation in CH4 dissociation being the dominant rate-limiting step. This work provides a valiant reference for the clean and efficient utilization of LCM.

097

The role of strain rate in microstructure evolution, deformation heterogeneity and cracking mode of high-pressure die-casting Al7Si0.2Mg Alloy

Yutong YANG (PhD)

SUPERVISORS Li Yang (XJTLU)
Haifei Zhang (UoL)
Xiaonong Cheng (JITRI: Jiangsu Industrial Technology Research Institute)

ACADEMY/SCHOOL School of Science

The quasi-static and dynamic deformation behaviours of high-pressure die-casting (HPDC) Al7Si0.2Mg alloy were studied in this work. Competing effects among porosities, α-Al(Fe/Mn)Si phase, eutectic phase and α-Al dendrites on strain concentration and crack propagation at different strain rates were investigated using X-ray computed tomography (CT), scanning electron microscopy (SEM), in-situ electron backscattering diffraction (EBSD), and high-resolution digital image correlation (HR-DIC). The results indicate that yield strength and ductility of Al7Si0.2Mg alloy were improved at high strain rates compare to quasi-static loading. Weak zones, including porosities and particle interfaces, primarily contributed to deformation heterogeneity under quasi-static tension, whereas both weak zones and Al matrix played a role under dynamic loading. Moreover, crack propagation was hardly observed on porosities during dynamic deformation, thereby reducing the sensitivity of ductility to porosity. The slip and rotation of α-Al dendrites became more pronounced during dynamic deformation.

098

Synthetic methodological development based on photocatalysis reaction

Zonglian HOU (PhD)

SUPERVISORS Yi Li, Kim Lau (XJTLU)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

In recent years, visible-light has gained recognition as a powerful tool for facilitating reactions under mild conditions, resulting in high speed, step-efficiency, and high yield. This has led to a significant interest in photocatalytic reactions and their potential applications in organic synthesis. Our research focuses on the development of novel methods that enable the selective activation of C-H bonds and their transfer to other functional groups (such as C-C, C-N, C-X, C-O) through photocatalytic reactions, while maintaining chemical selectivity in terms of chemo-selectivity, region-selectivity, stereo-selectivity, and site-selectivity. One of our recent research interests lies in exploring the photo-promoted generation of nitrenes, which are reactive intermediates with great potential in various synthetic applications. While there have been numerous studies on photocatalytic N-H activation, most of them involve the activation of the N-H bond through N-radical generation. However, there is limited research on the exploration of nitrene generation through photocatalysis. Additionally, we are also investigating the generation of carbon radicals, including aldehyde radicals and beta-position alcohol radicals, as well as nitrogen radicals. These radicals play crucial roles in various chemical transformations and hold promise for expanding the synthetic toolbox in organic chemistry.

099

The case of networked geese? The role of networks in knowledge and technology transfer in China-Africa relations

Chaofan YU (PhD)

SUPERVISORS Dragan Pavlicevic, Simon Schweighofer (XJTLU)
Obert Hodzi (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

Within the debate of China's rise and its implications for the global order, this research assesses the role of business relations in facilitating knowledge and technology transfer from China to Africa. Contrary to common wisdom that knowledge transfer tends to happen in low-tech sectors, the result suggests that in the high-tech telecom and labor-intensive construction sector. It argues that the type of business relations between Chinese and African companies decide the motivation and result of knowledge transfer. Deploying the flying geese theory and the New Structural Economy model as the theoretical framework, it also compared the case of Nigeria and Ethiopia to understand the role of government in KT. The result proves that the structural environment decides the way Chinese companies choose to cooperate with African companies, and thus influences the result of KT. It can be suggested that in line with the expectation of the New Structural Economy theory, the government should provide both hardware infrastructure and a soft business environment for local companies to grow and offer protection policies to local firms against the competition of foreign companies.

100

Taking the nation out of nationality: The leveraged citizenship(s) of Sino-British children in China and Beyond

Jolyon SWINDELLS (PhD)

SUPERVISORS Emily Williams (XJTLU)

ACADEMY/SCHOOL School of Humanities and Social Sciences

The attribution of citizenship to children is usually decided by either the citizenship of the parent(s) (jus sanguinis), the place of birth (jus soli), or a combination of the two. In mixed transnational families – parents, at least initially, hold the citizenship of different countries, and their children are eligible for multiple citizenship from birth. This longitudinal research project focuses on a particular mixed transnational family formation – between one Chinese and one British parent - to analyse how parents decide the citizenship of their children. In this context, the decisions of parents are placed 'under constraint' by China's non-recognition of dual citizenship. Multi-sited, semi-structured interviews are employed with Sino-British families based in China, the United Kingdom, as well as in third countries. The concept of 'leveraged citizenship' is offered as a theoretical framework for understanding how parents leverage Chinese and British citizenship depending on the family's circumstances.

101

Understanding Chinese women's political efficacy and effectiveness in village governance through Bourdieu's field theory

Ruoyu CAO (PhD)

SUPERVISORS Yu Song, Zhoulin Ruan (XJTLU)
Susan Pickard (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

Chinese village women have traditionally played a vital role in agricultural production and village life. In some developed regions, women are taking on increasingly important responsibilities in village governance. Quite a few women take deputy or lead positions as village cadres. This study uses Pierre Bourdieu's theory of fields to investigate women's efficacy and effectiveness in village governance in City A, Jiangsu Province. By interviewing women in the villagers' committees, this study finds that the interplay of field, capital and habitus influences women's political efficacy and effectiveness. As the primary field of village governance, the committee working culture and selection processes shape women's intrinsic motivations to participate. Women endowed with robust economic, social, cultural, and symbolic capital in this field tend to achieve better political outcomes. While traditional gender role conceptions constrain efficacy, villagers' trust in local women facilitates their effective engagement.

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Boundary making in basic education: Exploring practices of equity in educational opportunities in China's second-tier cities

Siyang LI (PhD)

SUPERVISORS Leif Johnson, Dragan Pavlićević (XJTLU)
Daniela Tepe-Belfrage (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

Basic education in China eliminates school choice at the compulsory level by restricting enrolment to school districts or administrative areas based on hukou location, property ownership and social insurance payments by the student's parents. This system also creates new implicit social boundaries along administrative divides, differentiating between urban, suburban, rural, and migrant access to educational resources. Compared to high barriers to education in first-tier cities reported in scholarship, second-tier cities with high-quality educational resources have become new destinations for educational migrants. Using Xi'an as an example, this study uses semi-structured interviews with migrants and secondary sources to investigate the implementation of educational equity policies in China's second-tier cities. I examine how implicit educational boundaries are maintained or altered following the relaxation of hukou settlement restrictions, highlighting asymmetries between implicit social boundaries in education and the geographical boundaries of the city.

103

Engaging adolescents in cultural heritage: An iterative model of interpretive activity design

Yunpeng XIANG (PhD)

SUPERVISORS Yu Song, Chun-fung Chen, Cheng-Hung Lo (XJTLU)
Pooya Sareh (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

Heritage interpretation plays a vital role in enhancing public understanding of cultural heritage by immersing visitors in experiential aspects. This project proposes an iterative approach to interpretation that enhances adolescent engagement. Current practices often lack systematic optimization and evaluation. The approach involves cyclical stages of analyzing heritage, storyboarding, creating interpretations, and testing refinements. Through implementing various activities, the project examines the effectiveness of this iterative method. As part of the project, this study describes a food-related activity in Suzhou, illustrating the approach. The activity design process and positive adolescent response showcase benefits of staged storyboarding, testing, and refinement. Further research will expand evaluation of iterative model outcomes and applicability. In sum, the iterative interpretive design model offers a systematic framework for creating heritage experiences that stimulate adolescent curiosity and comprehension.

104

Unofficial Chinese media and their culture-related productions on YouTube: The grass-rooted Chinese cultural promotion and the overseas influences

Zhaoyu BING (PhD)

SUPERVISORS Pawel Zygadlo, David Kurt Herold (XJTLU)
Angela Becher (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

In recent years, multiple grass-rooted Chinese media without official backgrounds, producing and publishing content of traditional Chinese culture, have ‘gone abroad’ on overseas platforms, especially on YouTube. Some even have attracted millions of followers. Previous research only emphasises the interaction between these Chinese media and marketing, and most scholars rarely highlight them in cultural studies. This PhD project aims to investigate the principal reasons behind the phenomenon that these grass-rooted Chinese media and their productions are popular on YouTube. More importantly, the study also examines the influences of these grass-rooted Chinese media and their productions on Chinese cultural confidence, cultural soft power and intercultural communication from distinctive participant groups. To ensure academic universality and authenticity, the integrated methods, involving interviews and questionnaires, are employed for several groups of potential participants with specific cultural backgrounds worldwide.

105

Psychological, sociocultural, and academic domains of intercultural adjustment and adaptation: A study of international students at higher education in China

Ziyun ZHANG (PhD)

SUPERVISORS Pawel Zygadlo (XJTLU)
Peng Lei (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

The population of international students in Chinese higher education continues to rise annually, yet little is known about them. Research in this area is imperative, as prior findings from a Western context are not necessarily generalisable to the situation in China. This study reports on a longitudinal, mixed methods investigation of the impact of psychological and sociocultural adjustment on the academic adaptation of a multinational sample of international students at universities in China. At the same time, the moderating impact of social support and Chinese proficiency on their academic adaptation is also examined. An improved understanding of the behaviours and needs of international students can contribute to internationalising higher education systems. Moreover, the study could serve as the basis for future research on international students studying in China.

106

Effect of HVFA binder and binder content on the production parameters and size of artificial aggregates made from Autoclaved Aerated Concrete (AAC) Powder

Anil Ratna SHRESTHA (PhD)

SUPERVISORS Jun Xia, Ominda Prasad Nanayakkara (XJTLU)
Luigi Di Sarno (UoL)

ACADEMY/SCHOOL Design School

Autoclaved aerated concrete (AAC), one of the most popular building and construction materials which is approaching the end of its useful life. This is creating environmental and depository problems. Utilizing recycled AACP powder as a raw material for producing artificial aggregates can be a potential solution as an alternative to landfill deposition. The study investigates the effectiveness of utilizing high-volume fly ash mortar as a binder to produce cold-formed AAC aggregates. The initial assessment focuses on the use of different high-volume fly ash (HVFA) binder contents and their impact on the production parameters (viz., production efficiency, duration of pelletization, water-to-total solid ratio) and size of the aggregates. The results indicated that higher binder content influenced greater production efficiency, shorter duration of pelletization, and larger aggregate size.

107

Developing Model for risk assessment of theater projects

Boya YANG (Master)

SUPERVISORS Jelena Andric (XJTLU)

ACADEMY/SCHOOL Design School

This study aims to develop a theatre project risk assessment model based on the fuzzy analytic hierarchy process (fuzzy-AHP). By establishing risk variables, sub-factors and indicators, and using a fuzzy judgment matrix to calculate the weight of each element and indicator, the overall risk assessment of the project is determined. In order to verify the effectiveness of the model, an actual theatre project was selected for a case study. The research results show that the model can more accurately assess the overall risk level of the project and provide relevant risk countermeasures and decision-making suggestions for the project team. Compared with traditional methods, the fuzzy-AHP method can effectively handle the relationship between subjective and objective factors while considering uncertainty, improving the reliability and accuracy of risk assessment. Therefore, this study provides a practical and feasible evaluation model for theatre project risk management.

108

Repair mortar enhanced with organic corrosion inhibitors to upgrade corroded reinforced concrete structures

Dhanushka KOBBEKADUWA (PhD)

SUPERVISORS Ominda Nanayakkara, Theofanis Krevaikas (XJTLU)
Luigi Di Sarno (UoL)

ACADEMY/SCHOOL Design School

The corrosion of the embedded reinforcing steel can significantly reduce the lifespan of reinforced concrete structures, requiring an increased need for upgrading. Organic corrosion inhibitors (OCIs) to protect reinforced steel are identified as an effective solution. Furthermore, developing lower carbon footprint repair solutions using geopolymer materials has been gaining interest. This study investigated the performance of Metakaloin-based alkali-activated mortar with two types of OCIs by experimentally evaluating the fresh and hardened mechanical properties and corrosion resistivity. The results indicate that the workability of mortar increased by up to 21% upon adding OCIs. The potentiodynamic tests revealed that both OCIs had enhanced the mortar's corrosion resistance by 63%.

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Investigation of fresh and mechanical properties of alkali-activated high volume fly ash pastes

Duo XIE (PhD)

SUPERVISORS Ominda Nanayakkara, Jun Xia (XJTLU)
Xue Zhang (UoL)

ACADEMY/SCHOOL Design School

As one of the main concerns in the construction industry, environmental impact by carbon dioxide (CO_2) emission in Portland cement (OPC) usage is an urgent problem should be resolved. The construction sector perceives significant potential in alkali-activated materials (AAMs) and high volume fly ash cement (HVFA) contained 60%-80% of fly ash which is the one of by-products after combustion of coals in power station. This study reports an investigation of the flowability, setting time and compressive strength of HVFA pastes contained 60%-80% of fly ash and activated by calcium hydroxide (CH), sodium sulphate (Ns) and hybrid activators comprised CH and Ns. The experimental works revealed that both the hybrid activators and Ns enhanced the strength of pastes at 7 days regardless of content of fly ash and as activator, Ns meanwhile is beneficial to workability of HVFA pastes.

110

A BIM and AIoT integration framework for improving energy efficiency in green buildings

Guofeng QIANG (PhD)

SUPERVISORS Shu Tang, Jianli Hao (XJTLU)
Luigi Di Sarno (UoL)

ACADEMY/SCHOOL Design School

The green building (GB) sector contends with a significant energy performance gap. Building information modeling (BIM), Artificial Intelligence (AI), and Internet of Things (IoT) technologies can address this issue effectively by optimizing design and accurately predicting and monitoring energy consumption. However, research on integrating BIM and AI of Things (AIoT) for GB is nascent. Intelligent processing and analyzing heterogeneous data schema from various information systems is the main challenge faced by many researchers in GB domain. Thus, this study aims to systematically analyze the application of BIM and AIoT in GB and construct an integration framework for improving energy performance. In addition, this framework illustrates how to exchange, transmit and process massive amounts of heterogeneous data from BIM and IoT platforms by leveraging AI and Semantic Web technologies. Results show that BIM and AIoT integration can assist in intelligent energy-saving decisions through effective data exchange, cloud/edge/fog computing, and user interface (UI).

111

Research on the optimization of self-anchored system for CFRP cables

Jialu TANG (PhD)

SUPERVISORS Charles Loo (XJTLU)
Huajiang Ouyang (UoL)
Dianlong Tan (JITRI: Jiangsu Industrial Technology Research Institute)

ACADEMY/SCHOOL Design School

Carbon Fibre Reinforced Polymer (CFRP) cable is popular due to its good mechanical properties and excellent corrosion resistance performance, and the self-anchored system of CFRP cables is widely used due to its lightweight and simple installation. However, the stress concentration around the metal rings always causes premature failure, which influences the bearing capacity of the whole cable system. Therefore, this project will conduct research on making local reinforcement for the prepregs around the metal rings and improving the metal ring to improve the cable system's bearing capacity.

112

Characterisation of sustainable high-performance fiber reinforced pervious concrete

Jie LI (PhD)

SUPERVISORS Jun Xia, Guobin Gong (XJTLU)
Luigi Di Sarno (UoL)

ACADEMY/SCHOOL Design School

Impermeable structures emerge to replace the original natural permeable structure, which causes urban runoff, flooding, and heat island effects to appear frequently. As a new type of material that can be exploited as a sponge city, the performance of pervious concrete (PC) needs to be improved as much as possible. Referring to fiber in conventional concrete, whether applying fibers to PC can improve its performance needs to be identified. This project will focus on how the fiber affects the pervious concrete, and identify the mechanism of fiber. According to previous findings, important factors affecting the properties of previous concrete include the strength and rheological properties of the paste. Therefore, in order to explore high-strength and sustainable pervious concrete, high-strength pastes have been discussed and found a paste with 120MPa compressive strength including three types of supplementary cementing materials (SCMs). In addition, the appropriate relationship between the mini-slump cone test and the rheometer test has been identified, and would further explore whether that relationship is suitable for fiber-reinforced paste. Furthermore, the review of fiber-reinforced pervious concrete has been completed, and it was found that metal and synthetic fibers are the best options for increasing the flexural and splitting tensile strength of PC.

113

On the effect of solute atoms on twin boundary migration in magnesium alloys

Lang LIU (PhD)

SUPERVISORS Konstantinous Papadikis (XJTLU)
Yunchang Xin (JITRI: Jiangsu Industrial Technology Research Institute)

ACADEMY/SCHOOL Design School

Solute segregation to the grain boundaries contributes to the strengthening of magnesium alloys. In order to reveal the atomic level strengthening mechanism of solute segregation, a series of molecular dynamic simulations were implemented where a pile-up composed of 20 <a> dislocations was inserted into each one of a set of bicrystal models, one bicrystal model for one special type of grain boundary with Al segregation. Constant applied force was added to the bicrystal models to drive the glide of dislocations. We showed from our results that the Al segregation impeded the formation of disconnections along grain boundaries even at high resolved stress, and slip transfer occurred to soften the high stress concentration around the tip of the pile-up. We confirmed that this change in deformation mechanism caused by solute segregation led to the strengthening of magnesium alloys.

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Adaptation of Grad-CAM method to neural network architecture for LiDAR point cloud semantic segmentation

Ningxin WENG (PhD)

SUPERVISORS Lei Fan (XJTLU)

ACADEMY/SCHOOL Design School

Explaining decisions made by deep neural networks is a rapidly advancing research topic. The gradient-based methods such as Grad-CAM are broadly used in an image processing domain. On the other hand, the autonomous vehicle sensor suite consists of auxiliary devices such as radars and LiDARs, for which existing Explainable Artificial Intelligence methods do not apply directly. In this presentation, an adaptation approach is presented to utilize Grad-CAM visualization for LiDAR point cloud specific semantic segmentation architectures in automotive perception systems. This research tries to solve data and network architecture compatibility problems. It also intends to prove the question whether Grad-CAM methods could be used with LiDAR sensor data efficiently.

115

Fatigue life behaviour and mechanical properties of concrete incorporating recycled tyre rubber materials

Ran ZANG (PhD)

SUPERVISORS Bowen Xu, Lei Fan, Jun Xia (XJTLU)
Luigi Di Sarno (UoL)

ACADEMY/SCHOOL Design School

Rubber is broadly applied in today's society and automotive tire tread is a typical product. The worn-out tire will be discarded, resulting in a large amount of "black pollution". This study aims to investigate the mechanical properties of rubberised concrete (RC) to get a further understanding of the effect of the addition of rubber particles on concrete. There is a huge demand for concrete in the world that will correspondingly consume large amount of discard tires as rubberised concrete could be widely applied in construction. This research has discussed the probability distribution of fatigue life of RC and the constitutive curve under triaxial loading. To capture the evolution law of fatigue life under different failure probability levels, representative Weibull distribution of describing the failure probability is established, which considered the various stress ratio and rubber content. Subsequent research will continue on mechanical properties of RC under multi-axis load, to analyse the performance of RC.

116

Assessing the building spatial design from fire evacuation perspective by integrated BIM and VR technology

Rong FU (PhD)

SUPERVISORS Cheng Zhang, Yong Yue (XJTLU)
Hyung-Joon Seo (UoL)

ACADEMY/SCHOOL Design School

Spatial design greatly influences fire evacuation in buildings. Although existing works have comprehensively assessed building spatial design in terms of building circulation, they overlooked how the building layout and emergency signage system affect occupants' attention allocation during fire emergencies. Therefore, this paper proposes a framework to investigate the effectiveness of building evacuation impacted by building spatial design by integrating Building Information Model (BIM), fire simulation, and Virtual Reality (VR) technology. A case study was carried out to evaluate building spatial design in terms of building circulation and emergency signage. The results demonstrated that when the signage sizes were relatively small but the spacing and placement heights were reasonable, participants were able to recognise and follow the guide. However, insufficient continuity caused the participants to waste much effort searching for helpful information on evacuation-irrelevant objects, reducing fire evacuation efficiency. Moreover, the signage placed at a higher position has a positive effect on route choice.

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Study on the conductive properties of carbon fiber-graphite on fine-grained concrete in TRC

Shichang LI (PhD)

SUPERVISORS Shiping Yin

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Mechanics and Civil Engineering

In order to cost-effectively reduce the resistivity of fine-grained concrete. The effect of single and double doped carbon fiber and graphite on the mechanical and conductive properties of fine-grained concrete is investigated. The research shows that compared with graphite, the fluidity of carbon fiber for fine-grained concrete decreases significantly. When two conductive phase materials were incorporated into the fine-grained concrete, the compressive strength was reduced to varying degrees. For the fine-grained concrete specimens mixed with different conductive phase materials, the resistivity of the specimens increases with the age, and the resistivity of the specimens gradually decreases with the increase of the content of the two conductive phase materials. Finally, the conductive paths in the fine-grained concrete with double-doped conductive phase materials are divided into a triple conductive path, and the resistivity calculation model of fine-grained concrete after doping with conductive phase materials is established based on the Ezquerra model.

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Photocatalytic-magnetic g-C3N4 quinary nanocomposite for efficient removal of aqueous organic pollutants

Tianqi LIU (PhD)

SUPERVISORS Pow Seng Yap, Graham Dawson, Konstantinos Papadikis (XJTLU)
B. Layla Mehdi (UoL)

ACADEMY/SCHOOL Design School

g-C3N4/Fe3O4/AgBr/AgCl/AgI novel magnetic quinary nanocomposite was synthesized by using a wet chemical method to enhance the photocatalytic degradation performance of pure g-C3N4. The photocatalytic degradation efficiency under visible light was analyzed for methylene blue (MB) as target organic pollutant. The quinary nanocomposite with weight ratio of 10% g-C3N4 displayed high photocatalytic performance with 83% of MB degradation in 6 h under LED light irradiation. For the prevention of secondary pollution, the quinary nanocomposite has good magnetic properties and can be magnetically collected. The band gap of g-C3N4/Fe3O4/AgBr/AgCl/AgI was lower than pure g-C3N4. The effect of parameters such as initial concentration of pollutant, initial solution pH, and light source have been studied. The photocatalytic mechanism was investigated. It was found that the hydroxyl and superoxide radicals were major reactive species by scavenging experiments. The mineralization results were also analyzed based on liquid chromatography-mass spectroscopy (LC-MS) and total organic carbon (TOC). Additionally, g-C3N4/Fe3O4/AgBr/AgCl/AgI nanocomposite showed excellent reusability after magnetic separation and regeneration, thus suggesting it to be a promising photocatalyst for treating wastewater containing organic contaminants.

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Study on travertine permeable concrete as a sustainable method for urban flooding and pollution management system

Tianzhen LI (PhD)

SUPERVISORS Xiaonan Tang, Jun Xia, Guobin Gong, Yunqing Xu (XJTLU)
Ming Li (UoL)

ACADEMY/SCHOOL Design School

Rapid urbanization and the consequent increase in impervious surfaces have become one of the major contributors to urban flooding. As the unprocessed solid waste, Travertine was introduced to produce the new travertine pervious concretes (TPC) to reduce runoff volume and improve water quality. The orthogonal design was used to evaluate the effect of travertine replacement rate, water/binder ratio and polypropylene fiber on the properties of TPC. The preliminary results show that when the natural aggregate is replaced by 0-100% travertine, the compressive strength and permeability coefficient of TPC ranges from 20-40MPa and 1-5mm/s, respectively, which meets the requirements of the different permeable pavement. The influence of water/binder ratio and polypropylene fiber on the compressive strength and permeability of TPC is much smaller than that of travertine replacement rate. Besides, a novel practical rainfall simulation system was developed to evaluate the overall performance of the different lab-scale travertine pervious concrete pavements.

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Application of system dynamics to evaluate the impact of government regulations for reducing carbon emissions from prefabricated building waste

Wenbo ZHAO (Master)

SUPERVISORS Jianli Hao (XJTLU)

ACADEMY/SCHOOL Design School

In the study, the effectiveness of government regulations in reducing waste and carbon dioxide (CO2) emissions throughout the life cycle of prefabricated buildings was assessed using a system dynamics approach. The causal loop diagrams illustrate the impact of government policies on waste reduction at the design, production, transportation, construction, and disposal phases of prefabricated buildings; while the stock-flow diagram quantitatively evaluates the influence of government regulations on the environmental performance (CO2 emissions) of demolition waste. The study's findings suggest that among various scenarios, increasing landfilling fees emerged as the most effective method for reducing CO2 emissions. Furthermore, implementing multiple government regulations simultaneously, such as increasing landfilling fees, enhancing supervision against illegal dumping, improving policies during the design phase, and promoting prefabrication rates, proved more effective than individual policies. Under optimal conditions, this multifaceted approach could potentially reduce 77.37% of CO2 emissions from China's construction industry waste by 2030.

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3D reconstruction of Chinese historical architectures based on parametric modelling and data fusion

Xinyu TONG (PhD)

SUPERVISORS Cheng Zhang, Yiping Dong (XJTLU)
Hyung-Joon Seo (UoL)

ACADEMY/SCHOOL Design School

Heritage building information modelling (H-BIM) integrates topological, geometric and semantic information of built heritages in digital representation, such as the structure, component types and quality defects, which improves the management of the protection, restoration and dissemination process. However, due to the unique and complex geometry of built heritages, reconstruction of an H-BIM model containing complete information is challenging. This study focuses on solving the technical difficulties in the 3D reconstruction process of built heritages, including point cloud classification and parametric modelling. A case study was carried out in the Suzhou Twin Pagoda. Photogrammetry and laser scanning technologies were used for data acquisition and measurement of the actual scale of the architecture. Based on historical design principles in Yingzao Fashi, various kinds of parametric components of the wooden structure were generated and then mapped onto the point cloud to become a complete model of the architecture.

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Sustainable quaternary g-C3N4 -based nanocomposite for removal of aqueous organic pollutants

Xiyang LIU (PhD)

SUPERVISORS Pow Seng Yap, Graham Dawson, Konstantinos Papadikis (XJTLU)
Maulik Patel (UoL)

ACADEMY/SCHOOL Design School

The recent decades have witnessed a significant rise in the cases of global water pollution. While conventional wastewater treatments are still being adopted, these methods are not effective to remove the recalcitrant organic pollutants. Thus, efficient and environmentally-friendly water treatment processes are urgently needed. In this regard, nanomaterials are highly promising to be employed for practical application in water purification and wastewater treatment. Recently, graphitic carbon nitride (g-C3N4) has been rigorously investigated owing to its appealing capabilities and unique superiorities. However, pure g-C3N4 suffers from several drawbacks such as insufficient light absorption, small surface area and the high recombination rate of photogenerated electrons/holes. To further enhance its photocatalytic performances, this research will aim to investigate the fabrication of a sustainable photocatalytic-magnetic quaternary nanocomposite, namely g-C3N4 coupled with and magnetite, silver bromide, and reduced graphene oxide (g-C3N4/Fe3O4/AgBr/rGO).

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Exploring the barriers encountered in trading construction waste through digital platforms in China

Yi YANG (PhD)

SUPERVISORS Jianli Hao (XJTLU)
Luigi Di Sarno (UoL)
Jingfeng Yuan (SEU: Southeast University)

ACADEMY/SCHOOL Design School

The construction industry is a pillar industry in China and also a major generator of large amounts of waste. A large amount of construction waste is generated during the design and demolition of buildings. There is an urgent need to minimise the environmental burden caused by construction waste in China through the resourcing of construction waste. Waste trading is an effective and sustainable strategy to increase construction waste recycling. Digital platforms, as a successful model for industrial upgrading for several industries, can also be applied to construction waste trading. However, trading of construction waste through digital platforms is hindered by several barriers. These barriers have not received attention in past studies. Based on the review of relevant literature, this study adopts a combination of expert interviews as a qualitative research method and questionnaire survey as a quantitative research method. This study aims to identify the barriers encountered in the process of effective waste trading through digital platforms in China's construction waste industry.

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Investigating the impact of urban energy structure on carbon emissions: A case study of Suzhou city

Yige SUN (Master)

SUPERVISORS Xiaonan Tang, Jianli Hao (XJTLU)

ACADEMY/SCHOOL Design School

This research paper addresses the pressing issue of excessive carbon dioxide emissions in Suzhou City, China. Utilizing a comprehensive dataset spanning 20 years, we employ data mining techniques and principal component analysis to examine the intricate relationship between urban energy structure, carbon emissions, and other influential factors. Our findings reveal significant correlations and provide valuable insights into the dynamics of carbon emissions in Suzhou. The study proposes actionable recommendations for adjusting the city's energy structure to achieve the dual carbon target set in 2020. These findings hold implications not only for Suzhou but also for other urban areas facing similar challenges globally. By understanding the underlying factors, policymakers and stakeholders can make informed decisions to address energy and environmental issues effectively. This research contributes to the broader sustainable development goal by providing practical guidance for reducing carbon emissions and promoting environmental sustainability in urban areas.

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Improving automation in construction inspection by Integrating dynamic environmental perception and 3D reconstruction

Ying LO (PhD)

SUPERVISORS Cheng Zhang, Min Chen (XJTLU)
Hyung-Joon Seo (UoL)

ACADEMY/SCHOOL Design School

Construction inspection plays a vital role in ensuring quality, safety, and progress in construction projects. Accurate assessment of the conditions in construction site allows managers to perform timely corrective action to prevent delays and cost overruns. Current practices of construction inspection are still mainly manual, time consuming and error prone. Recently, automation and robotics technology has demonstrated the potential to serve the construction industry, including shorter construction time, safer workspace, and improved quality control. To improve the overall efficiency and accuracy, implementing automation in construction inspection faces challenges due to the dynamic and complex nature of construction sites. It is indeed challenging to fulfil the requirements of automation considering the tremendous information needs to capture and the intensive interaction between crew and equipment. Therefore, a well perceived site environment together with a well-designed decision-making support is essential for improving the level of automation in construction inspection.

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Multi-source remote sensing image fusion

Yuan FANG (PhD)

SUPERVISORS Lei Fan, Guobin Gong, Jianli Hao (XJTLU)
Luigi Di Sarno (UoL)

ACADEMY/SCHOOL Design School

Pansharpening is a process of fusing a high spatial resolution panchromatic image and a low spatial resolution multispectral image to create a high-resolution multispectral image. A novel single-branch, single-scale lightweight convolutional neural network, named SDRCNN, is developed in this study. By using a novel dense residual connected structure and convolution block, SDRCNN achieved a better trade-off between accuracy and efficiency. The performance of SDRCNN was tested using four datasets from the WorldView-3, WorldView-2 and QuickBird satellites. The compared methods include eight traditional methods and five lightweight deep learning methods. Based on a visual inspection of the pansharpened images created and the associated absolute residual maps, SDRCNN exhibited least spatial detail blurring and spectral distortion, amongst all the methods considered. The values of the quantitative evaluation metrics were closest to their ideal values when SDRCNN was used. The processing time of SDRCNN was also the shortest among all methods tested.

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Exploring the microscopic mechanism of elongation fluctuations in high-pressure die-cast AlSi7MnMg alloy

Zhen ZHENG (PhD)

SUPERVISORS Guobin Gong (XJTLU)
Xue Zhang (UoL)
Shiyao Huang, Weijian Han
(JITRI: Jiangsu Industrial Technology Research Institute)

ACADEMY/SCHOOL Design School

In this study, the die-cast AlSi7MnMg alloy was taken as the research object, and the internal mechanism of elongation fluctuation was elucidated from a microscopic perspective. The results of uniaxial tensile tests are used to verify the stress-strain curves simulated by representative volume elements under periodic boundary conditions, and a prediction method of fracture behavior considering the influence of defects and microstructure is further established.

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Investigation of reinforcement corrosion in concrete by microwave Non-destructive testing

Zitong GAO (PhD)

SUPERVISORS Ominda Nanayakkara, Mark Leach, Engui Liu (XJTLU)
Hyung-Joon Seo (UoL)

ACADEMY/SCHOOL Design School

Corrosion of steel bars is one of the unavoidable problems in the use of buildings. In reality, it is nearly impossible to do the destructive testing of existing buildings. Non-destructive testing(NDT) is a kind of analysis technique used to evaluate the materials' properties without damaging them. The Microwave NDT method to determine reinforcement corrosion demonstrates the advantages over other testing methods as the method is purely non-destructive, has rapid measurements, and low energy consumption. The ultimate objective of the thesis is to use the material's unique dielectric properties to detect the corrosion of the bars in concrete and evaluate the location and percentage.

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Mechanism of rock fracturing by carbon dioxide phase change blasting with medium impact

Zhongshun CHEN (PhD)

SUPERVISORS Yong Yuan

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Mines

Compared with traditional explosive blasting, carbon dioxide phase change blasting has lower stress level and longer action time. Theoretical analysis, numerical simulation and field measurement were used to determine the mechanism of phase change blasting. Under the action of medium impact, the initial fracture of rock around the borehole is caused by tensile stress, and multiple radial fractures are generated under the combined action of shock wave and unloading wave. Under the continuous action of stress wave, some radial fractures expand continuously and form the main fractures through the rock body. The range of fracture development is wider than that of traditional blasting, and the number of fractures is more than that of hydraulic fracturing. The relationship between the characteristics of rock fragments and loading stress was determined, and the fractal method was used to describe the distribution characteristics of cracks.

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Enhancing the usability of the motor imagery brain-computer interface with pseudo-haptic feedback

Annan LU (PhD)

SUPERVISORS Rui Yang, Steven Guan, Mengjie Huang (XJTLU)
Floriana Grasso (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Usability is a vital factor in guaranteeing the practical application of a system in the real world. Despite the great potential of Motor Imagery Brain-Computer Interface (MI-BCI) for laboratory applications in various domains, the application of MI-BCI in practice is still limited due to the low usability of the system. Feedback is an important component of the MI-BCI system, which provides the user with information about the process and results of MI task execution. Multimodal feedback combining visual and haptic senses provides users with richer sensations and improves the usability of MI-BCI. It is important to propose novel feedback designs to improve the system's usability without haptic devices. Pseudo-haptic feedback based on visual stimuli without physical stimuli can activate the subject's haptic perception to mimic haptic properties, which can benefit MI-BCI. This project will investigate the effects of pseudo-haptic feedback on the usability of the MI-BCI system.

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Self-supervisd learning on point cloud data

Changyu ZENG (PhD)

SUPERVISORS Wei Wang (XJTLU)
Anh Nguyen (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute),
Kaizhu Huang (DKU: Duke Kunshan University)

ACADEMY/SCHOOL School of Advanced Technology

3D point clouds are a crucial type of data collected by LiDAR sensors and widely used in transportation applications due to its concise descriptions and accurate localization. Deep neural networks (DNNs) have achieved remarkable success in processing large amount of disordered and sparse 3D point clouds, especially in various computer vision tasks, such as pedestrian detection and vehicle recognition. Among all the learning paradigms, Self-Supervised Learning (SSL), an unsupervised training paradigm that mines effective information from the data itself, is considered as an essential solution to solve the time-consuming and labor-intensive data labelling problems via smart pre-training task design. My research topic is to design novel pretext to extract point cloud features effectively.

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Decentralized multi-agent cooperation via adaptive partner modeling

Chenhang XU (PhD)

SUPERVISORS Xiaohui Zhu (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Multi-agent reinforcement learning faces non-stationary challenges due to concurrent policy updates. Traditional communication-based solutions suffer from partner sample complexity. We introduce Decentralized Adaptive Partner Modeling (DAPM) to balance sample complexity and performance. DAPM utilizes Fictitious Self Play (FSP) to construct partner models, limiting partner model usage to address model bias. An adaptive rollout approach allows real agents to communicate with partner models based on quality, progressively improving performance.

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Fine-grained causal defect classification: A novel perspective and practice through FCDCN

Chenke YIN (PhD)

SUPERVISORS Jia Wang (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Sample augmentation is a common practice employed to enhance the diversity of training data, mitigate overfitting, and boost the performance of deep learning models. Nevertheless, in practical applications, random sample augmentation may suffer from inefficiency and could potentially introduce significant uncontrolled background noise or generate lower-quality samples, thereby potentially impeding the learning effectiveness of the model. In this research, we introduce a novel Fine-grained Causal Defect Classification Network (FCDCN), aimed at exploring the untapped potential of sample augmentation. Our approach initially leverages machine learning-based interpretable counterfactual explanations to enhance samples, segregating features into two categories: valuable key features pertinent to the classification task and background or noise. Subsequently, we utilize these key features for the classification task, ensuring that our model can scrutinize objects more meticulously, resulting in a substantial performance enhancement. On three fine-grained defect datasets (WM811K，AITEX，AIE), our FCDCN method has respectively improved accuracy by 5.41%, 4.86%, and 7.62% compared to Sota methods, substantiating its efficacy.

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Super-resolution of cardiac MRI using residual prismatic network

Defu QIU (PhD)

SUPERVISORS Xuesong Wang

UNIVERSITY/INSTITUTE China University of Mining and Technology /
School of Information and Control Engineering

Cardiac magnetic resonance imaging (CMRI) can help experts improve the accuracy of diagnosing cardiovascular diseases. However, the low resolution of CMRI makes it difficult to meet the needs of large-scale CMRI data processing in hospitals, leading to inefficiencies and misdiagnosis of cardiovascular diseases by experts. To solve this problem, we propose a residual prismatic network for CMRI super-resolution (RPNSR), which consists of the shallow feature extraction module, deep features extraction module, and reconstruction module. Extensive experimental results on axial, coral, and sagittal datasets with different scale factors (×2, ×3, ×4) show that our RPNSR is superior to other state-of-the-art algorithms in terms of quantitative evaluation and visual effect.

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Application of deep reinforcement learning in portfolio management

Fengchen GU (PhD)

SUPERVISORS Huakang Li, Jionglong Su (XJTLU)
Angel Garcia Fernandez (UoL)

ACADEMY/SCHOOL School of AI and Advanced Computing

Portfolio management refers to the construction and revision of a financial portfolio by selecting and allocating assets to optimize returns. Reinforcement learning is deemed suitable for portfolio management as it adapts strategies to cope with the ever-changing market environment. However, existing portfolio management frameworks are not designed for handling stock data. First, they lack measures to improve the stability of reinforcement learning in portfolio management framework construction. Second, they do not mitigate the effects of data outliers, resulting in reduced profitability. In this research, we propose a framework based on the Memory Instance Gated Transformer (MIGT) for portfolio management. It uses a deep reinforcement learning scheme and the Gated Instance Attention module to learn stock trading frameworks by maximizing investment returns.

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Multi-sensor fusion for intelligent transportation system

Fengyufan YANG (PhD)

SUPERVISORS Ka Lok Man (XJTLU)
Jeremy Smith (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Advanced Technology

This research project focuses on advancing multi-sensor fusion technologies to pursue for safer and more efficient intelligent transportation systems. It utilizes diverse array of sensors especially including cameras, LiDAR, Radar, and other sensors that providing unique insights to enhance the vehicle's perception of its surroundings. The project emphasizes the integration of these sensors to mitigate individual limitations, enabling comprehensive and reliable environmental understanding. Special attention is given to the Bird's-Eye-View (BEV) approach, while also considering the potential adaptation to Occupancy method, aiming for improved spatial awareness and decision-making in complex traffic scenarios. This year, the project shall experiment with camera-LiDAR 3D voxelization fusion approaches with adjustable weights. By combining cutting-edge deep learning techniques with robust fusion algorithms and optimization strategies, the research intends to contribute to the advancement of safer, more reliable, and highly efficient autonomous driving systems, bringing us closer to a future of enhanced intelligence transportation systems.

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Detection for transparent and specular objects using generalizable NeRF

Fengze LI (PhD)

SUPERVISORS Jieming Ma (XJTLU)
Zhongbei Tian (UoL)

ACADEMY/SCHOOL School of Advanced Technology

This work aims to address the problem of transparent and specular object detection, which is an essential yet challenging problem in vision-based robotic systems, as depth cameras are unable to perceive the geometry of objects. The proposed network is expected to utilise a generalisable Neural Radiance Fields (NeRFs) for material-independent object grasping in clutter. The proposed framework jointly learns generalisable NeRF and grasping detection in an end-to-end manner, optimising the construction of scene representations for detection. Regarding training data, the project expects to generate a large-scale realistic domain stochastic synthetic dataset for transparent and specular object detection in cluttered desktop scenes that can be directly ported to the real world.

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Personalized causal disentanglement for debiased recommendations

Haichao ZHANG (Master)

SUPERVISORS Jia Wang (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Item popularity can serve as a confounder between the exposed items and observed interactions, resulting in population bias. Existing works mainly eliminate the bias through propensity-based unbiased learning or causal embeddings. However, we argue that users' personalized choices and their preferences play a crucial role in debiased recommendation systems, i.e., some conservative users tend to like popular products, those who are independent may prefer to try less mainstream items. Blindly pursuing unbiased learning may remove the beneficial patterns in the data, degrading the recommendation accuracy and user satisfaction. In this work, we propose , a personalized causal disentang-lement for debiasing recommendation. We first build a causal graph to analyze the underlying reasons for user-item interactions. Subsequently, we employ multiple encoders to assign users distinct representations, disentangling their personalized interest and conformity toward popular items. To ensure that each learned representations only capture one cause, we incorporate a domain classifier to enhance the differentiation between conformity and interest. Furthermore, we apply contrastive learning techniques to disentangle users' individual conformity levels toward items of varying popularity. By performing causal interventions on personalized conformity, we achieve precise and effective bias reduction. To validate the effectiveness of , we conduct experiments on three real-world datasets (ML-1M, Douban Movie, and Jester) to verify the significance of PCDR, the average improvement of PCDR in three evaluation metrics (NDCG, HR, and Recall) compared to the state-of-the-art model are 8.9729%, 4.6727% and 8.6140%, respectively.

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Large-scale traffic signal control using constrained network partition and adaptive deep reinforcement learning

Hankang GU (PhD)

SUPERVISORS Dongyao Jia, Eng Gee Lim (XJTLU)
Rahul Savani (UoL)
Shangbo Wang (HKU: University of HongKong)

ACADEMY/SCHOOL School of Advanced Technology

Multi-agent Deep Reinforcement Learning (MADRL) based traffic signal control becomes a popular research topic in recent years. To alleviate the scalability issue of completely centralized RL techniques and the non-stationarity issue of completely decentralized RL techniques on large-scale traffic networks, some literature utilizes a regional control approach where the whole network is firstly partitioned into multiple disjoint regions, followed by applying the centralized RL approach to each region. However, the existing partitioning rules either have no constraints on the topology of regions or require the same topology for all regions. Meanwhile, no existing regional control approach explores the performance of optimal joint action in an exponentially growing regional action space when intersections are controlled by 4-phase traffic signals (EW, EWL, NS, NSL). In this paper, we propose a novel RL training framework named RegionLight to tackle the above limitations. Specifically, the topology of regions is firstly constrained to a star network which comprises one center and an arbitrary number of leaves. Next, the network partitioning problem is modeled as an optimization problem to minimize the number of regions. Then, an Adaptive Branching Dueling Q-Network (ABDQ) model is proposed to decompose the regional control task into several joint signal control sub-tasks corresponding to particular intersections. Subsequently, these sub-tasks maximize the regional benefits cooperatively. Finally, the global control strategy for the whole network is obtained by concatenating the optimal joint actions of all regions. Experimental results demonstrate the superiority of our proposed framework over all baselines under both real and synthetic datasets in all evaluation metrics.

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Incorporating coarse-grained data and physics information for superior physical systems modeling

Haodong FENG (PhD)

SUPERVISORS Dixia Fan

UNIVERSITY/INSTITUTE Westlake University / School of Engineering

Physics-informed machine learning has emerged as a promising approach for modeling physical systems. However, two significant challenges limit its real-world applicability. First, most realistic scenarios allow only coarse-grained measurements due to sensor limitations, making the use of physics loss based on finite dimensional approximations infeasible. Second, the high cost of data acquisition impedes the model's predictive ability. To address these challenges, we introduce a novel framework called Physics-Informed Coarse-grained data Learning (PICL) that incorporates physics information via the learnable fine-grained state representation from coarse-grained data. This framework effectively integrates data-driven methods with physics-informed objectives, thereby significantly improving the predictive ability of the model. The PICL framework comprises two modules: the encoding module, responsible for generating the learnable fine-grained state, and the transition module, used for predicting the subsequent state. To train these modules, we employ a base-training period followed by a two-stage fine-tuning period. The key idea behind this training strategy is that we can leverage physics loss to enhance the reconstruction ability of the encoding module and the generalization ability of the transition module, using both labeled and unlabeled data. In the base-training period, we train both modules collaboratively using data loss and physics loss. In the two-stage fine-tuning period, we first tune the transition module with physics loss using unlabeled data and then tune the encoding module with data loss using labeled data to propagate the information from the transition module to the encoding module. We demonstrate that PICL exhibits superior predictive ability across modeling various PDE-governed physical systems.

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Towards realistic analog film photo generation

Haoyan GONG (PhD)

SUPERVISORS Hongbin Liu (XJTLU)

ACADEMY/SCHOOL School of AI and Advanced Computing

In recent years, film photography has rekindled the interest of both the community and researchers. Differing from digital photography, film employs silver halide to capture scene information, imparting unique color and textured graininess. In this study, Generative Adversarial Network (GAN)-based method is employed as the primary approach for translating images from digital to film domain. Our model facilitates the transformation of digital images into film-style counterparts, further enhanced by the Color-Noise-Encoding (CNE) network for distinct color and grain extraction. Experimental results demonstrate our model’s exceptional performance across multiple datasets, yielding superior image quality compared to conventional methods.

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Multi-scale feature and multi-channel selection towards parkinson's disease diagnosis with EEG

Haoyu WU (PhD)

SUPERVISORS Jun Qi, Yong Yue (XJTLU)
Frans Coenen (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Objective: Reducing the dimensionality of traditional EEG features based on manual extracted features, such as statistical features in the time and frequency domains Methods and procedures: A total of 22 multi-scale features were extracted from the UNM and Iowa datasets using a 4th order Butterworth filter and wavelet packet transform. Based on single-channel validation, 29 channels with the highest R2 scores were selected from a pool of 59 common channels. The proposed channel selection scheme was validated on the UNM dataset and tested on the Iowa dataset to compare its generalizability against models trained without channel selection. Results: The experimental results demonstrate that the proposed model achieves an optimal classification accuracy of 100%. Additionally, the generalization capability of the channel selection method is validated through out-of-sample testing based on the Iowa dataset Conclusion: Using single-channel validation, we proposed a channel selection scheme based on traditional statistical features, resulting in a selection of 29 channels. This scheme significantly reduced the dimensionality of EEG feature vectors related to Parkinson's disease by 50%. Remarkably, this approach demonstrated considerable classification performance on both the UNM and Iowa datasets. For the closed-eye state, the highest classification accuracy achieved was 100%, while for the open-eye state, the highest accuracy reached 85.7%.

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New combinatorial perspectives on MVP parking functions and their outcome map

Haoyue ZHU (PhD)

SUPERVISORS Thomas Selig, Steven Guan (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Advanced Technology

In parking problems, a given number of cars enter a one-way street sequentially, and attempt to park according to a specified preferred spot in the street. Various models are possible depending on the chosen rule for collisions, when two cars have the same preferred spot. We study so-called MVP parking functions, where priority is given to later cars. More precisely, if a car's preferred spot is occupied by a previous car, it will bump that previous car out of its spot, forcing it to drive on and look for the next available spot to park. We focus on characterising MVP parking functions where the cars end up parking in some specified order or outcome. Our characterisation uses a correspondence to certain graphs associated with this outcome. We use this to obtain improved bounds on the number of MVP parking functions with a given outcome.

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Interaction techniques for 3D modelling in virtual reality 3D environments

Jialin WANG (PhD)

SUPERVISORS Hai-Ning Liang (XJTLU)
Navjot Kukreja (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Virtual reality (VR) provides users with an immersive experience by stimulating their vision and hearing. It is predominantly used in gaming and the entertainment industry, but its use has also extended to other fields such as education, engineering, and healthcare. In this immersive virtual environment, interaction techniques play a crucial role in enabling users to work with 3D models effectively. However, the novelty of the medium means that the most effective interaction techniques are still under exploration. The focus of this PhD research program is to investigate the effect of different factors, namely, render resolution, frame rate to benefit high performance interaction in VR 3D modeling applications.

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Enhancing flexible power point tracking accuracy through machine learning-based denoising of irradiance data

Jiang YUAN (PhD)

SUPERVISORS Jieming Ma, Ka Lok Man (XJTLU)
Zhongbei Tian (UoL)
Baojiang Li (External)

ACADEMY/SCHOOL School of Advanced Technology

Photovoltaic (PV) systems operate optimally when flexible power point tracking (FPPT) is accurately maintained. However, under varying irradiance conditions, the perturb and observe (P&O) method used for FPPT can be compromised by noise, predominantly Gaussian noise, which disrupts the irradiance data. This study proposes a novel approach that employs machine learning (ML) algorithms for filtering and denoising irradiance input, thereby refining the FPPT's accuracy. We evaluate several ML techniques, including Kalman filter, convolutional neural networks (CNNs), support vector machines (SVMs), and recurrent neural networks (RNNs). The RNN model, in particular, has shown significant promise in filtering out noise while retaining critical data patterns, thus ensuring more reliable P&O operation. Empirical results suggest that the application of ML for denoising can lead to a substantial improvement in FPPT accuracy, even under highly variable irradiance conditions.

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BD-RDE: Bridging domains for robust depth estimation in low-contrast environments with a color-balance domain and an edge-aware module

Jiawei GUO (PhD)

SUPERVISORS Jieming Ma (XJTLU)
Angel Garcia-Fernandez (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Depth estimation from images is a fundamental computer vision task that predicts per-pixel depth values, providing critical geometric cues for numerous applications such as 3D reconstruction, robotics and augmented reality. However, depth estimation performance often deteriorates for low-contrast images, as lack of contrast causes loss of image details and blurring of edges. To improve robustness of depth estimators in low-contrast settings, this paper proposes a self-supervised enhancement module inspired by domain adaptation techniques. Specifically, a color-balance domain bridging normal and low-contrast domains is designed, along with an edge-aware module to extract salient edge information. This allows our enhancement model to be trained without needing extra low-contrast images. We show the proposed module can be flexibly injected into existing depth estimators, boosting their performance on low-contrast data. The experimental results illustrate the efficacy of the proposed model in enhancing depth estimation performance for low-contrast images. The proposed technique provides a simple yet impactful way to improve generalizability of depth estimators to challenging imaging conditions.

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A pose-aligned structure for pose-agnostic anomaly detection

Jiejie LIU (PhD)

SUPERVISORS Quan Zhang (XJTLU)
Jeremy Smith (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Our research focuses on the field of industrial anomaly detection, exploring the application of deep learning techniques in industrial production. We propose an efficient deep learning anomaly detection framework aimed at monitoring and identifying anomalies in industrial processes to enhance production efficiency and reduce losses. Through experimental validation, our approach demonstrates exceptional performance in industrial settings, offering innovative solutions for industrial automation and quality control. This research holds significant implications for the advancement of industrial anomaly detection, with the potential to drive intelligent and sustainable development in industrial production.

148

Enhancing machine translation quality assessment through emotion and argumentation

Jingshi ZHOU (PhD)

SUPERVISORS Fei Cheng, Xiaojun Zhang (XJTLU)
Frans Coenen (UoL)
Kaizhu Huang (DKU: Duke Kunshan University)

ACADEMY/SCHOOL School of Advanced Technology

This research proposes a novel approach to improve machine translation quality assessment. It introduces sentiment analysis and argumentation dimensions as extensions to the current evaluation baseline. By examining sentiment accuracy and argument consistency between source and translated texts, this study aims to create a more comprehensive evaluation method. Natural language processing techniques will be employed to achieve this goal. The research seeks to benefit both translators and end-users by enhancing the evaluation process, ensuring that machine translations convey the content and emotional and argumentative aspects of the text.

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Text semantic mining study on patent novelty detection

Jingxuan LIU (PhD)

SUPERVISORS Huakang Li, Shanshan Zhao (XJTLU)
Huajiang Ouyang (UoL)

ACADEMY/SCHOOL School of AI and Advanced Computing

The assessment of the novelty of an invention patent directly determines whether the patent will be granted. In the current patent novelty examination, examiners mainly obtain similar patents by keyword search and determine whether they are novel by empirical comparison. This method is not only time-consuming and laborious, but also may lead to missing or wrong judgment due to the examiner's subjective factors. This project analyzes the textual content of invention patents based on natural language processing techniques. We extract the technical entities and related relationships of the textual content and automatically construct the technical network flow of the invention patent. A graph matching algorithm is then used to analyze the similarity and novelty between patents. The method uses full-text search, which not only reduces the problem of missing detection in the search, but also greatly reduces the subjectivity of the examiner.

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Prototype guided pseudo labeling and perturbation-based active learning for domain adaptive semantic segmentation

Junkun PENG (PhD)

SUPERVISORS Jimin Xiao (XJTLU)
Waleed Al-Nuaimy (UoL)

ACADEMY/SCHOOL School of Advanced Technology

This work aims at active domain adaptation to transfer knowledge from a fully-labeled source domain to an entirely unlabeled target domain. During the active learning period, some pixels in the target domain are selected and annotated as active labels through several selection rounds. Such active labels can improve the target domain model performance greatly. However, existing approaches solely rely on pseudo labels, highly-confident classifier predictions on target images, to train the initial target domain model, resulting in a sub-optimal solution for model training. This initial model will be used for active label selection. Meanwhile, previous methods use entropy-based measurement to select pixels for annotation, which fails to detect high-confidence errors in earlier selection rounds due to the absence of target information. To address these issues, we propose a prototype-guided pseudo-label generating approach that leverages the relationships between source prototypes and target features. It generates target pseudo labels based on diverse source prototypes, thereby alleviating the issue of classifier predictions. Furthermore, perturbation-based uncertainty measurement, calculating the discrepancy between the target image and the augmented one, is introduced to find the areas with unstable predictions. Extensive experiments demonstrate that our approach outperforms state-of-the-art active domain adaptation methods on two benchmarks, GTAV to Cityscapes, and SYNTHIA to Cityscapes. Comparable performance is also achieved when compared to fully-supervised methods.

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Z-axis rotation-invariant point cloud place recognition

Junwei WU (PhD)

SUPERVISORS Quan Zhang (XJTLU)
Jeremy Smith (UoL)

ACADEMY/SCHOOL School of Advanced Technology

The purpose of point cloud place recognition is to convert a point cloud into a global descriptor, which can be used to locate the best-matched road scene from the entire dataset for intelligent vehicles. However, capturing a point cloud from an arbitrary view by robots or self-driving vehicles often involves rotations of the road scenes, which makes existing deep learning-based methods susceptible to errors. In response, we propose a new task: z-axis (upward direction) rotationinvariant point cloud place recognition, as rotations along the z-axis represent the typical scenario for a normally running self-driving car. To evaluate this task, a new performance metric is also introduced: Average Recall@N under arbitrary rotations, denoted as "R-AR@N". To tackle this issue, we develop a framework consisting of two key modules: the geometrical transformation module (GTM) and the local feature transformation module (LFT). GTM converts rotation-sensitive coordinates into rotation-invariant representations, ensuring that the network achieves rotation-invariant place recognition. Meanwhile, the LFT module uses statistical representation to transform local point features within a reasonable range, enabling the network to capture diverse geometric structures and generate a better global descriptor. The proposed method is extensively evaluated on Oxford outdoor and three in-house datasets, and it outperforms previous methods by at least 2% on the newly proposed "R-AR@N" metrics.

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Artificial synapses for neuromorphic computing

Junyan LI (PhD)

SUPERVISORS Ka Lok Man, Chun Zhao, Sang Lam (XJTLU)
Xin Tu (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Synapses are the fundamental elements of our brains and nervous systems. Information and stimulations are stored in our brain by means of synaptic weights, i.e. the connection strength at the synapse formed between two neurons. Reverse engineering and replication of biological brains have been a heated focus for decades. Based on the previous researches on material level, the synaptic devices can be categorized by 0D, 1D, 2D, and 3D materials. On the basis of the literature review, we have also fabricated our own aluminum-oxide-based and gallium-oxide-based artificial synaptic Thin Film Transistors (TFTs) via aqueous solution process. We explored the ion transmission mechanisms of the devices, and the differences between two types of devices with different dielectric materials. To conclude, the three-terminal synaptic devices made with metal oxide via solution process can provide low-cost and swift production with relatively satisfactory quality.

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Human-vehicle risk level prediction for human-machine co-driving control

Lin ZHOU (PhD)

SUPERVISORS Yong Yue, Xiaohui Zhu, Eng Gee Lim (XJTLU)
Terry Payne (UoL)

ACADEMY/SCHOOL School of Advanced Technology

In the development of autonomous driving L2~L4, there is a division of labour between human drivers and autonomous driving systems in different scenarios. How to switch between manual driving and automatic driving is an important research topic to improve driving safety. Human-machine co-driving refers to a scenario where both the driver and the intelligent system are in the loop, sharing control of the vehicle, and collaboratively completing driving tasks. Compared to common ADAS (Advanced Driver Assistance Systems) functions, co-driving intelligent cars have both humans and machines as controlling entities. The controlled objects of both parties are interlinked and coupled, and their state transitions are mutually constrained, forming a dual-loop parallel control structure. Human-machine co-driving can leverage the intelligence of both humans and machines, enhancing through a mix of human and machine intelligence. This forms a two-way information exchange and control, creating a "1+1>2" human-machine collaborative hybrid intelligence system. The goal of my research is to create a reliable risk prediction model to enhance safety and efficiency during the transition period towards full autonomy where both humans and machines share driving responsibilities.

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MeTACAST: Target- and context-aware spatial selection in VR

Lixiang ZHAO (PhD)

SUPERVISORS Lingyun Yu, Hai-Ning Liang, Yue Li (XJTLU)
Floriana Grasso (UoL)

ACADEMY/SCHOOL School of Advanced Technology

We propose three novel spatial data selection techniques for particle data in VR visualization environments. They are designed to be target- and context-aware and be suitable for a wide range of data features and complex scenarios. Each technique is designed to be adjusted to particular selection intents: the selection of consecutive dense regions, the selection of filament-like structures, and the selection of clusters—with all of them facilitating post-selection threshold adjustment. These techniques allow users to precisely select those regions of space for further exploration—with simple and approximate 3D pointing, brushing, or drawing input—using flexible point- or path-based input and without being limited by 3D occlusions, non-homogeneous feature density, or complex data shapes. These new techniques are evaluated in a controlled experiment and compared with the Baseline method, a region-based 3D painting selection. Our results indicate that our techniques are effective in handling a wide range of scenarios and allow users to select data based on their comprehension of crucial features. Furthermore, we analyze the attributes, requirements, and strategies of our spatial selection methods and compare them with existing state-of-the-art selection methods to handle diverse data features and situations. Based on this analysis we provide guidelines for choosing the most suitable 3D spatial selection techniques.

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Robust perception according to domain adaptation for automatic driving

Liye JIA (PhD)

SUPERVISORS Ka Lok Man (XJTLU)
Jeremy Smith (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Advanced Technology

Modern developments of Deep Neural Networks (DNNs) have achieved accurate performances as perception systems based on cameras, radars, and lidars. However, while deploying the trained DNN into actual circumstances, a problem called “domain shift”, the differences in the distributions of training and testing samples caused by backgrounds, weather, time, and even the parameters and placements of sensors, will decrease the accuracy and threaten the user’s safety. Fortunately, Domain Adaptation (DA) aims to transfer the network's abilities on downstream tasks and feature extractions from the training distribution to realistic scenarios, making the network robust to “domain shift” problems in deployments. In this project, we aim to study the applications of DA in AD perception systems, especially for those based on cameras, radars, lidars, and multi-modal sensors, in dealing with “domain shift” problems. Increasing the robustness through DA can enhance the DNN's dependence and save the external re-training costs on unseen distributions.

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Enhancing PV energy harvesting with a dual-axis solar tracking system based on reinforcement learning

Ming HUANG (PhD)

SUPERVISORS Ka Lok Man, Jieming Ma, Steven Guan (XJTLU)
Xue Zhang (UoL)

ACADEMY/SCHOOL School of Advanced Technology

This research introduces a novel approach to enhance the PV energy harvesting of a dual-axis Solar Tracking (ST) system by incorporating attention-based Reinforcement Learning (RL). The attention mechanism is employed to narrow down the search range required by the system, and RL is used to generate an adaptive action strategy that agents can flexibly explore, learn, and modify in response to external environmental changes. By leveraging RL, the ST system's action strategy is developed in a way that avoids artificial constraints, ensuring a more natural and dynamic response to environmental variations. This project builds a simulation environment in Unity to obtain simulation data to train the action strategy and enables it to adapt dynamically to varying environmental conditions. By continuously adjusting the angle of the photovoltaic system to align with the optimal solar radiation position, the proposed system can significantly increase power generation compared to static solar panels.

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Gabor feature-based video emotion recognition

Misbah AYOUB (PhD)

SUPERVISORS Haiyang Zhang (XJTLU)
Andrew Abel (Strath: University of Strathclyde)

ACADEMY/SCHOOL School of Advanced Technology

This project aims to investigate and document the potential of lightweight and interpretable computer-based video emotion recognition analysis by exploring techniques of feature extraction and analysis methodology. The Facial Action Coding System (FACS) provides a framework for understanding individual facial components associated with blinking, eyebrow movement, and lip motion, which collectively contribute to emotion recognition. Two distinct approaches have been proposed for the analysis of eye blinking and eyebrow movement: the Lacrimal Aspect Ratio (LAR) and Lacrimal Distance Analysis (LDA), respectively. For lip movement analysis, Gabor feature extraction and a modified mouth aspect ratio are employed. Each of these approaches undergoes separate training and testing phases using Convolutional Neural Networks. Subsequently, a multimodal fusion technique is implemented, resulting in the recognition of universal facial emotions.

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IMCGNN: Information maximization-based continual graph neural networks for inductive node classification

Qi'Ao YUAN (PhD)

SUPERVISORS Steven Guan, Ka Lok Man (XJTLU)
Prodence Wong (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Continual graph learning is an emerging field allowing models to accumulate new knowledge incrementally while retaining past experiences, effectively adapting to evolving dynamic graphs and lessening the computational load of retraining. Its main departure from traditional continual learning is the interdependence of graph-structured data, necessitating a focus on consolidating and leveraging topological information. Current methods often overlook or underestimate this, resulting in overly conservative models. Our proposed Information Maximization-based Continual Graph Neural Network (IMCGNN) features a continual learning mechanism that involves a replay module extracting representative subgraphs from previous data, preserving historical experiences. A regularization module imposes penalties to retain encoded knowledge. By theoretically deriving a node scoring formula from information theory, our approach prioritizes subgraph nodes to preserve maximal information. Experiments comparing our method with seven baselines on five benchmark datasets using two graph learning models demonstrate its superior effectiveness and efficiency.

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Dynamic attention network based traffic prediction for intelligent transportation systems

Ruiyuan JIANG (PhD)

SUPERVISORS Dongyao Jia (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Accurate future traffic information is crucial for autonomous driving in complex traffic environments. Therefore, numerous research efforts have been conducted on traffic prediction techniques for intelligent transportation systems in recent years. Most existing methods tend to utilize deep learning models such as GCN (Graph Convolutional Network) or CNN (Convolutional Neural Network) to capture the spatio-temporal features of traffic information. However, they mostly use binary adjacency matrix to represent the graph information of the road network which cannot meticulously describe the spatial correlation of traffic conditions among multiple sensors. In addition, most existing frameworks ignore the global trends of dynamic temporal features over different time steps ahead, and train the model with static parameters, which can not capture the overall trend of traffic conditions and reduce the representation power of models. In this paper, we design a dynamic temporal self-attention graph convolutional network (DT-SGCN) for predicting traffic conditions at multiple sensor locations. DT-SGCN utilizes an attention-based graph convolutional network (Att-GCN) to model the spatial features of traffic conditions, which uses a spatial correlation ranking (SCR) block to group the sensors with high spatial correlation and considers the spatial features to be learnable parameters during model training. In addition, the Dynamic gated recurrent unit (Dynamic-GRU) network is proposed to capture the relationships between traffic conditions at each pair of time steps with dynamic features. In particular, with two real-world datasets, DT-SGCN shows superiority over recent spatio-temporal prediction models by up to 12% improvement in MAE (Mean Square Error) measure.

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A comprehensive water-surface panoptic perception framework based on prompt guidance and multi-sensor fusion

Runwei GUAN (PhD)

SUPERVISORS Ka Lok Man, Eng Gee Lim (XJTLU)
Jeremy Smith (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Advanced Technology

Multimodal learning is currently experiencing rapid development, with one area of application being autonomous navigation, particularly in the domain of aquatic environments, which has seen relatively slower progress compared to terrestrial autonomous navigation. Presently, aquatic autonomous navigation is primarily employed for tasks such as environmental monitoring using unmanned marine platforms, waste collection, autonomous boats, geological exploration, and disaster relief operations. A critical prerequisite for the successful execution of these tasks is efficient perception capability. To achieve all-weather robust perception, the fusion of cameras and millimeter-wave radar is a promising and cost-effective solution. Furthermore, in many scenarios, remote operators require the ability to search for specific targets, and a means of conveying human intent is through natural language. Therefore, we propose a parallel perception system that combines environmental perception with visual grounding. This system is capable of achieving panoramic environmental awareness while simultaneously detecting specific targets in response to operator commands.

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WaterScenes: A multi-task 4D radar-camera fusion dataset and benchmark for autonomous driving on water surfaces

Shanliang YAO (PhD)

SUPERVISORS Xiaohui Zhu (XJTLU)
Hyung-Joon SEO (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Advanced Technology

Autonomous driving on water surfaces plays an essential role in executing hazardous and time-consuming missions, such as maritime surveillance, survivors rescue, environmental monitoring, hydrography mapping and waste cleaning. This work presents WaterScenes, the first multi-task 4D radar-camera fusion dataset for autonomous driving on water surfaces. Equipped with a 4D radar and a monocular camera, our Unmanned Surface Vehicle (USV) proffers all-weather solutions for discerning object-related information, including color, shape, texture, range, velocity, azimuth, and elevation. Focusing on typical static and dynamic objects on water surfaces, we label the camera images and radar point clouds at pixel-level and point-level, respectively. In addition to basic perception tasks, such as object detection, instance segmentation and semantic segmentation, we also provide annotations for free-space segmentation and waterline segmentation. Leveraging the multi-task and multi-modal data, we conduct benchmark experiments on the uni-modality of radar and camera, as well as the fused modalities. Experimental results demonstrate that 4D radar-camera fusion can considerably improve the accuracy and robustness of perception on water surfaces, especially in adverse lighting and weather conditions. WaterScenes dataset is public on https://waterscenes.github.io

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Large language model assisted multi-agent dialogue for ontology alignment

Shiyao ZHANG (PhD)

SUPERVISORS Yuji Dong, Jie Zhang, Yong Yue (XJTLU)
Terry Payne (UoL)

ACADEMY/SCHOOL School of Internet of Things

In today's data-driven era, data is produced and utilized in nearly every activity, paving the way towards an interconnected future. A significant challenge for this interconnected future is achieving automatic data interoperability, which allows data to be exchanged and utilized with minimal human involvement. Recent advancements in Large Language Models (LLMs) have showcased a general cognitive ability that has the potential to minimize the need for costly human involvement. However, these models often produce outputs that lack reliability and interpretability. In response to this, we propose a novel approach involving a dialogue-based alignment negotiation with an LLM acting as a selector. Our findings indicate that this approach not only reduces the reliance on domain experts but also ensures the results are interpretable, despite the utilization of LLMs. This aligns with the ethical considerations in AI application. Moreover, our results provide an evaluation of the general capability of such alignment.

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Understanding User experience, task performance, and task interdependence in symmetric and asymmetric VR collaboration

Shuhao ZHANG (PhD)

SUPERVISORS Ka Lok Man, Yue Li, Yong Yue (XJTLU)
Jeremy Smith (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Asymmetric collaboration is an important topic for the research of multiuser collaborative systems. By providing different abilities, devices or contents to different users, they can take advantage of devices and collaborate effectively with each other. However, there is limited work comparing the differences between asymmetric and symmetric collaboration systems. In this work, we present a comparative study that investigated how user experiences, task performance, and task interdependence vary in symmetric and asymmetric collaborations. Participants were asked to collaboratively perform 3D object selection and manipulation tasks in pairs. A within-subjects study was conducted, where participants used PC and PC, VR and VR, and PC and VR, respectively in three conditions. Our results revealed that the asymmetric collaborative system showed the best results; the PC symmetric collaborative system showed the worst results. We discuss the features of PC and VR and provide design recommendations for future symmetric and asymmetric VR collaboration systems.

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Privacy-preserving lecture sharing in metaverse by using blockchain and attribute-based encryption

Sida HUANG (PhD)

SUPERVISORS Yuji Dong, Jasmine Kah Phooi Seng, Jie Zhang (XJTLU)
Terry Payne (UoL)

ACADEMY/SCHOOL School of Internet of Things

Metaverse has received significant attention as more individuals are interested in developing virtual environments and exploring digital worlds. The educational Metaverse has attracted particular interest, as it offers the potential for highly immersive and interactive learning experiences. Nevertheless, developing an educational metaverse faces several challenges, such as system robustness, latency, and data privacy and security. Blockchain technology provides a decentralized and secure approach to data management and storage. This paper provides a privacy-preserving lecture-sharing scheme for the educational Metaverse by using attribute-based encryption. Our approach ensures that only authorized students can access lecture materials while maintaining data privacy and security. Furthermore, we implemented a prototype of this platform on the Ethereum test network, illustrating the effectiveness of our solution in improving the efficiency of lecture sharing while guaranteeing data privacy. Index Terms—Lecture Sharing, Privacy Preservation, Access Control, Blockchain, Metaverse, Attribute-Based Encryption

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Parallel learning for HOI detection

Tianlun LUO (PhD)

SUPERVISORS Steven Guan (XJTLU)
Jeremy Smith (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Human-Object Interaction (HOI) detection is a critical topic in the visual understanding field. With the development of deep learning models, the research of HOI detection has been profoundly reshaped. Deep convolutional neural networks increased the object recognition accuracy of static images and induced a detection-based HOI detection stream. These methods resolve the HOI detection problem from a classification perspective. Another stream of HOI detection methods seeks a deeper understanding of the information shown in images, and they are named HOI understanding methods in this survey paper. These methods usually acquire external linguistic data to enable the deep models to learn more about the images. Additionally, some of the HOI understanding methods exploit graph neural networks (GNN) to increase the inference accuracy of the model.

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Parallel and stagger network: Rethinking information loss in medical image segmentation with various-sized targets

Tianyi LIU (PhD)

SUPERVISORS Haochuan Jiang (XJTLU)

ACADEMY/SCHOOL School of Robotics

In medical image segmentation, targeting organs or structures are always in various ranges of sizes. Despite recent CNN and ViT-based efforts attempting to predict large and small annotations, this wisdom is often unable to balance the detection of targets in various sizes simultaneously. Simply leveraging the local information from CNNs and the global relationship from ViTs will bring gaps in semantic information, possibly leading to substantial information loss. To address this challenge, in this paper, we propose a novel Parallel and Stagger Network (PS-Net). Specifically, to emphasize both global dependencies and local focus, we parallelly down-sample the same features in ViTs and CNNs simultaneously in the \textit {Parallel Pipeline} to bridge the semantic gap. Meanwhile, we propose the \textit{Stagger Pipeline} trying to fuse from the Parallel Pipeline selected features that are more semantically similar. An \textit{Information Recovery Pipeline} is further adopted to recover complementary information back to the network. As a key contribution, we theoretically analyze that the proposed parallel and stagger strategy would lead to less information loss, thus certifying the PS-Net's rationale. We compare the proposed PS-Net with recent popular SOTA approaches using unstagger settings on two benchmark medical datasets. Experimental results show that the PS-Net excels all the comparisons in segmenting various-sized targets by more than 9\% and 2\% on segmenting large and small targets respectively.

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Exploration of foot-based text entry techniques for virtual reality environments

Tingjie WAN (PhD)

SUPERVISORS Hai-Ning Liang (XJTLU)
Katie Atkinson (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Text entry in virtual reality (VR) can be challenging when users' hands are busy with other tasks or have hand impairments. This work explores the feasibility and design of foot-based techniques as a hands-free approach. We first conducted a preliminary study to assess foot-based text entry in standing and seated positions. Based on the findings, we developed three foot-based techniques (FeetSymTap, FeetAsymTap, and FeetGestureTap) and evaluated their performance in two studies. Study 1 compared the three techniques and showed FeetSymTap and FeetAsymTap outperformed FeetGestureTap in entry rate and FeetAsymTap led to a lower error rate. In Study 2, we introduced sentence-level entry to FeetAsymTap and FeetGestureTap and assessed their performance in visible and imaginary interfaces. The findings revealed that FeetAsymTap exhibited a faster entry rate, while FeetGestureTap had a lower total error rate. Our findings provide a strong foundation for the future design and implementation of foot-based text entry.

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TFPred: Learning discriminative representations from unlabeled data for Few-Label rotating machinery fault diagnosis

Xiaohan CHEN (PhD)

SUPERVISORS Rui Yang, Steven Guan, Huiqing Wen (XJTLU)
Roberto Ferrero (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Recent advances in intelligent rotating machinery fault diagnosis have been enabled by the availability of massive labeled training data. However, in practical industrial applications, it is often challenging and costly to annotate a large amount of data. To address the few-label fault diagnosis problem, a time-frequency prediction (TFPred) self-supervised learning framework is proposed to extract latent fault representations from unlabeled fault data. Specifically, the TFPred framework consists of a time encoder and a frequency encoder, with the frequency encoder to predict the low-dimensional representations of time domain signals generated by the time encoder with randomly augmented data. Subsequently, the pre-trained network is hooked with a classification head and fine-tuned with limited labeled data. Finally, the proposed framework is evaluated on a run-to-failure bearing dataset and a hardware-in-the-loop high-speed train simulation platform. The experiments demonstrate that the self-supervised learning framework TFPred achieved competitive performance with only 1% and 5%labeled data.

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Safe reinforcement learning for autonomous driving

Xiaohan HUANG (PhD)

SUPERVISORS Yuhu Cheng

UNIVERSITY/INSTITUTE China University of Mining and Technology /
School of Information and Control Engineering

With the development of deep reinforcement learning, its algorithms have been increasingly applied in the field of autonomous driving. However, safety is the primary concern during the driving process. Reinforcement learning, which involves interacting with the environment through trial and error, may result in unsafe behavior in autonomous driving if used without any safety constraints. Such behavior could result in the drive path deviation and even collision, causing catastrophic accidents. Therefore, we proposes a safe reinforcement learning algorithm for autonomous driving. Firstly, we establishes a safety experience buffer, which collects samples with different safety labels. Further, a safety critic network is constructed, which is trained by randomly sampling samples from the safety experience buffer. This enables the network to quantitatively evaluate the safety of driving actions, and the goal of safe driving for ego vehicle is achieved.

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Time series is not enough: An advanced deep reinforcement learning framework for portfolio management

Xiaotian REN (PhD)

SUPERVISORS Hongbin Liu, Jionglong Su, Jia Meng (XJTLU)
Anh Nguyen (UoL)

ACADEMY/SCHOOL School of AI and Advanced Computing

Portfolio management constitutes a critical financial investment process aimed at maximizing portfolio returns. Existing literature in this area predominantly concentrates on analysing relationship between price fluctuation of each asset to optimize transaction strategy, neglecting the relationship between the price fluctuation of different assets. In this study, we propose an innovative deep reinforcement learning framework named Financial Transformer Reinforcement Learning (FTRL) for portfolio management to address shortcomings in the time series analysis, e.g., the inherent limitations of neural networks and the neglect of inter-asset correlation analysis. Our work leverages the Deep Deterministic Strategy Gradient (DDPG) and incorporates a Financial Transformer (FT) that employs the attention mechanism to extract features of the temporal relationship between each asset’s return across various transaction days and their interactions. These feature of assets interactions serve as a valuable factor for optimizing the portfolio. We assess the efficacy of FTRL by comparing it with fourteen traditional strategies and three reinforcement learning frameworks, utilizing three data sets. Our findings show that our approach surpasses other strategies, yielding at least 25ξ\%ξ higher returns. Furthermore, The superior performance is demonstrated by the Sharpe ratio, Sortino ratio, and Omega ratio, with at least 22.37ξ\% ξ, 12.9ξ\%ξ, and 6ξ\%ξ improvements, respectively.

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Real-time multi-object tracking with fusion of near-infrared camera and binocular camera

Xiaoyu HUANG (PhD)

SUPERVISORS Yong Yue, Xiaohui Zhu, Eng Gee Lim (XJTLU)
Angel Garcia-Fernandez (UoL)

ACADEMY/SCHOOL School of Advanced Technology

An automatic driving system typically comprises three core components: perception, planning, and control. The effectiveness of object perception in the surrounding environment relies heavily on sensor technology. Since near-infrared cameras perform better in adverse weather, this project focuses on the utilization of near-infrared and binocular cameras for creating a dataset to serve as a validation resource for perception algorithms, specifically for the research of multi-object tracking algorithms. Multi-object tracking plays a pivotal role in the perception module, where it receives object data from the detector, analyzes the historical trajectories of these objects, and forwards the information to the predictor for forecasting future object trajectories. Recent advancements have showcased the significant potential of Poisson multi-Bernoulli mixture (PMBM) filters in the realm of multiple object tracking. The primary objective of this project is to dedicate efforts to the research and refinement of the PMBM filter based on the constructed dataset.

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A multitasking-based constrained multi-objective evolutionary algorithm with forward and backward stages

Xiaoyu ZHONG (PhD)

SUPERVISORS Xiangjuan Yao

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Mathematics

Solving constrained multi-objective optimization problems (CMOPs) via evolutionary multitasking optimization (EMTO) algorithm is a meaningful attempt due to the fact that knowledge learning and transfer across the related optimization exercises can improve the efficiency of others. However, the utilization of EMTO in CMOPs is still in its infancy. To fill this research gap, an EMTO-based constrained multi-objective optimization framework including forward and backward stages (CEMTFB) is developed to address an original CMOP task together with two helper CMOP tasks. Firstly, the original task and a helper task evolve forward simultaneously with and without constraints, responsible for exploring well-converged and well-distributed feasible and infeasible solutions, respectively. Then, in the backward stage, a novel reverse haulage strategy is designed for another helper task to conduct a search within the promising areas that are not dominated by any examined feasible solution, thereby collaborating with the original task to approach the constrained Pareto front from two complementary directions. Moreover, a dynamic knowledge transfer strategy is proposed to coordinate the interaction between the original and helper tasks. Finally, comprehensive experiments are conducted on 45 benchmark functions and 19 real-world CMOPs, and the comparison against seven state-of-the-art peer methods demonstrates the superior or at least competitive performance of CEMTFB.

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Temporal improvement of video traffic anomaly detection

Xinyue ZHANG (PhD)

SUPERVISORS Ka Lok Man, Eng Gee Lim, Yuxuan Zhao (XJTLU)
Jeremy Smith (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Advanced Technology

Internet of Things (IoT) technology plays a pivotal role in the real-time transmission of public facilities data to Intelligent Transportation Systems (ITS), such as surveillance camera video data feeds. With the popularity of video surveillance systems, the significance of Video Anomaly Detection (VAD) has surged in societal order management and traffic control. However, traditional, highly manual-dependent VAD methods and neural network model-based VAD methods (e.g., Recurrent Neural Networks) face significant challenges in temporal stream processing. To alleviate the temporal limitations in establishing long-term relationships and considering global information, we introduce a Transformer-based spatial-temporal VAD model. This poster demonstrates the architecture of our innovative VAD model and briefly provides the experimental plan for the temporal component and the entire fused model.

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Audio visual speech recognition

Yibo HE (PhD)

SUPERVISORS Jasmine Kah Phooi Seng (XJTLU)
Xingyu Zhao (UoL)
Jingxin Liu (External)

ACADEMY/SCHOOL School of AI and Advanced Computing

Investigates multimodal sensor architectures with deep learning for audio-visual speech recognition, focusing on in-the-wild scenarios. The term “in the wild” is used to describe AVSR for unconstrained natural-language audio streams and video-stream modalities. Audio-visual speech recognition (AVSR) is a speech-recognition task that leverages both an audio input of a human voice and an aligned visual input of lip motions.

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A novel local binary temporal convolutional neural network for bearing fault diagnosis

Yihao XUE (PhD)

SUPERVISORS Rui Yang (XJTLU)
Zhongbei Tian (UoL)

ACADEMY/SCHOOL School of Advanced Technology

In bearing fault diagnosis, the faulty data are generally limited due to the high cost of fault signal collection. Considering the excessive parameters in the traditional convo- lutional neural network (CNN), such a limited data issue can cause overfitting problem during the model training, eventually resulting in poor fault diagnosis performance. To resolve the overfitting issue and elevate the diagnostic accuracy of the conventional methods, a novel fault diagnosis method based on local binary temporal convolutional neural network (LBTCNN) is proposed in this paper. In the proposed LBTCNN, a novel temporal module with dilated causal convolution for deep feature extraction is proposed to increase model depth under limited model parameters, and a local binary convolution (LBC) layer is adopted to reduce the computational parameters. To evaluate the effectiveness of the proposed method, several experiments under different scenarios such as limited samples and different noise levels are conducted on two datasets, including the rolling bearing accelerated life test dataset of Xi' an Jiaotong University and Changxing Sumyoung Technology, and the motor bearing dataset of Case Western Reserve University. The comparison results demonstrate that the LBTCNN method is superior over six other prominent fault diagnosis approaches under different bearing operation stages, different training samples and different signal-to-noise ratios.

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The Effects of Avatar on collaborative social interactions in metaverse: A theoretical model and empirical evidence

Youwen WU (Master)

SUPERVISORS Yue Li (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

We investigate the relationship between the appearance of individuals' avatars and social interactions in Metaverse. Based on the existing theories, we proposed a theoretical model to identify the relationship between avatar-self similarity, group visual similarity, self-identification, group identification, and social interactions. The results indicated that high avatar-self similarity and high group visual similarity can increase people's collaborative social interactions in virtual environments, and the relationships are mediated by self-identification and group identification. Users performed better using avatars with high self-similarity in both convergent and divergent tasks. While group visual similarity did not result in significant differences in task performance, the words spoken were significantly higher in groups with high visual similarity. The research findings provide valuable insights for understanding social interactions and collaborations in Metaverse.

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Radar-based contactless cardiac monitoring

Yuanyuan ZHANG (PhD)

SUPERVISORS Rui Yang, Steven Guan (XJTLU)
Yi Huang (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Advanced Technology

Contactless cardiac monitoring has vast potential to replace contact-based monitoring in various future scenarios such as smart home and in-cabin monitoring. Various contactless sensors can be potentially implemented for cardiac monitoring, such as cameras, acoustic sensors, Wi-Fi routers and radars. Among all these sensors, radar could achieve unobtrusive monitoring with high accuracy and robustness at the same time. The research on radar-based cardiac monitoring can be generally divided into the radar architecture design and signal-processing parts, where the former has been thoroughly reviewed in the literature but not the latter. Our research mainly focuses on elaborating the algorithms for extracting cardiac features from the received radar signal, and overcoming the obstacles and investigating radar-based cardiac monitoring using deep learning methods to produce fine-grained cardiac features based on the proposed model.

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Harnessing reinforcement learning for dynamic pricing optimization in E-commerce: A generative adversarial imitation learning approach

Yuchen LIU (PhD)

SUPERVISORS Ka Lok Man, Yong Yue (XJTLU)
Terry Payne (UoL)
Gangmin Li (Beds: University of Bedfordshire)

ACADEMY/SCHOOL School of Advanced Technology

Implementing reinforcement learning (RL) in real-world settings like dynamic pricing on Amazon is challenging due to the impracticality of conducting extensive trials in an actual environment. This research explores an RL approach to optimize sales discounts based on diverse product attributes. Diverging from the conventional use of supervised learning as a simulator for RL, we create a "Simulated Amazon" using historical sales data through Generative Adversarial Imitation Learning (GAIL). We train our strategies in this simulated setting, incorporating an Action Norm Constraint to alleviate over-fitting, thus ensuring robust real-world performance. Our simulation, trained on over 10,000 product records, exhibits a high degree of similarity with the actual Amazon environment. Furthermore, strategies developed within "Simulated Amazon" demonstrate enhanced online performance compared to traditional methods. This work underscores the potential of leveraging RL in complex real-world scenarios via initial training in simulated environments, presenting a promising avenue for advancing dynamic pricing strategies on e-commerce platforms.

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Large-scale traffic signal control by a nash deep Q-network approach

Yuli ZHANG (PhD)

SUPERVISORS Dongyao Jia (XJTLU)
Valerio Selis (UoL)
Shangbo Wang (HKU: University of HongKong)

ACADEMY/SCHOOL School of Advanced Technology

Reinforcement Learning (RL) is currently one of the most commonly used techniques for traffic signal control (TSC), which can adaptively adjust traffic signal phase and duration according to real-time traffic data. However, a fully centralized RL approach is beset with difficulties in a multi-network scenario because of exponential growth in state-action space with increasing intersections. Multi-agent reinforcement learning (MARL) can overcome the high-dimension problem by employing global control of each local RL agent, but it also brings new challenges, such as failures of convergence caused by the non-stationary Markov Decision Process (MDP). In this paper, we introduce an off-policy nash deep Q-Network (OPNDQN) algorithm, which mitigates the weakness of both fully centralized and MARL approaches. The OPNDQN algorithm solves the problem that traditional algorithms cannot be used in large state-action space traffic models by utilizing a fictitious game approach at each iteration to find the nash equilibrium among neighboring intersections, by which no intersection has incentive to unilaterally deviate. One of the main advantages of the OPNDQN is that it can mitigate the non-stationarity of multi agent Markov process because it considers the mutual influence among neighboring intersections by sharing their actions. On the other hand, for training a large traffic network, the convergence rate of the OPNDQN is higher than that of existing MARL approaches because it does not incorporate all state information of each agent. We conduct extensive experiments by using Simulation of Urban MObility simulator (SUMO), and show the dominant superiority of the OPNDQN over several existing MARL approaches in terms of average queue length, episode training reward and average waiting time.

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Improvement of brain-computer interface with error-related potentials

Yuting ZHENG (PhD)

SUPERVISORS Rui Yang, Steven Guan, Mengjie Huang (XJTLU)
Michele Zito (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Brain-computer interface (BCI) is a system measuring its user's central nervous system and then converting the neurophysiological signals into artificial outputs representing the user's intention or mental state. The current non-invasive BCI control system based on electrical brain signals is safe, economical, and portable. However, existing BCI is not stable enough to precisely decode the user's intention. This PhD project aims to decode the error-related potentials (ErrPs), the electrical brain signals elicited by the user's perception of errors from potential BCI users, to help the system recognise erroneous output that misrepresents the user's intention and then remedy the output and improve the algorithm of the intention decoder. This project has successfully collected, analysed and classified the ErrPs. In the next step, the trained ErrPs decoder will be applied in the online BCI system. The final outcome will help build a more robust and user-friendly BCI in the real world.

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Enhanced 3D image segmentation using integrated depth and point cloud information

Yuzheng FENG (PhD)

SUPERVISORS Hongbin Liu, Jionglong Su, Jasmine Kah Phooi Seng (XJTLU)
Anh Nguyen (UoL)

ACADEMY/SCHOOL School of AI and Advanced Computing

3D segmentation plays a crucial role in various computer vision applications, such as autonomous driving and robotics. While deep learning methods have shown promising results in 3D segmentation, there is still room for improvement in leveraging the complementary information provided by RGB-D and point cloud data. Our proposed method utilizes deep learning techniques to extract features from both modalities and combines them synergistically to achieve more accurate segmentation results. Experimental evaluations on benchmark datasets demonstrate the effectiveness of our approach, outperforming existing methods in terms of segmentation accuracy. This research contributes to the advancement of 3D segmentation and provides valuable insights for future studies in the field of deep learning and computer vision.

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Semantic-aware data augmentation for text-to-image synthesis

Zhaorui TAN (PhD)

SUPERVISORS Xi Yang, Qiufeng Wang (XJTLU)
Anh Nguyen (UoL)
Kaizhu Huang (DKU: Duke Kunshan University)

ACADEMY/SCHOOL School of Advanced Technology

Data augmentation has been recently leveraged as an effective regularizer in various vision-language deep neural networks. However, in text-to-image synthesis (T2Isyn), current augmentation wisdom still suffers from the semantic mismatch between augmented paired data. Even worse, semantic collapse may occur when generated images are less semantically constrained. In this paper, we develop a novel Semantic-aware Data Augmentation (SADA) framework dedicated to T2Isyn. In particular, we propose to augment texts in the semantic space via an Implicit Textual Semantic Preserving Augmentation (ξITAξ), in conjunction with a specifically designed Image Semantic Regularization Loss (ξL_rξ) as Generated Image Semantic Conservation, to cope well with semantic mismatch and collapse. As one major contribution, we theoretically show that ξ ITAξ can certify better text-image consistency while ξL_rξ regularizing the semantics of generated images would avoid semantic collapse and enhance image quality. Extensive experiments validate that SADA enhances text-image consistency and improves image quality significantly in T2Isyn models across various backbones. Especially, incorporating SADA during the tuning process of Stable Diffusion models also yields performance improvements.

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Extraction of mechanical properties of materials based on transfer learning and multi-fidelity model from small punch test

Zhengni YANG (PhD)

SUPERVISORS Rui Yang (XJTLU)
Yuyuan Zhao (UoL)
Li Huang (JITRI: Jiangsu Industrial Technology Research Institute)

ACADEMY/SCHOOL School of Advanced Technology

The extraction of mechanical properties plays a crucial role in understanding material behavior and predicting performance across various applications. However, traditional methods for determining these properties often involve complex and time-consuming tests, which may not be practical in certain situations. To address this challenge, we proposed a novel approach that based on transfer larning and multi-fidelity Small Punch Test (SPT) datasets. The Small Punch Test is a simple technique where a localized load is applied to a small disc-shaped sample, and the resulting deformation is measured. By analyzing the load-displacement data obtained from the SPT, valuable insights into the material's mechanical properties can be derived. In our research, we develop a multi-fidelity model capable of predicting mechanical properties for steel and alloy. The proposed model takes into account variations in material thickness, it can effectively predict the mechanical properties of materials with different thicknesses, accommodating the practical scenarios where material samples exhibit varying thicknesses due to different applications or manufacturing processes. To construct our model, we integrate low-fidelity Finite Element Method (FEM) data, providing initial estimations of material properties, with high-fidelity experimental data. This combination allows us to refine and enhance the accuracy of the estimated properties, resulting in a comprehensive and reliable characterization of the material's mechanical behavior. By leveraging the advantages of the Small Punch Test and incorporating multi-fidelity modeling techniques, our approach offers a practical and efficient solution for extracting mechanical properties. The ability to predict properties for steel, alloys, and materials with varying thicknesses enhances the versatility and applicability of our model in real-world scenarios.

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Corporate perception on Muti object tracking

Zhenrong ZHANG (PhD)

SUPERVISORS Hongbin Liu (XJTLU)

ACADEMY/SCHOOL School of AI and Advanced Computing

The importance of precise perception is paramount for the progression of autonomous driving and resolving safety issues in contemporary transportation systems. Even though there have been substantial improvements in computer vision for object identification, current perception techniques continue to grapple with complexities in real-world traffic scenarios. Problems such as physical obstructions and restricted sensor field of view remain persistent for standalone vehicle systems. The advent of Cooperative Perception (CP) along with Vehicle-to-Everything (V2X) technologies offers a promising solution to these challenges, thereby enhancing the efficacy of automated driving systems.

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AC-Mapper: A novel architecture for cross-domain access control

Zhi LIN (PhD)

SUPERVISORS Jie Zhang, Ka Lok Man, Steven Guan (XJTLU)
Junqing Zhang (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Access control is a technology that prevents unauthorized access requests to resources. It requires parsing every request to access resources and determining whether it should be authorized or denied, which is crucial in scenarios like the Internet of Everything (IoE). The existing access control models can solve access problems within a single management domain. Usually, different management domains will adopt access control models that meet their needs. However, for cross-domain scenarios, where information exchange or resource sharing occurs between domains, existing models cannot effectively solve this access control problem. My work focuses on designing a general cross-domain access control mechanism where different domains can maintain their heterogeneity. Furthermore, Ethereum is the primary platform to implement the experiments where different cross-domain access control assignment are designed. Achieving a high level of universality in cross-domain access control solutions is essential to accommodate a wide range of application scenarios.

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A framework for portfolio management-based financial investor behavior perception model

Zhilu ZHANG (PhD)

SUPERVISORS Jionglong Su, Angelos Stefanidis (XJTLU)
Procheta Sen (UoL)

ACADEMY/SCHOOL School of AI and Advanced Computing

In the stock market, the factors affecting the stock price can be divided into two categories. The first is price fluctuations caused by irrational investment of the speculators. The second is endogenous value changes caused by operations of the company. In recent years, with the advancement of artificial intelligence technology, reinforcement learning (RL) algorithms have been increasingly employed by scholars to address financial problems, particularly in the area of portfolio management. However, the deep RL models proposed by these scholars in the past have focused more on analyzing the price changes caused by the investment behavior of speculators in response to technical indicators of actual stock prices. In this research, we introduce an RL-based framework called FinBPM, which takes both the factor pertaining to the impact on operations of the company and the factor of the irrational investment of the speculator into consideration.

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A largescale digital elevation model super-resolution transformer

Zhuoxiao LI (PhD)

SUPERVISORS Xiaohui Zhu (XJTLU)
Angel Garcia-Fernandez (UoL)

ACADEMY/SCHOOL School of Advanced Technology

The Digital Elevation Model (DEM) super-resolution approach aims to improve the spatial resolution or detail of an existing DEM by applying techniques such as machine learning or spatial interpolation. Convolutional Neural Networks and Generative Adversarial Networks have exhibited remarkable capabilities in generating high-resolution DEMs from corresponding low-resolution inputs, significantly outperforming conventional spatial interpolation methods. Nevertheless, these current methodologies encounter substantial challenges when tasked with processing exceedingly high-resolution DEMs (256×256,512×512, or higher), specifically pertaining to the accurate restore maximum and minimum elevation values, the terrain features, and the edges of DEMs. Aiming to solve the problems of current super-resolution techniques that struggle to effectively restore topographic details and produce high-resolution DEMs that preserve coordinate information, this paper proposes an improved DEM super-resolution Transformer(DSRT) network for large-scale DEM super-resolution and account for geographic information continuity. We design a window attention module that is used to engage more elevation points in low-resolution DEMs, which can learn more terrain features from the input high-resolution DEMs. A GeoTransform module is designed to generate coordinates and projections for the DSRT network. We conduct an evaluation of the network utilizing DEMs of various types of terrains and elevation differences at resolutions of 64×64,256×256 and 512 × 512. The network demonstrated leading performance across all assessments in terms of root mean square error (RMSE) for elevation, slope, aspect, and curvature, indicating that Transformer-based deep learning networks are superior to CNNs and GANs in learning DEM features.

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Rebalanced zero-shot learning

Zihan YE (PhD)

SUPERVISORS Xiaobo Jin, Xinheng Wang (XJTLU)
Xiaowei Huang (UoL)
Kaizhu Huang (DKU: Duke Kunshan University)

ACADEMY/SCHOOL School of Advanced Technology

Zero-shot learning (ZSL) aims to identify unseen classes with zero samples during training. Broadly speaking, present ZSL methods usually adopt class-level semantic labels and compare them with instance-level semantic predictions to infer unseen classes. However, we find that such existing models mostly produce imbalanced semantic predictions, i.e. these models could perform precisely for some semantics, but may not for others. To address the drawback, we aim to introduce an imbalanced learning framework into ZSL. However, we find that imbalanced ZSL has two unique challenges: (1) Its imbalanced predictions are highly correlated with the value of semantic labels rather than the number of samples as typically considered in the traditional imbalanced learning; (2) Different semantics follow quite different error distributions between classes. To mitigate these issues, we first formalize ZSL as an imbalanced regression problem which offers empirical evidences to interpret how semantic labels lead to imbalanced semantic predictions. We then propose a re-weighted loss termed Re-balanced Mean-Squared Error (ReMSE), which tracks the mean and variance of error distributions, thus ensuring rebalanced learning across classes. As a major contribution, we conduct a series of analyses showing that ReMSE is theoretically well established. Extensive experiments demonstrate that the proposed method effectively alleviates the imbalance in semantic prediction and outperforms many state-of-the-art ZSL methods.

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MathAttack: Attacking large language models towards math solving ability

Zihao ZHOU (PhD)

SUPERVISORS Qiufeng Wang, Wei Wang (XJTLU)
Xiaowei Huang (UoL)
Kaizhu Huang (DKU: Duke Kunshan University)

ACADEMY/SCHOOL School of Advanced Technology

With the boom of Large Language Models (LLMs), the research of solving Math Word Problem (MWP) has recently made great progress. However, there are few studies to examine the security of LLMs in math solving ability. Instead of attacking prompts in the use of LLMs, we propose a MathAttack model to attack MWP samples which are closer to the essence of security in solving math problems. Compared to traditional text adversarial attack, it is essential to preserve the mathematical logic of original MWPs during the attacking. To this end, we propose logical entity recognition to identify logical entries which are then frozen. Subsequently, the remaining text are attacked by adopting a word-level attacker. Furthermore, we propose a new dataset RobustMath to evaluate the robustness of LLMs in math solving ability. Extensive experiments on our RobustMath and two another math benchmark datasets GSM8K and MultiAirth show that MathAttack could effectively attack the math solving ability of LLMs. In the experiments, we observe that (1) Our adversarial samples from higher-accuracy LLMs are also effective for attacking LLMs with lower accuracy (e.g., transfer from larger to smaller-size LLMs, or from few-shot to zero-shot prompts); (2) Complex MWPs (such as more solving steps, longer text, more numbers) are more vulnerable to attack; (3) We can improve the robustness of LLMs by using our adversarial samples in few-shot prompts. Finally, we hope our practice and observation can serve as an important attempt towards enhancing the robustness of LLMs in math solving ability.

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TSDRM: Two-stage secondary discriminative regions mining for weakly supervised semantic segmentation

Ziqian YANG (PhD)

SUPERVISORS Quan Zhang (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Mage-level Weakly Supervised Semantic Segmentation (WSSS) has low annotation cost and has received increasing attention. Class Activation Mapping (CAM) generated through classifier weights in WSSS inevitably ignores certain useful cues, while the CAM generated through image specific class prototypes can avoid that. owever, the class prototype calculation lets the encoder focus on learning from primary discriminative regions, causing the class prototype not to activate secondary discriminative regions and resulting in an incomplete CAM. In this paper, we propose a Two-stage Secondary Discriminative Region Mining (TSDRM) framework for encouraging WSSS model to activate more secondary discriminative regions, thus generating a more complete CAM.

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Digital twin based Human-Ship-Environment control approach for unmanned surface vehicle

Zitian PENG (PhD)

SUPERVISORS Yong Yue, Xiaohui Zhu, Mengjie Huang (XJTLU)
Prudence Wong (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Unmanned surface vehicles (USVs) are autonomous or remotely controlled watercraft that can perform various tasks in fluvial environments. While the ultimate aspiration for USV is full automation powered by machine intelligence, due to the variability in the river environment, the current landscape necessitates human intervention, particularly in intricate encounter scenarios or challenging navigational environments. Therefore, a human-ship-Environment cooperative control approach is needed for the intelligent development of future ships. A potential situation is building models that resemble the real world, validating operations on the models, and providing predictions, which is the key idea of Digital Twin (DT). Since DT system may increase the operator's cognitive load, a natural and efficient navigation style to enable humans and USV to collaborate and interact freely is considerable. For this reason, we will explore a human-ship-Environment cooperative control approach based on DT to enable teleoperators to remotely control the USV with gaze control.

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Intellectual property data trading through NFTization

Ziyang JI (PhD)

SUPERVISORS Jie Zhang (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Intellectual Property (IP) is a special type of data that has broad and high trading demands. Existing blockchain-based IP data trading schemes can promote the IP data trading market by removing the dependence on centralized platforms. However, the problem of trading fairness among sellers and buyers is more challenging compared to centralized approaches. This paper addresses the trading fairness problem by representing the data as Non-Fungible Tokens (NFTs) and separating usage rights and ownership. An NFTized IP data trading system is designed and a two-stage fair trading scheme is proposed. They ensure that buyers need not pay additional money if the IP content is not useful for them, and the sellers will not lose the IP ownership until they receive additional money in the second stage of trading. A prototype for the system is realized, and based on it, a set of experiments are carried out to evaluate the performance.

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A case study of computer science instructor's professional identity influence on college students' learning

Biying WEN (PhD)

SUPERVISORS Qian Wang, Juming Shen (XJTLU)
Floriana Grasso, Qing Chen (UoL)

ACADEMY/SCHOOL Academy of Future Education

Several studies have investigated the impact of inquiry-based instruction in computer science education, but little has been written about how computer science instructors' professional identity contributes to students' learning. Based on 23 semi-structured interviews with instructors from two countries (China and UK), the study followed Bigg's 3-P framework to analyze computer science instructors' professional identities. It examined how their professional identities contribute to students' learning processes and outcomes. The data identified three professional identities: learning partner, expert, and role model in research. The instructor's professional identity as a role model in research influenced students' learning outcomes more than the other two professional identities. Therefore, the study recommends that computer science instructors in higher education incorporate their research affairs into teaching practices.

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How social interactions could disrupt career identity formation – a qualitative study on university students during education-career transition

Huaiyuan ZHANG (PhD)

SUPERVISORS Youmin Xi, Xiaojun Zhang (XJTLU)
Gayle Brewer (UoL)

ACADEMY/SCHOOL Academy of Future Education

This is a work-in-progress study aiming to explain how social interactions during education-career transition disrupt career identity internalization and social examination among university students. We employ the dual-cycle approach identity formation theory and focus on the disruptive factors in social interactions that hinders career identity internalization and social examination. The main method used is constructive grounded method theory and we selected 23 university students and studied their education-career transition experience. Key finds and discussions are provided to enlighten the development of university students career identity development.

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Multi-level students' sense of comunity development in hybrid and online learning environments at higher educational institutions: A systematic literature review

Huijin LU (PhD)

SUPERVISORS Youmin Xi, Xiaojun Zhang (XJTLU)
Maria Limniou (UoL)

ACADEMY/SCHOOL Academy of Future Education

The formulation of a sense of community (SOC) among students has received significant attention in the literature in recent years. However, digitally enhanced learning and COVID-19 have amplified the challenges vis-à-vis connecting students and making them feel involved and recognized in virtual learning ecologies for higher educational institutions (HEIs). This review examines the factors impacting students' SOC development in online and hybrid learning environments for HEIs. To provide a holistic view, we synthesize the streams of theoretical foundations on SOC for keyword search strategy and follow Preferred Reporting Items for Systematic Reviews and Meta-Analyses protocol. In total, 128 empirical studies from 2015 to October 2022 are synthesized. One of the main contributions lies in disclosing the multiple levels of students' SOC formulation from a sociological perspective on HEIs. It further broadens our understandings on the dimensions, and the roles and responsibilities of key players, as well as the units involved in the social context of HEIs. The main findings reveal that HEIs should "circulate the blood" by integrating various key elements identified in pedagogy, instructor, learner, and extra-curriculum fields into the learning ecology for SOC facilitation to formulate an implicit curriculum and a more interactive, supportive, and caring environment.

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A study on the influence of academic passion on PhD students' research engagement - The role of ambidextrous learning and academic climate

Jianyue CHEN (PhD)

SUPERVISORS Wanhong Zhang

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Public Policy and Management

Research engagement, as the main type of learning engagement of PhD students, is of great significance for the improvement of competitive strength of PhD students. Academic passion, as a key factor of learning engagement, has an important role in influencing PhD students' research enthusiasm. However, the "black box" of how academic passion influences PhD students' engagement in research remains unresolved. This study, which is based on the self-determination theory, utilizes the motivation-behavior-effect analytical framework and adds ambidextrous learning as a mediating component and academic climate as a moderating variable. The results indicate that academic passion has a significant positive effect on PhD students' research engagement; ambidextrous learning mediates the effect of academic passion on PhD students' research engagement; academic climate can effectively facilitate the transformation of PhD students' academic passion into ambidextrous learning. The study's conclusions contribute to PhD students' enthusiasm for researching, improve learning effectiveness and innovation vitality, and offer a theoretical framework for reforming the doctoral training system.

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Building a hybrid assessment system through a bridging assessment approach: Lekao (Fun Test)

Jingjing FU (PhD)

SUPERVISORS Xiaojun Zhang (XJTLU)
Gayle Brewer (UoL)

ACADEMY/SCHOOL Academy of Future Education

The aim of the research project is to explore the potential role of 'Hybrid Assessment' in a context of a Chinese K-12 international school, by examining how 'Activity Theory' can play a positive role in promoting formative assessment through the analyse of quantitative and qualitive material and interview data. The project first investigates whether Lekao (Fun test) could play the role as a 'Hybrid Assessment' tool to bridge and mediate summative assessment and formative assessment for lower grades primary pupils. The project then examines the contradictions and mediating tools by applying 'Activity Theory'. The research questions are threefold: RQ1: To what extent can a hybrid assessment be built through a bridging assessment approach: Lekao, RQ2: Were there any contradictions in the development of hybrid assessment and RQ3: If so, what are the main mediating tools facilitating hybrid assessment. Literature has been focused on the most recent publications on 'Formative Assessment' and 'Activity Theory, and three stages of 'Activity Theory' development are traced and sorted.

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The effect of organisational learning on ESG (environmental, social, and governance) performance

Jingwen XIA (PhD)

SUPERVISORS Peng Liu (XJTLU)

ACADEMY/SCHOOL Academy of Future Education

This research aims to provide an overall perspective of the interaction between organisational learning and ESG by using a mixed method approach. Firstly, a systematic review helps to connect organisational learning with ESG performance from a holistic perspective through different learning loops and put stress on the importance of two learning loops to better facilitate ESG strategy through '2P' (people and process). Following the systematic review, a quantitative analysis is going to validate the significance of organisational learning capacity (OLC) to improve ESG performance. Then a qualitative analysis is going to explore the reasons why organisational learning improves ESG performance. It is worth noting that the quantitative and qualitative analyses are conducted within the context of the beauty industry, in which the researcher has more than 10 years working experience. The researcher intends to exploit the overall findings to inspire and transform organisational learning to accelerate ESG application and performance.

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Beyond Chabuduo: The influence of achievement goal orientation and perceived university learning management style on student willingness to volunteer for entrepreneurial learning-through-service

Joseph IESUE (PhD)

SUPERVISORS Jinjin Lu, Xiao Wang (XJTLU)
Kristy Morrin (UoL)

ACADEMY/SCHOOL Academy of Future Education

Service learning is an approach to higher education curricula encouraging experiential learning and engagement. Little is known about how student perceptions affect their intent to participate in entrepreneurial-specific service-learning activities. Developing student attitudes necessary for successful entrepreneurial social engagement can benefit educational institutions by improving workforce capabilities and situational awareness, increasing the rate of entrepreneurial activities. A quantitative survey will collect data from university students regarding achievement goal orientation, the perception of a university's learning leadership style, and its relation to the willingness to volunteer for entrepreneurial learning-through-service events. The study identifies causal effect contributions to students' voluntary willingness to engage in entrepreneurial service learning activities. The results will help develop effective service-learning programs that foster students' entrepreneurial and prosocial development. Educational institutions can better understand the effect varying student goal orientation and perceptions about institutional learning environments have on developing attitudes necessary for positive, prosocial, successful entrepreneurial activity.

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The role of teachers in university transformation from teaching centred to learning centred: an institutional work perspective

Lin YI (PhD)

SUPERVISORS Xiaojun Zhang, Youmin Xi (XJTLU)
Paul Jones (UoL)

ACADEMY/SCHOOL Academy of Future Education

Under the dramatically changing society facilitated by internet and artificial intelligence, global higher education encounters significant challenge regarding paradigm transformation from teaching centred to learning centred. China's higher education reform is considerably a unique case as there is a strong tradition for teaching centred for thousands of years in China. As teachers are key actors in the transformation, it is crucial to understand how Chinese university teachers could break the conventions of Teaching-Centred Paradigm, and approach to Learning-Centred education which suits the present and future trend of the world. This project adopts a practice-based perspective to investigate how university teachers conduct institutional work and negotiate with the higher education field during this dynamic transforming process. This study contributes to bridging institutional work to higher education field within Chinese context, and aims to provide practical instructions on facilitating Chinese higher education paradigm transformation.

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A longitudinal study of social support and depression of adolescents with different academic achievements during and post-COVID-19: The mediating/moderating role of attributional style

Meng WU (PhD)

SUPERVISORS Rong Yan, Eng Gee Lim, Jeong Jin Yu (XJTLU)
Atif Rahman (UoL)

ACADEMY/SCHOOL Academy of Future Education

Chinese adolescents, especially the middle school students, commonly experience high level of internal stress and pressure from themselves and the external environment to acquire better academic achievement due to tense competition for going to senior middle schools. This kind of pressure may have negative effects on their psychological status. Previous studies have explored the relationship among various supporting factors, academic achievement, and mental health of junior middle school students, especially for the migrant or left-behind adolescents. Their research, however, remains far from in-depth and lacking in the urban or non-migrant samples with different academic achievement and particularly their attributional style, which is very much likely to play a mediating role in the relationship between social support and mental health.

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Corporal punishment

Naila RAFIQUE (PhD)

SUPERVISORS Zhe Liu

UNIVERSITY/INSTITUTE Xi'an Jiaotong University / School of Public Policy and Administration

Corporal and Non-Corporal Punishments are used in schools as a major means of controlling students' behavior. Although the government has made clear policy Regulation Act Number 24 of 2002 that state how punishments should be administered to students as corporal punishments should not exceeding four strokes and should be administered by the head of school or any other teacher authorizes by the head of school in writing, and the punishment to be recorded in a book but teachers beat students without following the regulation. This study intended to find the impacts of corporal punishment on students' performance in District Bagh Azad Kashmir Secondary schools. Clustered sampling technique was applied to identify the sample size for the study. The data collection for this study was conducted to address the specific objectives outlined in the research. The primary method used for data collection was through the distribution and completion of questionnaires. The findings suggest that, teachers should provide non-corporal punishment responses that can be productive to students after completing their studies. Students are advised to follow school rules in order to avoid the punishments. It has been recommended that teachers should get training on how they can manage students' disciplinary problems in schools. Schools should create conducive environment in schools by organizing activities such as football matches and occasional trips for students. This will help students to use their time wisely for betterment of their academic endeavors and physical growth. Disciplinary committees should be given powers and authority in schools, and their decision should be taken into consideration when used carefully as tool in controlling the discipline of the students.

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A study to identify the features of effective kindergarten outdoor environment

Tian HONG (PhD)

SUPERVISORS Ting Ting Tay, Marco Cimillo, Jinjin Lu (XJTLU) David Chow (UoL)

ACADEMY/SCHOOL Academy of Future Education

Despite the importance of the outdoor environment in children's learning and development, there is no validated evaluation tool to measure its effectiveness. To address this gap, this study aims to identify features of effective kindergarten outdoor environments to develop a series of constructs that could be used to develop the evaluation tool. Effective kindergartens in this study is defined as kindergartens that meet the quality kindergarten rating criteria of the Chinese government in the local province. The data will be collected through surveys, interviews, and photos of the kindergarten outdoor environment. Through the survey, I will collect information on the kindergarten. Photos will be analysed with the help of Nvivo to compare the differences and summarise the similarities among the kindergartens. Using Grounded Theory, the interview data will be analysed to identify the kindergarten principals' perceptions of an effective kindergarten outdoor environment. The data collected will be used to examine kindergarten principals' beliefs and opinions of effective kindergarten outdoor environment and their ideas of the relationship between the outdoor environment and child development influence the kindergarten's effectiveness. Based on the analysis, I will be able to develop the constructs needed when evaluating kindergarten outdoor environments.

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The connotation and positioning of internationalized talents in Chinese-foreign cooperatively-run institutions - A study based on the talent cultivation goals of 171 institutions

Xiao HAN (PhD)

SUPERVISORS Lihua Wang

UNIVERSITY/INSTITUTE Zhejiang University / School of Education

To study the connotation and positioning of internationalized talents in Chinese-foreign Cooperatively-run Institutions, this article analyzes the statements of talent cultivation goals of171 institutions. After using the deductive method with the three-element analysis framework, the research finds that internationalized talents are not the most used talent positioning, but rather professional talents and international knowledge, abilities, and attitudes. Moreover, Chinese-foreign Cooperatively-run Institutions in different regions have preferences of the expression of goals. In addition, the study compares the goals of institutions and Double First-class Universities, and finds both focus on innovation awareness and ability, and give consideration to international vision and national sentiment. Also, Double First-class Universities pay more attention to literacy and leading talents. Therefore, the article proposes that to achieve the connotative quality development, the institutions need emphasize the positioning, connotative requirements, professional characteristics and market demand to provide empirical contributions to Chinese educational modernization.

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Cognitive agency in reducing negative emotions caused by poor teacher-student online interactions: A case study of faculty's synchronous online teaching

Xiaochen LIN (PhD)

SUPERVISORS Qian Wang, Jeong Jin Yu (XJTLU)
Maria Limniou (UoL)

ACADEMY/SCHOOL Academy of Future Education

Cognitive emotion regulation strategies can help individuals to intentionally avoid being overwhelmed by negative emotions. However, little research explains what enables individuals to activate those strategies and how. This research addresses the research gap by investigating how higher education (HE) faculty deliberately and consciously activate their cognitive agency to reduce negative emotions caused by teacher-perceived poor teacher-student online interactions. The study conducted narrative analysis based on data collected from semi-structured interviews with sixteen HE faculty. Findings unveil that when teachers face poor interaction-induced negative emotions, it is their cognitive agency activates teachers' reflective thinking, leading to the design fo cognitive strategies and following problem-solving actions to regulate emotions. The research contributes to literatures of cognitive emotion regulation strategies by shedding lights on the application of cognitive agency and reflective practice. The findings also highlight the importance of training educators to use cognitive agency and reflective practices in online teaching.

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Strategy as space—How does competing institutional logics penetrate in mature institutional environment

Xin XU (PhD)

SUPERVISORS Xiaojun Zhang, Youmin Xi (XJTLU)
Kirsty Morrin (UoL)

ACADEMY/SCHOOL Academy of Future Education

The purpose of this research is to explore how competing institutional logic is encountered and battled in the space of organizational-level strategies. As China opens the country and economic reform evolves, China's higher education sector is under reformation to accommodate globalization and information technology development. The concept of institutional logic with its features of 'organizing principal' provides insight for this mandate reformation. Building on an in-depth qualitative study of Chinese Double-First Universities, our findings will explain the pattern and trajectory of competing logic exerted by powerful referent battled and evolved with inherent incumbent logic in the space of universities' long-term strategies. This study contributes to the growing body of institutional logic theory by synergizing the strategy theory perspective, examining the constellation of conflicting logic reflected in a bounded space of long-term organizational strategy under an authoritarian context. On the other hand, it can also contribute to the strategy literature by examining the strategic change from the perspective of multiple logic integration.

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Enhancing interactive learning experiences with XIPU AI Platform: A practice of AI tools for education

Xuan LI (PhD)

SUPERVISORS Peng Liu, Youmin Xi (XJTLU)
Wiebe Van Der Heok (UoL)

ACADEMY/SCHOOL Academy of Future Education

In recent years, the integration of Artificial Intelligence (AI) in education has entered in a new era of innovative learning solutions. The XIPU AI Platform, a product of Learning Mall, stands at the forefront of this technological advancement, using the power of the OpenAI GPT model. This platform offers a myriad of features designed to revolutionize the educational experience, allowing users to engage with an AI assistant in an interactive way. This study aims to investigate the transformative potential of the XIPU AI platform on learning outcomes, student engagement, and collaborative learning. Through a mixed-methods approach, quantitative surveys will be employed to gather data on user experiences, engagement levels, and perceived learning outcomes based on Technology Acceptance Model (TAM). Additionally, qualitative interviews will provide in-depth insights into user perspectives regarding the platform's effectiveness. The study will focus on the adoption and impact of AI tools in education. Specifically, it will explore the extent to which the platform enhances personalized learning experiences and whether it effectively adapts content to cater to diverse learning styles. Additionally, the study will assess the platform's capacity to foster collaborative learning environments and its influence on student engagement levels. By evaluating the XIPU AI Platform's efficacy in real-world educational settings, this study seeks to contribute valuable insights to the practice of technology enhanced learning (TEL). The findings will not only inform educators and institutions about the potential benefits of integrating AI tools but also offer practical recommendations for optimizing learning experiences. Ultimately, this research endeavors to shape the future of education by harnessing the power of AI to create dynamic, adaptive, and engaging learning environments.

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Digitization and K-9 education in Chinese rural areas: A governmentality analysis

Xuhui JIAO (PhD)

SUPERVISORS Juming Shen, Rining Wei (XJTLU)
Junqing Wu (UoL)

ACADEMY/SCHOOL Academy of Future Education

Educational digitization has been developing rapidly all over the world, especially since the outbreak of COVID19. Mainland China has also set its own agenda for educational digitization as response to the changes. However, during the development of education, the imbalance between urban and nonurban development concerning primary education is the most essential and challenging point that must be overcome. As most of the educational reforms and programmes in China are underpinned and enhanced by top-down educational policies, this paper will conduct a policy analysis to explore the motivation, purpose, and implementation of the policies related to educational digitization. Moreover, governmentality, a framework proposed by Michel Foucault, will be adopted to conduct the policy analysis to investigate the rationale of the policies, which is derived from the historical, social, cultural backgrounds. In this way, the paper tends to offer some critique to the policy-making and policy implementation process.

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Navigating the academic labyrinth: A latent growth curve analysis of high school GPA trajectories and their influencing factors

Yanyi CHEN (PhD)

SUPERVISORS Jeong Jin Yu, Sam Zare (XJTLU)
Meng Fang (UoL)

ACADEMY/SCHOOL Academy of Future Education

This study delves into the underexplored domain of overall high school GPA trends and the influencing factors, seeking to bridge a gap in existing research that mainly centers on STEM courses. Utilizing data from the High School Longitudinal Study of 2009, the study used latent growth curve modelling to analyze a nationally representative sample of 23,502 ninth graders in the US (49.0% female). The findings indicated that students with learning disabilities and attention-deficit/hyperactivity disorder experience a decline in GPA over time, while parental engagement and intrinsic motivation positively influence academic success. Additionally, non-native English speakers exhibit a steeper upward GPA trajectory compared to native English speakers, and though gender differences in initial GPA were observed, they did not significantly impact GPA trajectory. The study provides insights for educators and policymakers, emphasizing the need for personalized support and fostering intrinsic motivation in students, regardless of their background or challenges.

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A case study of investigating the Chinese undergraduate students' learning experience and transitions in target Sino-foreign university

Yimei MI (PhD)

SUPERVISORS Youmin Xi, Xiaojun Zhang (XJTLU)
Shuang Gao (UoL)

ACADEMY/SCHOOL Academy of Future Education

This research focuses on Chinese undergraduate students who are studying in a Sino-foreign university. By applying a longitudinal study combining interviews and questionaries to track the target students' intercultural communication skills within a foreign socio-cultural environment, this study aims at investigating target students' transitions from different perspectives such as academic, social and cultural adjustments. The findings indicate that the target students consciously or unconsciously immersed in the foreign educational environment transit themselves into different outcomes. It is hypothesized that after the target students who transitioned successfully from the previous earning experience are more capable to adopt to the new cultural environment. Moreover, the students who have high scores on intercultural competence questionnaires are more easily to adapt to the new socio-cultural environment and are more aware of the cultural differences. Through exposing to the foreign learning and living environment, the Chinese students with high scores overall will acquire more intercultural communication abilities.

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A word list for modern written Chinese

Yipu WANG (PhD)

SUPERVISORS Hong Bo (CNU: Capital Normal Universiry)
Stuart Perrin (XJTLU)

UNIVERSITY/INSTITUTE Capital Normal University / School of Arts

Within international Chinese Language Education, it is essential to cultivate the learners' competence to use different Chinese registers. However, most international learners generally lack the awareness of distinguishing between spoken and written registers of modern Chinese. Written vocabulary of modern Chinese is acknowledged as a difficult point in Chinese learning. This paper highlights the construction of a learner corpus for modern written Chinese. Using the software Python, the paper employs standard modern texts and selects the most frequently used and widely distributed written words. This word list contains 2729 words, covering about 60% of written language corpus, and about 50% of common Chinese reading and writing textbooks. Compared with the Dictionary of Chinese Written Language, this list has its own characteristics in terms of syllable, word formation and semantic connotation. It provides a more solid basis for setting vocabulary teaching objectives, optimizing teaching design and strengthening textbook compilation.

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Understanding first-year Chinese students' transition into blended learning: An investigation of engagement and digital literacy development

Yiqun SUN (PhD)

SUPERVISORS Rong Wang, Zhoulin Ruan (XJTLU)
Tunde Varga-Atkins (UoL)

ACADEMY/SCHOOL Academy of Future Education

This study investigates the transition experiences of first-year Chinese university students into blended learning, which is distinct from their K12 education. Utilizing Astin's Input-Environment-Output (I-E-O) model and second-generation activity theory, the research explores students' engagement and digital literacy development. Employing an explanatory sequential mixed-methods design, this research utilized a questionnaire (N=341) and interviews (N=20) to gather data. Preliminary results indicate that various factors such as gender, prior technology exposure in high school, number of classes taken in the first year, design and perceived value of blended learning, alignment with students' learning needs, English language proficiency, teacher accessibility, digital literacy, and user-friendliness of learning tools influence students' engagement in blended learning. Moreover, gender, socioeconomic status, and engagement in blended learning experiences significantly impact digital literacy development. Findings emphasize the significance of tailored support and effective pedagogical design to enhance first-year Chinese students' transition into blended learning and digital literacy development.

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Engaging students as pedagogical partners in higher education: A systematic review from 2018 to 2022

Yu WANG (PhD)

SUPERVISORS Rong Wang, Jinjin Lu (XJTLU)
Maria Limniou (UoL)

ACADEMY/SCHOOL Academy of Future Education

Engaging with students as partners (SaP) in learning and teaching is fundamental to involve students actively in a collaborative, inclusive, reciprocal and student-centered learning environment. Student-staff pedagogical partnership is experiencing a rapid expansion by a growing body of global scholarship. Seeking to expand understanding of partnership approaches and their development environment from the latest initiatives, this study is guided by the question: how is pedagogic partnership conceptualized in higher education in the recent five years? The review followed the PRISMA method of identifying 70 empirical studies published from year 2018 to year 2022 on student-staff co-creation in teaching, learning, assessment and curriculum development. The findings were categorized into three areas: foundational contextual factors of the pedagogical co-creation, roles of student partners, student and staff's perceptions of such partnership initiatives in higher education. The analysis of multiple outcomes reveals valuable insights pertaining to three prominent themes: the complexity of SaP level, a focus on the influence of growth mindset, and the need of incorporating transition into SaP development.

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The dualistic moderating effect of passion on the relationship between parental psychological control and entrepreneurial fear of failure among Chinese college students

Yuan GAO (PhD)

SUPERVISORS Jinjin Lu, Xiao Wang, Bing Chen (XJTLU)
Kirsty Morrin (UoL)

ACADEMY/SCHOOL Academy of Future Education

Entrepreneurship represents a career path fraught with uncertainties and opportunities, especially for young Chinese college students. This study endeavors to examine the impact of parental psychological control on entrepreneurial fear of failure (EFoF), considering the moderating effects of obsessive and harmonious passion among Chinese college students aged 18 to 24 years. Utilizing a hierarchical regression approach, data from 1,957 Chinese college students harboring intentions to embark on entrepreneurial ventures were analyzed. The findings underscore the significant influence of parental psychological control on EFoF among Chinese college students. Notably, entrepreneurial obsessive passion mitigates this direct influence, while harmonious passion assumes a contrasting moderating role. This study sheds light on the complex psychological mechanisms encountered by aspiring college student entrepreneurs within the unique context of China. Furthermore, recommendations and insights are extended to career counselors involved in delivering entrepreneurship education and facilitating training programs for young Chinese graduates.

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A Systematic review: Chinese undergraduates' learning experience from 2012 to 2022

Yuchen LU (PhD)

SUPERVISORS Rong Wang, Rining Wei, Jinjin Lu (XJTLU)
Maria Limniou (UoL)

ACADEMY/SCHOOL Academy of Future Education

Chinese undergraduates were usually considered passive learners who preferred rote learning, rare faculty-student interactions, and rare peer learning during the course. This systematic review aims to help people discover a new profile of Chinese undergraduates, compared with former stereotypes. The method is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Then, the data extraction and analysis are done by coding. 871 articles were collected and finally 72 articles were included. Active learning, teacher-student interactions, and peer learning have been the new signals of the Chinese undergraduate's learning experience. Also, when they study abroad, they were influenced by international faculty from foreign language, culture, and more faculty-student interactions. The explanations of these new points can be found in Confucian educational philosophy, which has an over 2000-year history, but they remain dynamic and be emphasized again in the new era.

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Inculcating morality in machines...Applying machine ethics in the creation of ethically intelligent robots: The case study of Xiaoice

Yue XI (PhD)

SUPERVISORS Samiullah Paracha (XJTLU)
Maria Limniou (UoL)
Russell Fulmer (Husson: Husson University)

ACADEMY/SCHOOL Academy of Future Education

This paper examines current controversies in the ethical problems of AI robots and discusses how to build good ethics and trust in computational intelligence, through the lens of the philosophy of science. By analyzing the case study of Xiaoice, this paper highlights the ethical problems currently existing in AI robots. Machine ethics is introduced as a framework to address these issues and to examine the feasibility of imparting ethical dimensions to machines. The crux lies in integrating human values through applying machine ethics in creating ethically intelligent robots. This research suggests combining utilitarianism and deontology to create a pluralistic theoretical approach. Furthermore, this research will have policy implications, such as aiding the public and the policymakers in understanding the subject matter and designing policy instruments to facilitate its application.

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Research on the design and practice of situated learning curriculum for cultivation of children's creative thinking

Yuyue GU (PhD)

SUPERVISORS Ting Ting Tay (XJTLU)

ACADEMY/SCHOOL Academy of Future Education

Creative thinking, characterized by the generation of novel and imaginative ideas, is a vital cognitive skill recognized for its profound impact on children's cognitive and educational development (Amabile, 1983; Runco & Jaeger, 2012). In today's rapidly changing world, creative thinking is increasingly viewed as an essential survival skill. China, as a rising global force, recognizes the vital role of education in fostering a creative and innovative society. The existing education model in China, which often neglects irrational factors. To bridge this gap, this research endeavors to investigate how the principles of situated learning can effectively cultivate creative thinking in Chinese children, considering unique cultural and contextual factors. It aims to provide practical strategies and approaches that enhance creative thinking within Chinese educational settings, contributing to the global discourse on creativity and learning. By addressing these objectives, this research plan seeks to inform effective pedagogical practices, curriculum development, and educational policy decisions.

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Comparison of social entrepreneurship education in different disciplines: Teaching approach and learning process

Zhulin HAN (PhD)

SUPERVISORS Xiaojun Zhang (XJTLU)
Maria Limniou (UoL)

ACADEMY/SCHOOL Academy of Future Education

Different from entrepreneurship, social entrepreneurship (SE) is characterized by the integration of social problem-solving and sustainable economic growth into the entrepreneurship field. Social entrepreneurship education (SEE) could enable students to acquire the necessary skills to develop an enterprise and identify and solve social problems. Prior studies have thoroughly discussed the importance to have SEE in higher education, but because of the interdisciplinary and cross-boundary nature of SE, SEE requires the involvement of multiple disciplines. However, most SE courses are currently provided mostly in business schools, and few researchers have explored the integration of SE and various disciplines. This limited exploration in both practical and theoretical fields may lead to an uncomprehensive view of SEE and prevent further development. This study identified three types of SE-related courses (social innovation, social entrepreneurship, and disciplinary social innovation) and conducted focus group discussions to reveal the differences and similarities in curriculum design for the implementation of these courses. The study results provide a unique insight on how SE elements can be integrated into different course contexts.

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Data-aided channel estimation scheme for cell-free massive MIMO IoT systems

Bowen ZHONG (PhD)

SUPERVISORS Eng Gee Lim (XJTLU)
Yi Huang (UoL)

ACADEMY/SCHOOL School of Advanced Technology

With the proliferation of Internet of Things (IoT) devices, there is a growing demand for efficient wireless communication techniques in massive connectivity scenarios. This work proposes a data-aided semi-blind channel estimation scheme specifically developed for cell-free massive Multiple-Input Multiple-Output (MIMO) IoT systems. The proposed scheme leverages the received data signal to estimate the channels more accurately by mitigating the impact of pilot contamination with subspace analysis. By exploiting the rich information in the received data, our scheme reduces the complexity of channel estimation and enhances overall system performance. Moreover, the algorithm effectively addresses the challenges posed by spatially correlated channels in cell-free massive MIMO IoT networks. Through extensive simulations, we demonstrate the superior performance of our data-aided scheme in terms of channel estimation accuracy and spectral efficiency when compared to existing methods. This innovative approach opens up new possibilities for reliable and scalable communication systems within the evolving IoT landscape.

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Research on Au-free ohmic contacts with annealing temperature and pre-ohmic recess etching on AlGaN/GaN heterostructure

Chao WANG (PhD)

SUPERVISORS Wen Liu (XJTLU)
Harm Van Zalinge (UoL)

ACADEMY/SCHOOL School of Advanced Technology

The thesis reports the research of Au-free ohmic contacts with annealing temperature and pre-ohmic recess etching. For high annealing temperature, the smallest contact resistance is 1.6482 Ω · mm when digital etch 10 cycles and annealing temperature is 965 ℃. However, there is the spatter of aluminum. The spatter of Al will affect the performance of HEMT devices. Therefore, the lower annealing temperature condition is researched. For low annealing temperature, the smallest contact resistance is 1.93 Ω · mm when digital etch 80 cycles and annealing temperature is 675 ℃. And there is no spatter of Al. In addition, when the digital etching depth is deeper, the contact resistance is lower for both high annealing temperature and low annealing temperature.

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Predicting fatigue life of automotive adhesive bonded joints: A data-driven approach using combined experimental and numerical datasets

Chendi WEI (PhD)

SUPERVISORS Min Chen (XJTLU)
Maulik Patel (UoL)
Qiuren Chen (JITRI: Jiangsu Industrial Technology Research Institute)

ACADEMY/SCHOOL School of Advanced Technology

The majority of vehicle structural failures originate from joint areas. Cyclic loading is one of the primary factors in joint failures, making the fatigue performance of joints a critical consideration in vehicle structure design. The use of traditional fatigue analysis methods is constrained by the absence of adhesive life data and the wide variety of joint geometries. Therefore, there is a pressing need for an accurate fatigue life estimation method for the joints in the automotive industry. In this work, we proposed a data-driven approach embedding physical knowledge-guided parameters based on experimental data and finite element analysis results. Different machine learning algorithms are adopted to investigate the fatigue life of three typical adhesive joints, namely lap shear (LS), coach peel (CP) and KSII joints. After the feature engineering and tuned process of the machine learning models, the preferable model using the Gaussian Process Regression (GPR) algorithm is established, fed with eight input parameters, namely thicknesses of the substrates, line forces and bending moments of the adhesive bonded joints obtained from FEA. The proposed method is validated with the test data set and part-level physical tests with complex loading states for an unbiased evaluation. It demonstrates that for life prediction of adhesive joints, the data-driven solutions can constitute an improvement over conventional solutions.

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Analysis and reliability assessment for a bidirectional single-stage DAB-based AC/DC converter

Guangyu WANG (PhD)

SUPERVISORS Huiqing Wen, Wen Liu (XJTLU)
Jiafeng Zhou (UoL)

ACADEMY/SCHOOL School of Advanced Technology

This paper presents a single-phase bidirectional isolated AC/DC converter, which is composed of a half-bridge composed of bidirectional switches on the primary side and a full-bridge composed of ordinary MOSTST on the secondary side. It can realize the function of single-stage power conversion. The converter adopts a control scheme combining phase shift and frequency modulation to realize the AC/DC conversion function on the premise of realizing zero voltage switching (ZVS). This essay first analyzes the operation mode of the proposed topology, then discusses the conditions required to implement ZVS, and then makes a simple analysis of the reliability of the entire topology. Finally, the simulation parameters and the simulation waveforms of the proposed topology under two operation modes are given.

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Comparing direct and indirect sky image-based solar irradiance forecasting

Guoping RUAN (PhD)

SUPERVISORS Eng Gee Lim, Xiaoyang Chen (XJTLU)
Lin Jiang (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Photovoltaic (PV) power fluctuations caused by passing clouds bring significant challenges to the secure and economical operation of a power system. With the development of ground-based sky imagers, ground-based sky image (GSI), consisting of the intuitive information of clouds, has become widely utilized in intra-hour solar irradiance forecasting to address PV intermittence. Sky image-based solar irradiance forecasting can be classified into direct and indirect solar forecasting. Direct forecasting is to create a direct mapping function from GSIs to solar irradiance built with supervised machine learning techniques. Indirect forecasting contains additional cloud forecasting, which extracts the cloud information from GSIs. In this article, we made a detailed analysis and comparison of these two solar forecasting approaches. Through empirical studies, direct solar forecasting outperforms indirect solar forecasting for intra-hour forecasting. In addition, the impacts of image resolution and the number of image sequences on forecasting models have also been analyzed.

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Microstructure engineering for highly sensitive artificial receptors

Hao LEI (PhD)

SUPERVISORS Chun Zhao, Eng Gee Lim (XJTLU)
Xin Tu (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Machine haptics has strong research significance in the medical field. The key is to use a highly sensitive sensor to detect the degree of compression. Therefore, we use silicone rubber to make triboelectric sensors, and simulate the tactile effect of fingers by detecting the voltage signal generated by compression to establish a machine tactile system. In addition, a human-computer interaction system based on machine haptics has been developed and applied to wearable devices.

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Structural pruning for vision-radar fused network

Haocheng ZHAO (PhD)

SUPERVISORS Limin Yu (XJTLU)
Junqing Zhang (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Advanced Technology

Certainly, here's a more refined version of the translation: As large multimodal models become increasingly prevalent, the dimensions of neural networks continue to grow, posing greater challenges for efficient inference. Unlike methods such as knowledge distillation and lightweight operators, neural network pruning offers a significant enhancement in inference speed at a minimal cost. While conventional unstructured pruning can compress neural network parameters down to a mere 10% of their original size, substantial acceleration is often elusive without the support of dedicated hardware. In contrast, structured pruning offers a direct and highly effective means to compress neural networks, resulting in a relatively substantial acceleration. This project harnesses the power of structural pruning techniques to compress both visual and millimeter-wave radar modalities, ensuring the safety of detection and low-latency inference.

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Study on electric vehicles integration in power and transportation networks

Huayu ZHANG (PhD)

SUPERVISORS Bing Han, Fei Xue (XJTLU)
Lin Jiang (UoL)
Shaofeng Lu (SCUT: South China University of Technology)

ACADEMY/SCHOOL School of Advanced Technology

In the face of the challenges posed by urbanization and diverse travel demands, vehicles are gradually becoming networked, electrified, shared, and intelligent. Shared autonomous electric vehicles (SAEV) exhibit many advantages in addition to mitigating traffic burden. Encompassing reduced energy consumption, diminished operational and labor expenditures, it has attracted operators' substantial attention and investment. This study from the operator's perspective presents a mixed-integer linear programming (MILP) model of the SAEV fleet that comprehensively considers 1) Fleet operation strategy. 2) Time-varying transportation demands. 3) Fleet size management. The effectiveness of the proposed method was verified on a 25-node road network, which demonstrates the model can efficiently reallocate idle vehicles to restore balance, reduce fleet size, and optimize the received orders to achieve the best economic benefits of the fleet. Key words: Shared autonomous electric vehicle; fleet operation; fleet size;best economic benefits

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Progressive supervision for tampering localization in document images

Huiru SHAO (PhD)

SUPERVISORS Qiufeng Wang, Wei Wang (XJTLU)
Xiaowei Huang (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Tampering localization in document images plays an important role in the field of forensic and security, which has made great progress in recent years, however it is far from being solved. In this work, we aim to improve the tampering localization performance by refining both sides of the localization model. On one hand, we propose a multi-view enhancement (MVE) module at the input side, which combines RGB image, noise residual and texture information to obtain more forensic traces for tampering localization. On the other hand, at the output side, we propose both progressive supervision (PS) and detection assistance (DA) modules to enrich more detailed supervision information. Under the progressive supervision, we calculate BCE loss at each scale to extensively explore multi-scale features, which are vital for the tampering localization. To explore the tampering detection model, we adopt a KL loss to align both tampering localization and detection scores in the DA module, benefiting the estimation of global tampered probability. In the experiments, we evaluate the proposed method on the benchmark dataset DocTamper and the results demonstrate its effectiveness.

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Cross-frame feature-saliency mutual reinforcing for weakly supervised video salient object detection

Jian WANG (PhD)

SUPERVISORS Eng Gee Lim (XJTLU)
Angel Garcia-Fernandez (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Scribble annotations have recently become popular in video salient object detection. Previous methods only focus on utilizing shallow feature consistency for more integral predictions. However, there is potential for consistency between cross-frame deep features to be used to help regularize better saliency predictions. Besides, we have observed that leveraging saliency predictions as pseudo-supervision signals yields notable improvements in extracting both intra-frame and cross-frame deep features. This, in turn, leads to more precise and detailed object structural information. Thus, we propose a cross-frame feature-saliency mutual reinforcing training process to assist scribble annotations for integral video saliency predictions. Specifically, we design a cross-frame feature regularization head, which leverages intra-frame and cross-frame deep feature consistency to regularize saliency predictions as auxiliary supervision. Then, to help obtain more accurate feature consistency, we design a cross-frame saliency regularization head, where predicted saliency values are used as pseudo-supervision signals to acquire better feature consistency. In this way, our cross-frame feature and saliency regularization heads can benefit from each other to help the network learn more accurately. Extensive experiments show that our method can achieve better performances than the previous best methods.

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SaliencyCut: Augmenting plausible anomalies for anomaly detection

Jianan YE (PhD)

SUPERVISORS Xi Yang (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Anomaly detection under open-set scenario is a challenging task that requires learning discriminative fine-grained features to detect anomalies that were even unseen during training. As a cheap yet effective approach, data augmentation has been widely used to create pseudo anomalies for better training of such models. Recent wisdom of augmentation methods focuses on generating random pseudo instances that may lead to a mixture of augmented instances with seen anomalies, or out of the typical range of anomalies. To address this issue, we propose a novel saliency-guided data augmentation method, SaliencyCut, to produce pseudo but more common anomalies which tend to stay in the plausible range of anomalies. Furthermore, we deploy a two-head learning strategy consisting of normal and anomaly learning heads, to learn the anomaly score of each sample. Theoretical analyses show that this mechanism offers a more tractable and tighter lower bound of the data log-likelihood. We then design a novel patch-wise residual module in the anomaly learning head to extract and assess the fine-grained anomaly features from each sample, facilitating the learning of discriminative representations of anomaly instances. Extensive experiments conducted on six real-world anomaly detection datasets demonstrate the superiority of our method to competing methods under various settings.

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Deep learning based multi-camera pedestrian detection

Jining ZHANG (PhD)

SUPERVISORS Ming Xu (XJTLU)
Waleed Al-Nuaimy (UoL)

ACADEMY/SCHOOL School of Advanced Technology

In recent years, deep learning has made many breakthroughs in the field of computer vision. Convolutional neural network greatly improves the performance of target detection by simultaneously learning detection and appearance features. Existing single-camera pedestrian detection methods perform well in scenarios where the targets are clearly visible, but the performance of single-camera methods tends to degrade significantly in challenging situations such as serious occlusion and crowded public places. In this research we hope to propose a deep learning based multi-camera pedestrian detection algorithm that will fuse data from multiple camera views for pedestrian detection tasks to solve the occlusion problem in complex scenarios and improve the efficiency of detection. In addition, the algorithm can also detect in 3D space, such as pedestrians standing at different heights.

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Leveraging multi-objective optimization and additive manufacturing for enhanced heat transfer in microchannel heat exchangers

Junjia ZOU (PhD)

SUPERVISORS Long Huang, Eng Hwa Yap, Konstantinos Papadikis (XJTLU)
Joseph Camm, Volfango Bertola, Oliver Cadot (UoL)

ACADEMY/SCHOOL School of Intelligent Manufacturing Ecosystem

Microchannel heat exchangers, valued for their high heat transfer efficiency, compact size, and reduced material use, present design and optimization challenges due to conflicting performance objectives. This study employs a multi-objective genetic optimization algorithm, enhanced by approximation-assisted optimization using Artificial Neural Networks (ANN), to address these challenges. Variables such as channel count, wetted perimeter, cross-sectional area, and individual channel flow distribution are optimized for improved performance. The objectives include maximizing heat transfer capacity and coefficient, minimizing pressure drop and material usage. After optimization, Selective Laser Melting (SLM) additive manufacturing constructs the advanced designs. These are then experimentally tested to confirm whether the optimized structures outperform traditional models. Overall, by combining advanced optimization techniques, artificial intelligence, and additive manufacturing, this study aims to significantly enhance the performance and efficiency of microchannel heat exchangers in various applications.

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Design and control of a bio-inspired wheeled bipedal robot

Lei YU (PhD)

SUPERVISORS Yuqing Chen (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

The project focuses on enhancing the balancing performance of wheeled bipedal robots through innovations in both hardware and software aspects. A bio-inspired mechanical design, inspired by the human barbell squat, is proposed and implemented to achieve an efficient distribution of load onto the limb joints. This design improves knee torque joint efficiency and facilitates control over the distribution of the center of mass (CoM). Meanwhile, a customized balance model, namely the wheeled linear inverted pendulum (wLIP), is developed. The wLIP surpasses other alternatives by providing a more accurate estimation of wheeled robot dynamics while ensuring balancing stability. Experimental results demonstrate that the robot is capable of maintaining balance while manipulating pelvis states and CoM velocity; furthermore, it exhibits robustness against external disturbances and unknown terrains.

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Vehicle behavior recognition based on camera-radar information fusion

Ningwei OUYANG (PhD)

SUPERVISORS Ming Xu (XJTLU)
Waleed Al-Nuaimy (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Institute)

ACADEMY/SCHOOL School of Advanced Technology

The behaviour recognition of vehicles is crucial to intelligent transportation. In this paper, a vehicle behaviour recognition method based on multiple road-end cameras is proposed. The vision modality information from multiple cameras is fused by a VFA network, a voxelization-based fusion and detection model, to obtain 3D detection results, which contain the locations, dimensions, and rotations of objects. Behaviour recognition of vehicles is based on the trajectories output from a tracker. The behaviour recognition process is performed by an LSTM network, which extracts the features within steps of trajectories to classify their types.

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A conical-neck helmholtz resonator-based piezoelectric self-powered system for urban transportation

Pengfei FAN (PhD)

SUPERVISORS Xinheng Wang (XJTLU)
Shangbo Wang (HKU: University of HongKong)

ACADEMY/SCHOOL School of Advanced Technology

As urbanization accelerates, the issue of traffic noise escalates. Efficiently harnessing this prevalent acoustic energy and facilitating its collection and conversion has emerged as a notable challenge in contemporary research. This paper delineates the existing scenario of urban traffic noise pollution and introduces a piezoelectric self-powered system anchored on a Conical-Neck Helmholtz Resonator-Based Piezoelectric Self-Powered System (CNHR-PSS). This system amalgamates acoustic energy harvesting, traffic noise abatement, and traffic condition discernment. It encompasses a front-end Piezoelectric Self-Powered Node (PSN) and a backend machine learning algorithm. The front-end PSN, employing the Conical Neck Helmholtz Resonator and piezoelectric module, seizes noise and transmutes it into electrical energy, showcasing robust scalability. Multiple PSNs coalesce to form a sound barrier for traffic noise mitigation.

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A monolithic gallium nitride driver with zero-voltage-switching and dead time control

Pingyu CAO (PhD)

SUPERVISORS Miao Cui, Fei Xue, Ping Zhang (XJTLU)
Harm Van Zalinge (UoL)

ACADEMY/SCHOOL School of Advanced Technology

The Gallium Nitride (GaN)-based synchronous buck converter can reduce the power loss on the rectifier diode in an asynchronous buck converter. Dead time should be applied to avoid the shoot-through problem, while the length of the dead time will affect the efficiency of the synchronous buck converter. Therefore, the optimization of dead time is required to improve transmission efficiency. This paper proposes a driver circuit for the synchronous buck converter based on GaN devices with zero-voltage-switching (ZVS) capability and dead time self-adjustment. This work is based on advanced design system (ADS) software. The simulation results indicate that the dead time was reduced from 0.5 μs to 0.084 μs, and the efficiency can be improved from 87.82% to 94.18% when the load resistance is 50 Ω.

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Hydrodynamic analysis and optimization design of unmanned surface vehicles with paddle wheel propulsor

Ran XU (Master)

SUPERVISORS Min Chen (XJTLU)
Ji Xiang (ZJU: Zhejiang University)

ACADEMY/SCHOOL School of Advanced Technology

As industrialization continues, it leads to eutrophication of water bodies. Paddle wheel propulsor is highly adaptable in inland lakes with low-speed requirements and low wind and wave conditions. It has the advantages of good maneuverability and a shallow draft. This paper establishes a numerical simulation method to realize complex motion in gas-liquid two-phase flow based on computational fluid dynamics (CFD) theory. The sliding mesh technique is used to control the motion of the paddle wheel propulsor through the open-channel flow. The RNG k-ε turbulence model is combined with the VOF (Volume of Fluid) method. The hydrodynamic analysis of the paddle wheel propulsor is carried out. Immersion ratio, rotational speed, paddle area, and paddle number were analyzed, and SOBOL global sensitivity analysis was performed. Then, the rotation angle of the paddle is optimized. At the same time, arc paddle and wavy paddle are designed according to topology optimization. The navigability of the unmanned surface vehicle with an optimized paddle wheel propulsor is verified by experiments.

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Scalable and energy-efficient multi-building and multi-floor indoor localisation/navigation based on deep neural networks with a multivariate database

Sihao LI (PhD)

SUPERVISORS Kyeong Soo Kim (XJTLU)
Jeremy Smith (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Indoor localization based on Wi-Fi fingerprinting utilizing Received Signal Strength Indicators (RSSIs) has become popular because it does not require deployment of new infrastructure or modification of existing one but exploits existing Wi-Fi networks. The use of Deep Neural Networks (DNNs) has significantly improved the accuracy, reliability, and scalability of large-scale indoor localization based on Wi-Fi fingerprinting. However, the success of DNNs for indoor localization heavily depends on a large amount of preprocessed and labeled data for training, which is hard to obtain in indoor environments, especially during the pandemic. The aim of our doctoral research is to explore the potential of advanced learning frameworks for DNNs in overcoming the challenge of data scarcity, which is one of the major issues in conventional supervised learning. Specifically, we are to investigate Semi-Supervised Learning (SSL), Stage-wise Training (SWT), and their hybrid together with data augmentation based on Multi-Output Gaussian Process (MOGP) for large-scale Wi-Fi fingerprint-based indoor localization. The intended outcome is a DNN-based indoor localization system that can greatly improve the accuracy, reliability, and scalability of indoor localization even with a much smaller amount of RSSI fingerprint data, which holds significant implications for various industries, ranging from healthcare to retail to transportation.

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A MPC-WBC framework of legged robots

Siying QIN (PhD)

SUPERVISORS Yuqing Chen (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

In this framework, the quadruped robot's locomotion problem is be formulated as an optimal control problem for switched systems and this problem is solved using Model Predictive Control (MPC) scheme to compute online. For example, the ocs2 toolbox is used to implement this scheme. The fundamental algorithm employed is a continuous-time rendition of the iterative Linear Quadratic Regulator (iLQR) technique. Moreover, a set of equality and inequality are added into this algorithm. Moreover, The optimal reference trajectories for both the base and limbs are traced by a wholebody controller (WBC) that aims to accomplish a series of prioritized tasks.

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Traffic agent trajectory prediction based on graph neural networks

Wei DAI (PhD)

SUPERVISORS Limin Yu, Fei Ma (XJTLU)
Linglong Yuan (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Advanced Technology

Accurate trajectory prediction of agents is key for safety but modeling complexinter-agent interactions remains challenging. We propose a network integrating graph neural networks and Transformer to capture structural relations and temporal contexts. This hybrid model leverages attention mechanisms to simultaneously encode interactions and temporal dependencies. Our network provides a promising direction to advance multi-agent motion forecasting.

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Inverse-eigenstrain residual stress reconstruction in high-energy density welding

Wei SUN (PhD)

SUPERVISORS Min Chen (XJTLU)
Maulik Patel (UoL)
Guohua Fan (JITRI: Jiangsu Industrial Technology Research Institute)

ACADEMY/SCHOOL School of Advanced Technology

Analysis on the effects of residual stress (RS) within engineering components is limited by the knowledge acquirable from physical experiments, namely the finite spatial resolutions, incomplete stress tensors, and uncertainties. The inverse-eigenstrain approach allows full-field RS reconstruction, but with stringent requirements for initial conditions. In this work, it was demonstrated an X-ray diffraction (XRD) line profile analysis-based method to efficiently determine both the residual stress distribution and extent of the strain-incompatible zone, as well as their effects on the reconstructed RS distribution. The results revealed that ambiguity in the definition of the strain-incompatible zone boundary, both overestimations and underestimations, can led to physically improbable distributions, and definition of the strain incompatibility can significantly reduce the number of experimental measurements required for RS reconstruction. The reconstructed field was compared to laboratory-based XRD results and showed that the reconstruction error was exponentially related to the initial uncertainty and experimental spatial resolution.

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Separation adaptive wireless power transfer with switchable compensating loops

Weijun HONG (PhD)

SUPERVISORS Jingchen Wang, Eng Gee Lim, Mark Leach (XJTLU)
Yi Huang (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Traditional 2-Coil magnetic resonant wireless power transfer system is vulnerable to change in coupling strength, which is affected by separation distance and coil misalignment. When the separation is small, the coupling strength will be very strong which leads to frequency splitting for the load power. In this case, the load power at the designated resonant frequency will drop drastically and leads to poor power transfer capability. This poster demonstrates a novel WPT system with switchable compensating loops which can cancel the exceeding coupling and maintain the load power at the designated frequency. As the compensating loops can be turned off, this modification will now reduce the maximum transfer distance of the WPT system.

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Investigation of Ni/Ag/Ni ohmic contact on p++GaN/pGaN/AlGaN/GaN Heterojunction

Weisheng WANG (PhD)

SUPERVISORS Wen Liu (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Gallium nitride(GaN) transistors have tremendous potential for future cost-effective power transfer applications due to their superior performance in power switching. Recently, p-channel GaN transistors have attracted more attention, for they are essential components in the GaN complementary logic circuit. Due to the low activation rate of the impurity Mg in pGaN, most p-type ohmic contacts on traditional commercial pGaN HEMT platforms exhibit Schottky characteristics at low voltages. Ni/Ag contact has been proven to reduce the Schottky barrier effect, but Ag suffers from agglomeration, which may affect the contact resistance. In this work, we added a Ni cladding layer to improve the surface of the metal alloy. The Ni/Ag/Ni contact shows a contact resistance of 20.5Ω·mm with sheet resistance of 44.423 kΩ/□ on the p++GaN/pGaN/AlGaN/GaN heterojunction.

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A SERS Nanocellulose-paper-based analytical device for ultra-sensitive preclinical detection of Alzheimer's disease

Wenwen YUAN (PhD)

SUPERVISORS Pengfei Song (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Alzheimer's disease (AD), the most prevalent neurodegenerative ailment in the world, results in severe cognitive decline and irreversible memory loss. Despite the severity of the disease, existing high-sensitive AD detection methods including neuroimaging and brain deposit-positive lesions tests are still challenging due to high cost and complicated operation. Therefore, these methods are unsuitable for preclinical, especially in low resource settings. Though the regular paper-based microfluidic devices are cost-efficiency, they are limited by the high limit-of-detection (LOD) and contamination. To solve these limitations, we first report the ultrasensitive and low-cost nanocellulose paper (nanopaper)-based analytical microfluidic devices (NanoPADs) for AD detection by Surface-enhanced Raman scattering (SERS). Nanopaper has advantages of ultrasmooth surface, high optical transparency, and tunable chemical properties, but SERS nanopaper-based immunoassay detection was yet to be developed. As a proof-of-concept, we first demonstrated our approach through a sandwich immunoassay involving rabbit IgG with 369 fg/mL LOD. Furthermore, we realized the LOD of AD biomarker (glial fibrillary acidic protein (GFAP)) to be 150 fg/mL. Therefore, our NanoPADs are distinguished by its high integration, cost-efficiency, practicality, and ease of implementation, presenting a promising avenue for effective early preclinical detection of AD.

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Revisiting 3D point cloud analysis with Markov process

Wuwei MA (PhD)

SUPERVISORS Qiufeng Wang (XJTLU)
Xiaowei Huang (UoL)
Kaizhu Huang (DKU: Duke Kunshan University)

ACADEMY/SCHOOL School of Advanced Technology

3D point cloud analysis has recently garnered significant attention due to its capacity to provide more comprehensive information compared to 2D images. To confront the inherent irregular and unstructured properties of point clouds, recent research efforts have introduced numerous well-designed set abstraction blocks. However, few of them address the issues of information loss and feature mismatch during the sampling process. To address these problems, we have explored the Markov process to revisit point clouds analysis, wherein different-scale point sets are treated as states, and information updating between these point sets is modeled as the probability transition. In the framework of Markov analysis, our encoder can be shown to effectively mitigate information loss in downsampled point sets, while our decoder can accurately recover corresponding features for the upsampled point sets. Furthermore, we introduce a difference-wise attention mechanism to specifically extract discriminative point features, focusing on informative point feature distillation within the states. Extensive experiments demonstrate that our method equipped with Markov process consistently achieves superior performance across a range of tasks including object classification, pose estimation, shape completion, part segmentation, and semantic segmentation.

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Density and impurity based supervoxel selection for active point cloud semantic segmentation

Xianglin QIU (PhD)

SUPERVISORS Jimin Xiao (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

The success of point cloud semantic segmentation based on deep neural networks relies on large-scale and reliable labeled data, but there are always difficulties in getting annotated point cloud data. In order to alleviate the labor of annotation, active point cloud semantic segmentation uses supervoxel regions as the basic annotation unit and selects the most informative supervoxel samples for manual annotation and model training.

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MSC: Velocity-based multi-sphere contraction for unsupervised video anomaly detection under surveillance

Xiaolei WANG (PhD)

SUPERVISORS Jimin Xiao, Eng Gee Lim (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Unsupervised video anomaly detection mainly focuses on identifying unexpected anomaly patterns without abnormal samples during training. However,The process of fitting normal data distribution is inevitably influenced by the noise (outlier) in feature space. Therefore, we propose a GMM-guided multi-sphere contraction to compact features' distribution to alleviate the adverse effects of outliers in training phase. Moreover, we only apply optical flow information to detection anomalies, which is very safety on ethical issue. Finally, we evaluate the performance of our method by using three benchmark datasets, and achieve state-of-the-art performances.

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The multifunctional hydrogel sensor for neonatal respiratory monitoring

Xiaoyan WANG (PhD)

SUPERVISORS Pengfei Song (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Flexible hydrogels are promising materials for artificial intelligence electronics and wearable devices. The main properties of conductivity hydrogel are electrical conductivity, mechanical properties, self-healing properties, anti-freezing and moisturizing properties, self-adhesive properties and anti-swelling properties. Benefits from above advantages, it is used wildly in healthcare field to collect real-time data. However, there are few hydrogel sensors that are used in respiratory monitoring system, especially for new-borns, since they are prone to infection. So the development of a breath sensor for babies is necessary. In my doctoral project, we will develop a hydrogel with MXene. The hydrogel shows many properties (antibacterial, strain sensitivity, and self-healing) that cannot be achieved simultaneously by a single hydrogel. The hydrogel can be used as a strain sensor to monitor human motion. Due to its antibacterial property, it can be used as a wearable senor for new borns to detect respiratory rate information to decrease infection.

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Hunting sparsity: Density-guided contrastive learning for semi-supervised semantic segmentation

Xiaoyang WANG (PhD)

SUPERVISORS Jimin Xiao, Limin Yu (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Recent semi-supervised semantic segmentation methods combine pseudo labeling and consistency regularization to enhance model generalization from perturbation-invariant training. In this work, we argue that adequate supervi- sion can be extracted directly from the geometry of fea- ture space. Inspired by density-based unsupervised clus- tering, we propose to leverage feature density to locate sparse regions within feature clusters defined by label and pseudo labels. The hypothesis is that lower-density fea- tures tend to be under-trained compared with those densely gathered. Therefore, we propose to apply regularization on the structure of the cluster by tackling the sparsity to in- crease intra-class compactness in feature space. With this goal, we present a Density-Guided Contrastive Learning (DGCL) strategy to push anchor features in sparse regions toward cluster centers approximated by high-density posi- tive keys. The heart of our method is to estimate feature density which is defined as neighbor compactness. We de- sign a multi-scale density estimation module to obtain the density from multiple nearest-neighbor graphs for robust density modeling. Moreover, a unified training framework is proposed to combine label-guided self-training and density- guided geometry regularization to form complementary su- pervision on unlabeled data. Experimental results on PAS- CAL VOC and Cityscapes under various semi-supervised settings demonstrate that our proposed method achieves state-of-the-art performances.

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Metamaterial with split ring resonators in the wireless power transmission system

Xiaozhe JI (PhD)

SUPERVISORS Jingchen Wang, Ka Lok Man, Eng Gee Lim (XJTLU)
Jiafeng Zhou (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Advanced Technology

This project explores the negative permeability metamaterial and the configuration is split ring resonators. By using CST Microwave Studio Software and Matlab Software, the proposed metamaterial and the effective permeability were simulated and extracted. The improvement in power transfer efficiency and the magnetic field distribution of the system were also simulated and compared.

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The relationship between local Lüders band morphology and macroscopic discontinuous yield phenomena in low carbon steel under the influence of sample size effect

Xingrui JIANG (PhD)

SUPERVISORS Min Chen (XJTLU)
Maulik Patel (UoL)
Guohua Fan (JITRI: Jiangsu Industrial Technology Research Institute)

ACADEMY/SCHOOL School of Advanced Technology

In metallic materials, the size effect resulting from a reduction in the ratio of grain size to specimen size can lead to a decline in material properties. However, there is a lack of comprehensive research on the impact of size effects on Lüders band deformation in mild steel. Lüders deformation is associated with a decrease in both upper and lower yield strengths. In our study, we observed that the Lüders strain also diminishes with increasing specimen thickness, causing a gradual weakening of the Lüders band. The evolution of local Lüders strain, as characterized by the Digital Image Correlation (DIC) method, decreases in tandem with increasing specimen thickness, mirroring the macroscopic Lüders strain. To investigate the size effect, we introduced a surface layer model into our finite element (FE) simulations to simulate Lüders deformation. Our results indicate that incorporating surface layers with continuous flow stress can mitigate the Lüders deformation. However, in the thinnest sample, the Lüders strain experiences a significant drop and cannot be adequately simulated. This phenomenon can be attributed to premature failure in the micro-sized sample. The stress triaxiality at the Lüders band front is lower in the thin sample, resulting in lower local stress, as supported by a modified model, which contributes to the reduced Lüders strain.

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Transient DC-bias and hard-switching mitigation for fast power reversal in dual-active-bridge DC-DC converters

Xu HAN (PhD)

SUPERVISORS Huiqing Wen, Wen Liu (XJTLU)
Jiafeng Zhou (UoL)
Yong Yang (SCU: Soochow University)

ACADEMY/SCHOOL School of Advanced Technology

As one of promising power interfaces in Microgrids, dual active bridge (DAB) converters have been extensively studied and widely applied. However, the dc bias during its transient process, as well as the electromagnetic interference and efficiency loss caused by the hard-switching operation, urgently need to be addressed. In addition, traditional transient optimization strategies mainly focus on unidirectional power transmission, which cannot ensure fast power reverse operation of DAB converters and eliminate dc bias and hard-switching defects at the same time. To address this issue, a novel transient power reversal control (TPRC) strategy based on the principle of straightforward phase-shift optimization is proposed in this article. Extensive and comparative experimental evaluations under various scenarios have been conducted to verify the effectiveness of the proposed TPRC strategy.

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Economics research on the impact of cable physical characteristics on investment and operation costs of distribution system

Yanxi LYU (PhD)

SUPERVISORS Lurui Fang, Eng Gee Lim (XJTLU)
Lin Jiang (UoL)

ACADEMY/SCHOOL School of Advanced Technology

As an essential component of the power system that connects the transmission network to the consumers, uncertainty of cables lifetime in distribution networks would be taken into account. This project will use Vine-copula and Two Stage Robust Optimization to analyze the cables lifetime and optimize the cost-efficient investment. In summary, this project will generate a new investment strategy by considering cables lifespan and a new model based on cables lifespan for distribution network to defer reinforcements.

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Araucaria leaf-inspired microfluidic patch for highly efficient sweat collection and analysis

Yifan LI (PhD)

SUPERVISORS Quan Zhang, Pengfei Song, Mark Paul Leach (XJTLU)
Kai Hoettges (UoL)

ACADEMY/SCHOOL School of Advanced Technology

This paper reports a novel sweat detection device which incorporates a micro-structured array mimicking Araucaria leaf for the collection and analysis of sweat. Unlike existing sweat patches, the patch has a large sweat collection chamber and directs the directional diffusion of sweat through the micro-vane array therein, thus introducing sweat into the flow channels without having to fill the entire collection chamber. Polydimethylsiloxane (PDMS) models of micro-vane arrays have demonstrated the ability of the design to handle unidirectional flow of liquid. Human testing of young healthy volunteers demonstrated the device' s ability to collect, store and analyze sweat.

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An end-to-end method for multi-camera multi-object tracking

Yihan YANG (PhD)

SUPERVISORS Ming Xu (XJTLU)
Jason Ralph (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Traditional single-view Multi-Object Tracking (MOT) methods often face challenges such as occlusion, appearance changes, and limited field-of-view. To overcome these challenges, Multi-view Multi-object Tracking (MVMOT) approaches have emerged. MVMOT utilizes overlapping views from multiple cameras to improve tracking accuracy and consistency. In this work, we propose MVTr, an end-to-end method for multi-view pedestrian tracking. MVTr fully take the advantages of multiple camera views and incorporates the concept of positional offsets to complete the tracking task on the pedestrian occupancy maps (POMs). By performing multi-view and temporal aggregation, MVTr generates position offsets that precisely estimate the object positions between consecutive frames. Unlike traditional single-view methods, MVTr utilizes robust feature extraction from different angles, addressing the challenges of missed detections or target switches. The algorithm is evaluated on challenging datasets, Wildtrack and MultiviewX, demonstrating its state-of-the-art performance and potential for real-world applications.

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Which restrains few-shot class-incremental learning, forgetting or few-shot learning?

Yijie HU (PhD)

SUPERVISORS Qiufeng Wang (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

Few-shot class-incremental learning (FSCIL) is one common yet difficult task in machine learning. There are mainly two challenges in FSCIL: catastrophic forgetting of old classes during incremental sessions and insufficient learning of new classes with only a few samples. Recent wisdom mainly focuses on how to avoid catastrophic forgetting by calibrating prototypes of each class while surprisingly overlooking the issue of limited samples of new classes. In this paper, we aim to improve the FSCIL by supplementing knowledge of new classes from old ones. To this end, we propose an old classes-guided FSCIL method with two stages of the base and incremental sessions. In the base session, we propose a prototype-centered loss trying to learn a compact distribution of old classes. During the incremental learning sessions, we first augment more samples for each new class by Gaussian sampling, where the mean and covariance are calibrated by old classes; we then propose to update the model based on both prototype-based and replay-based learning methods on those augmented samples. In addition, based on a series of analyses on examining the performance in both old and new classes during each session, we find out that most works contain a deceptive accuracy bias to old classes, where test data usually consists of a large part of samples in old classes. Extensive experiments on three popular FSCIL datasets including mini-ImageNet, CIFAR100, and CUB200 demonstrate the superiority of our model to the other state-of-the-art methods on both old and new classes.

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Context does matter: End-to-end panoptic narrative grounding with deformable attention refined matching network

Yiming LIN (PhD)

SUPERVISORS Xiaobo Jin (XJTLU)
Yi Huang (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Panoramic Narrative Grounding (PNG) is an emerg- ing visual grounding task that aims to segment visual objects in images based on dense narrative captions. The current state- of-the-art methods first refine the representation of phrase by aggregating the most similar k image pixels, and then match the refined text representations with the pixels of the image feature map to generate segmentation results. However, simply aggregat- ing sampled image features ignores the contextual information, which can lead to phrase-to-pixel mis-match. In this paper, we propose a novel learning framework called Deformable Attention Refined Matching Network (DRMN), whose main idea is to bring deformable attention in the iterative process of feature learning to incorporate essential context information of different scales of pixels. DRMN iteratively re-encodes pixels with the deformable attention network after updating the feature representation of the top-k most similar pixels. As such, DRMN can lead to accurate yet discriminative pixel representations, purify the top- k most similar pixels, and consequently alleviate the phrase-to- pixel mis-match substantially. Experimental results show that our novel design significantly improves the matching results between text phrases and image pixels. Concretely, DRMN achieves new state-of-the-art performance on the PNG benchmark with an average recall improvement 3.5%.

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Multi-view pedestrian detection in 3D space

Yuchen LING (PhD)

SUPERVISORS Ming Xu (XJTLU)
Jeremy Smith (UoL)

ACADEMY/SCHOOL School of Advanced Technology

In recent years, multi-view pedestrian detection has been important in computer vision field as it can effectively handle heavy occlusion between pedestrians. However, the current multi-view detection algorithms are constrained to the scenarios where all pedestrians are standing on the same ground plane. The extension of the multi-view detection algorithm to detect pedestrians in 3D space is of great significance. We proposed an algorithm to localize pedestrians in 3D space through foreground observations from multiple cameras' images. The space of interest is discretized into a 3D grid. At each point, a cuboid of pedestrian model is placed and then projected into multiple camera views as initial candidates. Probabilities of pedestrian' s presence is found through a foreground pixels binary map. A logical minimization method is used to select essential candidates from a 3D occupancy matrix. Our method can reach a 91.5% MODA and a 62.7% MODP.

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Optimal viewpoint planning of structure from motion-based 3D reconstruction with proximal policy optimization in virtual physical training

Yuchen WANG (PhD)

SUPERVISORS Xinheng Wang (XJTLU)
Junqing Zhang (UoL)

ACADEMY/SCHOOL School of Advanced Technology

The pervasive cyber-physical technology is promoting 3D reconstruction to support emerging services in modern industries, such as smart commissioning, remote control, and safety monitoring. As a popular 3D reconstruction technique, structure from motion is characterized for its convenience and low cost. However, the dilemma between high-fidelity modeling and fast transmission has long remain a challenge. In structure from motion terms, this challenge is interpreted as viewpoint planning that ensure the modeling quality with minimized photo shots. This research proposes an innovative method of viewpoint planning for structure from motion-based 3D reconstruction with the prominent proximal policy optimization through virtual-physical training. As the latest deep reinforcement learning algorithms, proximal policy optimization can explore the optimal viewpoint planning through policy gradient training. Besides, the algorithm training is completed in the virtual environment before transferring to the physical environment to resolve the slow training speed of deep reinforcement learning in industry.

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Design of dual-band CPW rectenna for wireless power transmission

Zeyu LIU (PhD)

SUPERVISORS Jinchen Wang (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

This poster features a compact four-port dual-band Co-Planer Waveguide (CPW) rectenna. The two bands (2 3 GHz) and (5 6.5 GHz) of the proposed antenna are cover the standard WI-FI bands (2.412 2.484 GHz) and WLAN bands (5.745 5.825 GHz). The gain of the proposed antenna is 3.72 dBi at 2.4 GHz and 3.73 dBi at 5.8 GHz. A double voltage rectifying circuit with a load of 6.2 kΩ is designed to achieve relatively high power conversion efficiency. When the input power is 0 dBm, the proposed rectifier can achieve RF-to-DC efficiencies of 66% at 2.4 GHz and 58% at 5.8 GHz. The combined output voltage can reach to 10 V, which is suitable for wireless charging in Internet of Things (IoT) applications.

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Investigation of 4H-SiC MOS capacitor flat band voltage shift characteristics and low-pressure oxidation process

Zhaoyi WANG (PhD)

SUPERVISORS Wen Liu, Huiqing Wen, Zhao Wang (XJTLU)
Joseph Yan (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Silicon carbide (SiC) is the third generation of wide band gap semiconductor material, has large critical field strength and excellent thermal conductivity. In addition to silicon, SiC is the only semiconductor material that can obtain insulating film by thermal oxidation directly. However, the poor quality of the oxide film is due to the large number of defects at the SiO2/SiC interface. SiC oxidized in low pressure was investigated in order to obtain a high-quality oxide layer. It was found that oxidation at 0.1 atm exerted a more considerable effect on the electrical performance of SiC MOS capacitors, including high breakdown voltage, low interface trap density and more flat-band voltge stability.

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Research on indoor localization algorithms and data processing based on time-varying Wi-Fi fingerprint database

Zhe TANG (PhD)

SUPERVISORS Kyeong Soo Kim (XJTLU)
Jeremy Smith (UoL)

ACADEMY/SCHOOL School of Advanced Technology

Location fingerprinting based on the Received Sig- nal Strength Indicator (RSSI) has become a mainstream indoor localization technology due to its advantage of not requiring the installation of new infrastructure and modification of ex- isting equipment. With the wide application of Artificial In- telligence (AI)/Machine Learning (ML) techniques in the field of location fingerprinting the accuracy has been significantly improved in large-scale multi-building and multi-floor indoor localization scenarios. However, the mainstream public databases were established around 10 years ago, which can not adapt to today's changing indoor electromagnetic environment, and most of them are static databases ignoring the time-varying information, which makes the algo- rithm's training set have a large difference between the deployed test. This leads to problems with localization accuracy, extended algorithm lifecycles, etc. Therefore, in this paper, we construct a dynamic database based on the XJTLU campus, which contains three floors of a building and lasts for 44 days of measurements, to reveal the difference between the dynamic database and the static database from the statistical point of view and indoor localization accuracy point of view.

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Advanced synaptic transistors for neuromorphic computings

Zhengjun LIU (PhD)

SUPERVISORS Qing Liu, Chun Zhao (XJTLU)
Ivona Mitrovic (UoL)

ACADEMY/SCHOOL School of Advanced Technology

With the increase in the amount of data and the need for parallel computing, modern computers based on the Von Neumann architecture face the severe challenge of inefficient information processing. Inspired by biological neural network systems, this work proposes a perovskite-based optoelectronic synapse device. The photogenerated electron pair migration of perovskite materials enables the device to add photosensitive synaptic plasticity to traditional electrical synapses, which can be used for deep learning networks that simulate image classification functions.

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Loss balance and transient DC-bias suppression strategies in three-level DAB converters modulated with five DoFs

Zhichen FENG (PhD)

SUPERVISORS Huiqing Wen (XJTLU)

ACADEMY/SCHOOL School of Advanced Technology

In the three-level (3L) neutral-point-clamped (NPC) dual-active-bridge (DAB) converter, both sides of the converter can adapt to higher DC bus voltage, and more control degrees of freedom (DoFs) are provided compared to the conventional DAB converter. In the PWM generating technique with 5 DoFs, loss imbalance may develop in inner switches and outer switches because the leading or lagging arm is introduced, affecting system reliability. In addition, the transient DC-bias issue may also arise in the 3L-NPC-DAB converter modulated with 5 DoFs, leading to the transformer saturation. In this paper, two strategies are proposed to suppress the loss imbalance and the transient DC-bias in the current stress and magnetizing branches. It is also general and applicable for SPS, DPS, and TPS modulations. Furthermore, the loss balance strategy and DC-bias suppression strategy are applied in the PWM generation technique simultaneously without additional components. With the proposed solutions, the loss imbalances of inner switches and outer switches are suppressed and DC-bias in the integral of voltages on both sides of the 3L-NPC-DAB converter is abolished. The effectiveness of the proposed strategies is validated by a series of experiments conducted under varying situations.

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Formation of high-quality Ni/Ag contacts on p-GaN/AlGaN/GaN platform

Zhiwei SUN (PhD)

SUPERVISORS Wen Liu (XJTLU)
Harm Van Zalinge (UoL)

ACADEMY/SCHOOL School of Advanced Technology

In this study, we investigated Ni/Ag contacts on P-GaN/AlGaN/GaN/Si Platform comprehensively, focusing on the influence of annealing pressure on the surface morphology, the ohmic formation mechanism, and the carrier transfer model of Ni/Ag metal stack on P-GaN/AlGaN/GaN/Si Platform. The annealing conditions with the tube furnace have been optimized, including low-pressure (1-10 Pa) and low oxygen rate (16 sccm), to mitigate the challenges of surface agglomeration and void in Ag contacts [13]. The optimized ohmic contact achieved significant enhancements in the surface morphology of Ni/Ag, particularly with a very low-pressure (1 Pa) annealing environment.

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Two-dimensional semiconductor devices and application on neuromorphic computing

Zishen ZHAO (PhD)

SUPERVISORS Qing Liu, Chun Zhao (XJTLU)
Ivona Mitrovic (UoL)

ACADEMY/SCHOOL School of Advanced Technology

In order to break the Von Neumann bottleneck and further improve the computational energy efficiency of transistors, artificial synapses have received widespread attention and development. The floating-gate transistor (FGT) has proven to be a promising scheme of artificial synapse due to the storage and regulation of charge carriers by energy barriers. In this work, we proposed an electric-stimulated indium oxide (InOx) artificial synaptic thin-film transistor introduced two-dimensional material, MXene, to construct a floating-gate structure to enhance the nonvolatile property of the device. In addition, incorporating potassium ions into MXene has significantly improved the linearity of device long-term depression (LTD) regulation through ion migration. The characteristics extracted from long-term potentiation (LTP) and LTD are adopted to simulate the synaptic weight update process. By embedding simulation algorithms into artificial neural networks (ANN), our floating gate synaptic devices can achieve a recognition rate of over 80% on the MNIST handwritten digit dataset.

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Be a part of the narrative: How audiences are introduced to the "free choice dilemma" in the interactive film Bandersnatch

Hanxue ZHANG (PhD)

SUPERVISORS Marco Pellitteri, David Herold (XJTLU)
Paolo Ruffino (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

When consuming an interactive movie or series, viewers are led to different experiences, plot directions, and endings depending on their choices while watching. In this project, I argue that many viewers might consider this "private room" online as a utopian community. While contributing to the "democratisation" of audience engagement, interactive films attempt to release the viewer's subjectivity, which the author's primary position has long suppressed. However, even though new digital technologies enable increased audience interaction in narrative deployment, there are still many constraints and controls. Through a case study, the interactive film Bandersnatch (2018), I will examine interactivity in film and how the features of interactive mechanisms can be used to accomplish the illusion of user-generated content and "free choice", in a way to attain an understanding of users' experiences and discussing their interplay with the peculiar mechanisms of interactive media.

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Understanding the political economy of Covid coverage in the UK

Heyang HU (PhD)

SUPERVISORS Tabe Bergman, Xiaoling Zhang (XJTLU)

ACADEMY/SCHOOL School of Humanities and Social Sciences

Covid-19 is the first pandemic in human history in which technology and social media are used to keep people informed and connected on a massive scale. The Covid-19 pandemic is not just a global public health crisis but also amplified political and social crisis in many countries, including the UK. The Covid-19 outbreak has exacerbated populism and societal polarization in the UK, leading to an 'infodemic'. During this difficult time, journalism had to be critical to help inform people and unite society. Is Covid-19 a proud moment for journalism? Based on a quantitative analysis of media coverages, this research will discuss challenges faced by journalism in the UK during the Covid-19 pandemic. There will be a particular concern about the political economy pressures on journalism and a long-term implication related to journalism that we can draw from this pandemic.

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A gradable prompting taxonomy for ChatGPT translation

Hui JIAO (PhD)

SUPERVISORS Xiaojun Zhang, Lu Zong (XJTLU)
Bei Peng (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

ChatGPT, as a language model based on large-scale pre-training, has exerted a profound influence on the domain of machine translation. In ChatGPT, a "Prompt" refers to a segment of text or instruction employed to steer the model towards generating a specific category of response. The design of the translation prompt emerges as a key aspect that can wield influence over factors such as the style, precision and accuracy of the translation to a certain extent. However, there is a lack of a common standard and methodology on how to design and select a translation prompt. Accordingly, this paper proposes a generic taxonomy, which defines gradable translation prompts in terms of expression type, translation style, POS information and explicit statement, thus facilitating the construction of prompts endowed with distinct attributes tailored for various translation tasks. Specific cases are selected to validate the effectiveness of the method.

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Language as social capital: The role of CMC in the acculturation of South African ESL teachers in China

Jaclisse Lorene MAYOMA (PhD)

SUPERVISORS E. Dimitris Kitis, Songqing Li (XJTLU)
Sofia Lampropoulou (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

The migration of South African teachers to China, driven by socio-economic factors and China's burgeoning demand for English education, is ever-increasing. Despite a growing body of literature on language and migration, there is a paucity of research focusing on this specific population, who hold dual identities: as teachers of English and learners of Chinese. This study explores how these teachers use Computer-Mediated Communication (CMC) platforms as linguistic and social mediators in their professional and social lives. Using a qualitative approach with 36 semi-structured interviews, the study integrates Vygotsky's Sociocultural Theory and Schumann's Acculturation Model to explore language as social capital. Findings indicate that CMC platforms, particularly WeChat, are crucial for acculturation and language learning. Professionally, these platforms offer minimal pedagogical support; socially, they facilitate community ties. The study underscores the complexities of using digital tools for social integration and linguistic practice, contributing to interdisciplinary dialogues in Linguistics and Migration Studies.

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A case study of auteurist martial arts films

Jie SUN (PhD)

SUPERVISORS Hui Miao, Xiaoling Zhang (XJTLU)
Penny Ding (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

Chinese martial arts films had long struggled to break out of their established paradigms, until film auteurs began to engage with the genre. Wong Kar-wai's The Grandmaster (2013) and Hou Hsiao-hsien's The Assassin (2015) are the most representative, attracting considerable attention and sparking extensive discussion in world filmdom. This research is a case study of the two films. By analysing their cinematic techniques and narrative structures, this research aims to examine how film auteurs engage with and innovate in this commercial genre while retaining their personal styles and aesthetics with new spiritual connotations into the traditional martial arts concept. Therefore, It is also conducive to exploring the many possibilities for the future development of martial arts films, providing a point of reference for cinematic practices that seek to break the shackles of this genre's traditions.

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Bilingual education for older adults: A research synthesis of the influencing factors and outcomes of learning a Lx

Jing WANG (PhD)

SUPERVISORS Rining Wei (XJTLU)
Lesley Randles (UoL)
Lihe Huang (Tongji: Tongji University)

ACADEMY/SCHOOL School of Humanities and Social Sciences

The past three decades have witnessed a strong upward trajectory in empirical studies on the potential benefits that Lx learning and bilingualism can afford to both individuals and society. However, the state of cumulative scientific knowledge in the outcomes of learning a Lx by older adults (e.g. aged 60 and above), an emerging important research domain, remains largely unknown. Therefore, the present study uses synthetic techniques to examine empirical research published till 2022 in international journals indexed in Scopus. Synthetic analysis identifies several overarching themes in these studies conducted in different countries including Poland. Overall speaking, the synthesised results highlight a myriad of potential benefits of learning a Lx at a later stage in life. It is hoped that the present study can help to position the extant empirical research to accurately and clearly inform different stakeholders of the value in Lx learning at different stages across the lifespan.

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Reception, resistance, and reminder: Towards a framework of understanding misinformation belief in China

Kuangjian WU (PhD)

SUPERVISORS Xianwen Kuang, Xiaoling Zhang (XJTLU)
Antal Wozniak (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

It was commonly believed that politically motivated reasoning tends to drive poor truth judgment. However, growing evidence points to a lack of relevant knowledge responsible for misinformation beliefs. This research aims to explore the presence of motivated reasoning and the role of elite cues in influencing people's ability to detect false information in China. It will also try to resolve the debate by examining whether it is the dominance of ideological preferences or a lack of correct knowledge that leads to beliefs in misinformation. A survey experiment will be conducted to measure people's political ideologies and prior knowledge on a variety of political issues, where the elite played a role in either propagating or fact-checking related misinformation. The study will contribute to the existing debate on misinformation beliefs by bringing data from China.

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Patriotic expression of the younger generation: National mirror image in cross-cultural communication

Liangqi XU (PhD)

SUPERVISORS Wei Lu

UNIVERSITY/INSTITUTE Zhejiang University / College of Media and International Culture

With the continuous improvement of Internet platform technology, video has become an important form of media consumption and production for more and more Internet users, and these young people, who have been exposed to online media since childhood, have gradually created their own online communication language and circles with their characteristics, and have their personalized expressions of traditional national culture. This paper attempts to compare the ways in which young people express their national identity and communication on two video platforms, YouTube and Bilibili, while reflecting on the mirroring of Chinese society and culture through the perspective of the "other" by foreign bloggers who have lived in China. The paper then discovers how the interaction on the video platforms reflects the collision and connection between Chinese and Western cross-cultural communication and broadens Chinese audiences' ethnic mirroring perceptions.

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The impact of vernacular mobile phone photography on ideas of beauty in daily life

Qi WANG (PhD)

SUPERVISORS Marco Pellitteri (XJTLU)

ACADEMY/SCHOOL School of Humanities and Social Sciences

This study investigates whether and how the everyday practice of vernacular photography among mobile phone users may impact their long-term aesthetic taste in identifying and appreciating beauty in their everyday moments. This study's starting assumption is grounded in Susan Sontag's "On Photography" (1977), which proposed that photographs set the standards for beauty. In the context of mobile phone photography, does this mean everyone can find beauty through photography? Is Sontag's understanding of photography and photographs still current and valid? Whether photography enhances people's aesthetic experience and lets them view things beautifully will be examined in the context of mobile phone photography. This study employs qualitative research methods, including interviews and observations. Interviews with mobile phone practitioners will gain insights into beauty with their photography practice. The core hypothesis is that increased engagement in vernacular mobile phone photography allows users to discover and assess beauty in everyday life through their practice.

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Translation in the digital era: Digital paratexts in translating feminist literature in China

Qiyao ZHANG (PhD)

SUPERVISORS Lily Yu

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / School of Education and English

This study examines the role of digital paratexts in translating feminist literature in China. Advances in digital technology have brought about changes in translation industry. One evidence is that more and more translators are using digital media to promote their translations. Chen Xuan's translation of a feminist novel Tipping the Velvet (TTV) is a case in point. Chen actively uses the digital media, such as her WeChat Official Account '冬惊 Dongjing' (lit. winter shock), and Douyin (Chinese Tiktok), to promote her translation of TTV . Her online promotion has received lots of responses from online readers. These online materials created by Chen and her readers about TTV fall into the two types of digital paratexts recently categorised by Freeth (2022, 2023). An analysis of these two types of digital paratexts for TTV will demonstrate the important role they have played in the translation of feminist literature in China.

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The role of city branding in China's central-local bargainin dynamics: A case study of Ningbo's engagement in the Belt and Road Initiative

Xiang LI (PhD)

SUPERVISORS Tracey Fallon

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / School of International Studies

This project argues that city branding is holding an important role in the bargaining process between central and local government in China. Through the lens of structural functionalism, this study seeks to understand how city branding contributes to and interacts with China's central-local relations in the context of Belt and Road Initiative (BRI). Through the analysis of Ningbo's BRI city branding efforts, this research will unveil how local governments use BRI branding to assert their position and negotiate with the central government in pursuit of their own interests and agendas and how the central government influences local cities via the national strategy brand. The research adopts single case study, utilizing content analysis, social media source, documentation, and participant observation. The central objective of this study is to examine the function and impact of city branding as an intangible tool in the central-local governance system.

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The digital bunker: metaphor, materiality and temporal/spatial framework

Xiaomei JIANG (PhD)

SUPERVISORS Deqiang Ji

UNIVERSITY/INSTITUTE Communication University of China / Insititute of Communication Studies

This study describes and advances a theoretical framework, revealing a "digital bunker" in the digitally mediated world at where the interactions between the constructors, insider/outsider, as well as the crisis itself are restructured. An online cross-cultural campaign #BeijingBunker was selected which launched in the very initial phase after the viral lockdown policies in Beijing. We obtained all the content under the #BeijingBunker hashtag for a total of 32 articles through pathon, and categorized them into 28,600 characters. By employing text analytics, we conclude that the sudden lock down in China due to Covid-19 created a real time laboratory for digital adaptation and communication within the digital nomads: as a hybrid structure of time and space, it is simultaneously open and closed, connected and discrete, seemingly providing information and protection, but without enabling individuals to truly comprehend and penetrate the authentic local world, intensifying the clustering of small communities.

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Uncovering deep frames in COVID-19 communication: A study of metaphors used in Weibo government accounts during China's early stage of the pandemic

Xingfu YU (PhD)

SUPERVISORS David Kurt Herold (XJTLU)
Ekaterina Balabanova (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

Metaphors about COVID-19 were common on social media, influenced people's understanding and responses, and could activate deep frames: structures of mutually exclusive views on COVID-19. However, it was unclear what COVID-19 metaphorical uses by the Chinese government accounts intended to activate. This study aims to investigate deep frames intentionally activated by them. Combining word frequency and critical metaphor analyses, this study analysed 40,289 posts by 49 government accounts, containing COVID-19 related keywords or Chinese characters. This study found that with mobilisation and empathy, the Chinese government mainly used "War" and "Journey" metaphors to highlight (a) the antagonism and severity of pandemic prevention, and (b) the duty and difficulty of medical workers, civil servants, and volunteers. These intended to activate the Weibo users' deep frame of obedience, and provide them with a plausible impression – with public supports for healthcare professionals and strict controls, the whole society can unite against COVID-19 pandemic.

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Audiovisual translation and audience reception of wordplay in comedy films from Chinese to English: A case study

Yanan REN (PhD)

SUPERVISORS Xiaojun Zhang, Zhoulin Ruan (XJTLU)
Marco Paoli (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

In the past decade, Chinese comedy films have flourished, achieving both fame and fortune with consistently high box office returns. However, their English translation has long been criticized for its failing to evoke respective responses from English-speaking audiences. Dore argues that compared to literary translation, subtitle translation falls short in capturing the humorous effect. To further explore the inherent causal factors in comedy films, wordplay is a frequently employed technique in films to stimulate laughter whose inclusion with humorous plotlines helps to drive the development of the story. However, its special linguistic structure and pragmatic functions seems to exacerbate its untranslatability. Therefore, this presentation will present findings of research from the perspective of wordplay translation and examine its taxonomy and corresponding translation strategies, using films produced by Mahua FunAge(开心麻花) as cases to explore the classification and translation strategies that are conventionally used in Chinese comedy film.

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Use of social media, cross-cultural adaptation and "belt and road" common development

Yuan YAO (PhD)

SUPERVISORS Qingning Wang, Xiaoling Zhang (XJTLU)
Rosalynd Southern (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

The "Belt and Road" initiative refers to the use of the ancient Silk Road Economic Belt and the 21st World Maritime Silk Road as the basis for international cooperation to promote multiple areas of communication and common prosperity between China and the countries along the route and has become a practical path for intercultural communication (Liu & Dunford, 2016). 2020 Seventh Chinese Census showed that there are nearly 850,000 international populations in mainland China, of which 500,000 are international students, with more than 320,000 international students from countries along the "Belt and Road". The international student commonly faces the challenge of cross-cultural adaptation, and social media provides a multifaceted communication platform for their adaptation. However, existing research has focused mainly on the potential of social media use to help international students adapt to different environments(Forbush & Welles,2016). Comprehensive explanations of how social media can reduce stress and facilitate gradual adaptation are still largely lacking. Kim (2017) defines cross-cultural adaptation as the dynamic process through which individuals transition from experiencing stress in an unfamiliar environment to successfully adapting and growing together with the host country's society. In this context, this study aims to critically analyse relevant empirical studies, theoretical frameworks, and conceptual models. The study found that international students potentially use social media to escape the stress of adaptation rather than to reduce stress and achieve better adaptation to the local community. In addition, students from different countries have different attitudes towards the use of social media when dealing with stress, which warrants further research. The results of this study could help to understand how international students can achieve adaptation and develop in a mutually beneficial way with China.

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Housing preferences and consumption: Self-identity of the new middle class in Suzhou city proper

Yunman ZHANG (Master)

SUPERVISORS Lefeng Lin (XJTLU)

ACADEMY/SCHOOL School of Humanities and Social Sciences

Housing is a widespread global problem for the "new" middle class, especially in emerging countries. For the "new" middle class, the process of house choosing is a continuous effort to construct their self-identity. This study will take Suzhou City proper as an example to examine three main research questions: What housing choice does the "new" middle class make for living in Suzhou City proper? What factors influence the housing choices of the "new" middle class in Suzhou City proper? How does housing consumption assist the "new" middle class in establishing their sense of identity in Suzhou City proper? It will adopt semi-structured interviews to collect data from six districts and use textual analysis. The potential conclusion for this project is that most of them prefer to live a middle-class life by owning an ordinary housing.

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Gallery films in contemporary China: Intersections between contemporary art and film

Zitong ZHU (PhD)

SUPERVISORS Laura Sava, Xiaoling Zhang (XJTLU)
Angela Becher (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

This study investigates the growing intersection of contemporary art and film, focusing on the phenomenon of artists exhibiting 'gallery films' in art spaces. This phenomenon has attracted significant critical attention in the Western context, but academic scholarship on the Chinese manifestations of this trend remains limited. The existing scholarship centers on established artists such as Yang Fudong and Cao Fei (Becher, 2021; Berry, 2014, Berry, 2015), disregarding the emerging artists who produce gallery films in China. The dissertation seeks to spotlight the contribution of younger Chinese artists to this genre, delving into the dynamic between the younger and older generation and the differences and similarities between their artistic practice. The gallery films of Yang Di will constitute one of the case studies. Following an overview of the doctoral project, I analyse Yang Di's gallery film Black Mirror, which I recently curated as part of the exhibition 'Flection Intersection'.

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BUB1B plays an important role in Aflatoxin B1-Induced Hepatocellular Carcinoma

Hayam Hamdy MOHAMMED FARGHALY (PhD)

SUPERVISORS Qizhan Liu

UNIVERSITY/INSTITUTE Nanjing Medical University / School of Public Health

Background: Aflatoxin B1 (AFB1) is increasingly linked to cancer development. Hepatocellular carcinoma (HCC) is a globally prevalent malignancy known for its rapid progression, metastatic tendencies, and recurrence risk. The aim is to clarify the role of BUB1B in HCC progression and the mechanisms influenced by AFB1. Methods: We analyzed publicly available databases to investigate expression, correlation, prognosis, and pathway of BUB1B in liver cancer. AFB1-transformed L-02 cells were subjected to western blotting, immunofluorescence, CCK-8, colony formation, EdU, and transwell assays to assess BUB1B expression, cell growth, and metastatic potential. Results: BUB1B was significantly elevated in HCC tissues and correlated with stemness, epithelial-mesenchymal transition (EMT), and decreased survival rates in HCC patients. Genes associated with BUB1B were enriched in cell cycle pathways. AFB1 exposure induced cellular changes, disrupted cell cycle, promoted cell growth, and increased BUB1B expression. In conclusion: AFB1 may contribute to HCC progression by affecting BUB1B expression and associated processes.

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Life cycle assessment and techno-economic analysis of green & low-carbon ethanol pathways

Lingyun ZHANG (PhD)

SUPERVISORS Chengheng Pang , Kien Woh KOW
(UNNC: University of Nottingham Ningbo China)
Wei Wei
(SARI: Shanghai Advanced Research Institute, Chinese Academy Sciences)
Edward Lester (UoN: University of Nottingham)

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China /
Faculty of Science and Engineering

Conversion of low-value tail-gas from industries into ethanol (TG-ethanol) was a promising cutting-edge route for value-added utilisation of tail-gas. In this work, this technology's TEA and environmental footprint are systematically evaluated by life cycle assessment (LCA) and compared with its competitors. Results show that TG-ethanol is the most environmentally benign option, whose environmental impact value is 22%-25% lower than that of the Corn-ethanol and Coal-ethanol. To address the low carbon efficiency of TG-ethanol, we proposed an upgraded technology of TG-ethanol coupled with Electro-catalytic CO2 reduction (ECR), The results show a maximum carbon efficiency potential ranging from 36% to 82% and the minimum ethanol selling price is estimated to be less than 458 £/t with about a 50% probability for different cases. Importantly, this "waste-to-fuel" technology has abundant sources of feedstocks and can be extended to multiple industries with low cost and environmentally friendly.

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Three-way catalysts with low-concentration precious metals for natural gas vehicles (NGVs)

Run PAN (PhD)

SUPERVISORS Jun He

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / Faculty of Science and Engineering

Pd@CeO2/Al2O3 catalysts hold significant importance in practical applications, particularly in three-way catalysis. This study successfully synthesized uniform Pd@CeO2 and Pd@CeO2-OA core-shell nanospheres, along with Pd-CeO2 and Pd@CeO2-OA nanospheres without a core-shell structure, utilizing the salting-out effect method. The Pd@CeO2 and Pd-CeO2 nanoparticles were supported on Al2O3 through electrostatic attraction and supramolecular self-assembly methods. The influence of KBr in core-shell NP synthesis was thoroughly investigated, underlining its significance in achieving the desired structure. Analysis techniques, including FTIR, XRD, TEM, and BET, provided valuable insights into catalyst properties. Catalytic performance and water poisoning issues were explored. Notably, Pd@C/LA-S-500, prepared via supramolecular self-assembly and calcined at 500°C, exhibited exceptional catalytic activity and moisture resistance, with low T50 values for CH4, CO, and NOx (328°C, 219°C, and 470°C, respectively). Further investigations using XPS, H2-TPR, and CO-DRIFT shed light on the reaction mechanism.

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Soil metabolome impacts the formation of the eco-corona and adsorption processes on microplastic surfaces

Shi YAO (PhD)

SUPERVISORS Xin Jiang

UNIVERSITY/INSTITUTE Chinese Academy of Sciences / Institute of Soil Science

The eco-corona on microplastics refers to the initial layer of biomolecular compounds adsorbed to the surface after environmental exposure. The formation and composition of the eco-corona in soils have attracted relatively little attention; however, the eco-corona has important implications for the fate and impacts of microplastics and co-occurring chemical contaminants. Here, it was demonstrated that the formation of the eco-corona on polyethylene microplastics exposed to water-extractable soil metabolites (WESMs) occurs quite rapidly via two pathways: direct adsorption of metabolites on microplastics and bridging interactions mediated by macromolecules. The main eco-corona components were common across all soils and microplastics tested and were identified as lipids and lipid-like molecules, phenylpropanoids and polyketides, nucleosides, nucleotides and their analogs. WESMs were found to reduce the adsorption of co-occurring organic contaminants to microplastics by two pathways: reduced adsorption to the eco-corona surface andco-solubilization in the surrounding water. These impacts from the eco-corona and the soil metabolome should be considered within fate and risk assessments of microplastics and co-occurring contaminants.

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Sources, transport, variations, distributions and toxicity of Atmospheric Microplastics in Ningbo, China

Taiseer Hussain NAFEA (PhD)

SUPERVISORS Jun He

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / Faculty of Science and Engineering

Microplastics (MPs < 5mm) are highlighted for their ubiquity in almost every environment. Their presence in the aquatic and soil environments is well recognized. However, atmospheric MPs are given very little attention. MPs are identified in almost every part of the biosphere thereby forming a MPs contamination cycle, posing threat to the environment. Due to their small size and low density, airborne MPs can remain suspended for a very long durations and can travel long distance from their origin. MP abundance depends on many factors including population density, local sources, meteorological conditions, weather as well as topography. Currently the observations on MPs variations does not have a common trend/relationship. In this research we study the abundance and variations of MP in Ningbo city. MP variations with population density and rainfall is studied. Results show that higher population density leads to higher MP abundance suggesting local sources contribute significantly.

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How to promote public continuous participation in carbon generalized system of preferences? Dual-path motivating mechanism from the perspective of mental accounting

Ting XU (PhD)

SUPERVISORS Lingyun Mi

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Economics and Management

The Carbon Generalized System of Preferences (CGSP) is a voluntary carbon emissions reduction initiative by the Chinese government. It measures individuals' carbon reductions from their low-carbon behavior and converts them into carbon currencies for redeeming goods and services. We established a dual-path motivation model by integrating concepts from behavioral economics and environmental psychology to encourage public continuous engagement in the CGSP. Two investigations using experimental and empirical methods were conducted to validate the model. The results indicate that carbon currencies are allocated into three mental accountings. Carbon currencies in functional mental accounting are primarily utilized for practical commodity exchange, while carbon currencies in emotional accounting are typically directed toward hedonic commodities, and those in social accounting are inclined towards exchanging for public welfare commodities. Furthermore, the exchange of public welfare commodities significantly enhances public perceived value and further stimulates low-carbon behaviors. Practical reference for policymakers and countries worldwide are discussed.

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Unveiling the nexus of institutional pressure on pro-environmental behavior and environmental performance amidst organizational silence

Usama USMAN (PhD)

SUPERVISORS Xueyan Yang

UNIVERSITY/INSTITUTE Xi'an Jiaotong University / School of Public Policy and Administration

By concentrating on the strength of institutional pressure, this study broadens our understanding of resolving the problem of environmental policy performance in public organizations. The impact of institutional pressure from elected board members on public managers' behavior and environmental performance are both examined in this study. The study also looks at how organizations' silence effects pro-environmental behavior. A sample of public managers from Pakistan's National Energy Efficiency and Conservation Authority and Ministry of Climate Change were surveyed to gather data. The formation of pro-environmental behavior and environmental performance are positively and scientifically influenced by institutional pressure. Pro-environmental behavior has significantly mediated the association. The findings provide an important factor of organizational silence which negatively affects the development of pro-environmental behavior. It is suggested that organizations should use institutional pressure to develop positive and policy implementing bog their employees to enhance environmental policy performance.

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Potential threat of heavy metals in rice-fishery co-culture systems

Yimin ZHOU (PhD)

SUPERVISORS Ming Lei

UNIVERSITY/INSTITUTE Hunan Agricultural University / College of Environment and Ecology

Bibliometric analysis revealed a shift in research focus within rice-fishery co-culture, moving from yield and ecological benefits to a concern for heavy metal pollution and risk assessment. To investigate further, we surveyed some demonstration bases in Hunan Province, analyzing soil and rice heavy metal pollution. Results showed average soil As and Cd levels of (31.23±6.67) and (0.69±0.21) mg · kg-1, highlighting heavy metal threats to rice-fishery co-culture systems. Brown rice from this system exhibited higher As and Cd levels compared to monoculture ($p>0.05$), suggesting aquatic animal activity contributes to metal accumulation. In lab experiments, we explored key factors behind heavy metal activation due to bioturbation by carp and loach. Findings demonstrated that bioturbation can alter metal distribution in sediments, release metals into water, and modify their chemical forms. This research underscores the emerging concern over heavy metal pollution in rice-fish co-culture systems.

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The effects of China's supporting policy for resource-exhausted cities on local energy efficiency: An empirical study based on 284 cities in China

Yiwen PENG (PhD)

SUPERVISORS Weihua Yu

UNIVERSITY/INSTITUTE Xi'an Jiaotong University / Jinhe Center for Economic Research

In China, the economic transition and industrial restructuring of resource-based cities is one of the high-priority tasks in sustainable economic development. As the State Council issues successive lists of resource-exhausted cities, the government provides substantial support to these cities. This study utilizes a difference-in-difference (DID) model and data on 284 cities in China from 2004 to 2016 to analyze the influence of the supporting policy on energy efficiency. According to our analysis, the supporting policy for resource-exhausted cities has significantly improved energy efficiency. Specifically, compared with the non-resource-exhausted cities, the energy efficiency of the resource-exhausted cities has risen by 0.0145. Then the preliminary regression results are verified by robustness tests and heterogeneity tests. The further mechanism analysis indicates that the reduction of resource dependence accounts for the improvement of energy efficiency over the sample period. Finally, research conclusions and policy implications are provided for achieving the sustainable development of resource-exhausted regions.

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Larger seed size shows less germination and seedling growth decline caused by seed ageing under NaCO3 Stress in Leymus chinensis

Yunna AO (PhD)

SUPERVISORS Junfeng Wang

UNIVERSITY/INSTITUTE Northeast Normal University / School of Life Science

Understanding of seed germination in sodic soils is needed to accelerate the restoration process in degraded saline - sodic grassland. The objective of this study was to determine the influence of seed age (2 vs. 6 yr) and seed size (small vs. large) on seed germination and seedling growth in sodic grasslands. Older seeds (6 vs. 2 yr) reduced seed germination by 29%, germination potential by 36%, and the seedling vigor index by 52%. Seed size (small vs. large) reduced seed germination by 18%, germination potential by 20%, and seedling vigor by 19%. Sodic salt stress (>10 mM Na 2 CO 3) decreased germination by 64%, germination potential by 68%, and seedling vigor index by 33%. Sodic salt stress decreases in seed germination and seedling vigor increased with seed age. These findings suggest that younger and large seeds are preferable for restoration efforts in sodic soils. Thus, in regions where the soil has a high level of sodicity, we suggest that large seeds be selected and stored only for a short period of time for seeding. Core Ideas Germination of a 6 - yr - old seed lot was reduced by seed ageing compared with a 2 - yr - old seed lot. Light sodic salt stress increased seed germination, whereas heavy stress markedly inhibited germination and the seedling vigor index. Larger seed size partially offset reductions in germination and the seedling vigor index, especially in high sodic salt stress conditions.

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Experimental and numerical study on CO2 absorption and mass transfer enhanced by compact multi-flow spray and packed tower

Zhenzhen ZHANG (PhD)

SUPERVISORS Fang Liu

UNIVERSITY/INSTITUTE China University of Mining and Technology / School of Low-Carbon Energy and Power Engineering

In this research article, orthogonal experiments were performed in a proposed compact multi-flow spray and packed tower system to evaluate the importance of operating parameters and analyzed the relationship between factors and the mass transfer evaluation indices。Two different flow methods such as parallel flow and counter flow method were discussed for performance comparison. Optimal operating conditions for different evaluation indices were obtained by using range analysis. The effects of different operating parameters on the CO2 removal rate and overall absorption rate were also discussed by using trend analysis. The comparison with the reported conventional reactor system shows that atomization on the basis of filler can reduce the size of the absorber, the operating cost, and improve the efficiency of CO2 capture, which has great application potential. Finally, simulation results show that the multi-flow absorber coupled with spray and packing can improve the CO2 absorption performance.

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Research on the exchange of bioaerosols between terrestrial ecosystems

Baifeng ZHU (PhD)

SUPERVISORS Peng Zhao, Bailiang Li (XJTLU)
Andrew Morse (UoL)

ACADEMY/SCHOOL School of Science

Bioaerosols, consisting of airborne biological particles like bacteria, fungi, and pollen, have garnered significant attention for their potential impacts on the whole environment and human health. However, there needs a comprehensive analysis and understanding of the variability and origin of bioaerosol particles. This study conducts real-time particle monitoring using the Wideband Integrated Bioaerosol Sensor (WIBS) instrument at specific sites. Three research components are identifying and characterising bioaerosol particles, variability study of their composition and concentration, and traceability study of their sources. Possible preliminary results demonstrate notable variations in the composition and concentration of bioaerosols across different meteorological conditions, air quality, etc. A trajectory model was developed based on previous characterisations to find emission points with significant contributions. Furthermore, these observations suggest a potential exchange pattern of bioaerosols between different ecosystems.The study provides insights into the sources and transport of bioaerosols and contributes to a better understanding of their impact on air quality and climate. Further analysis is needed to fully understand the exchange of bioaerosols between terrestrial ecosystems and the atmosphere.

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A millimeter scale perturbation to leaf litter enhances methane emission across the soil-water interfaces

Hao LIU (PhD)

SUPERVISORS Zheng Chen (XJTLU)
Roy Goodacre (UoL)

ACADEMY/SCHOOL School of Science

Wetlands and rice paddies contribute approximately one-third of total methane emissions, with submerged sediments and soils acting as substantial reservoirs of organic carbon. Investigating the dynamics of organic matter in these environments is essential for advancing our understanding of the global carbon cycle. In this study, we developed a mesoscale model using soil-water interfaces to examine how methane emission from these systems might be altered by organic inputs and physical disturbances. Prior research discovered that a ten-millimeter perturbation to the leaf litter at soil-water interfaces significantly amplifies methane emission. To clarify this positive priming effect, we profiled water chemistry, redox potential, and microbial communities as the processes evolved. A few millimeters do matter. Our research highlights the potential underestimation of physical processes in modifying methane emission in submerged environments. Currently, we are exploring other physical interventions on organic carbon, such as the placement of a plastic film at the soil-water interface. This film shows a capacitor-like effect on carbon dioxide, which is believed to be predominantly physical due to the artificial material's persistence. However, the decline in methane fluxes remains inadequately explained by known mechanisms, leading to development of new hypotheses and the consideration of light-driven processes.

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What are herders' attitudes toward grassland replanting on the Qinghai-Tibetan Plateau?

Huxuan DAI (PhD)

SUPERVISORS Li Li, Johannes Knops (XJTLU)
Mark Riley (UoL)
Zhi Lyu (PKU: Peking University)

ACADEMY/SCHOOL School of Science

Ecosystem restoration practices are gaining prominence in coping with the crisis of ecosystem degradation. To improve the long-term effectiveness of restoration activities, community engagement in restoration projects needs to be strengthened. In communities where traditional and local values drive adaptation to environmental changes, a community-engaged restoration approach requires the integration of restoration techniques and local value systems. In two pastoral communities on the Qinghai-Tibetan Plateau, we used Q method to explore pastoralists' attitudes towards grassland degradation and restoration and to understand different levels of community engagement in grassland restoration activities. The study revealed eight types of pastoralists with different attitudes, with the type of Active Agents leverages transformative restoration action through creating value-inclusive narratives of grassland restoration. We disclosed the pastoralists' perspectives of biodiversity in restoration and the importance of local leadership in facilitating multiple-actor cooperation in restoration projects. Lastly, policy implications for promoting community engagement in ecosystem restoration projects were discussed.

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Does a burrowing rodent, plateau zokor, decreases livestock forage?

Jiahuan NIU (PhD)

SUPERVISORS Johannes Knops, Li Li, Lingyun Xiao (XJTLU)
Kate Parr (UoL)

ACADEMY/SCHOOL School of Science

Plateau zokors (Eospalax baileyi) are small burrowing mammals common in Tibetan alpine meadows. Zokors are regarded as a pest because of soil disturbance and reduced palatable forage for yak and sheep. Therefore, there are large zokor eradication programs conducted in China. In May 2021, Henan local government (Qinghai Province, China) held their annual rodent control campaign, eliminating approximately 67,000 zokors. We established control areas with no eradication and eradicated areas in 17 pair of fields, over 3 years, examined vegetation dynamics. The original zokor density was 20.2 per hectare, on average 71% of the original population were killed. The bare soil patches caused by zokor mounds average 3.7 % cover. However, there was no significant effect of zokor eradication on vegetation biomass, nor functional composition in any year. Thus, we found no impact of zokor eradication on livestock forage and zokor eradication efforts should be reevaluated.

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Constant stress layer characteristics in simulated stratified air flows: Implications for Aeolian transport

Lukas Florian MELDAU (PhD)

SUPERVISORS Bailiang Li (XJTLU)
James Cooper (UoL)

ACADEMY/SCHOOL School of Science

Varying thermal atmospheric stability conditions and their effects on shearing flows has long been a subject of interest for researchers working in atmospheric science. In the presented study, we use a laser Doppler anemometer within the Trent Environmental Wind Tunnel Laboratory to investigate the influence of thermal stratification on the constant stress layer. Analyses of the thermal stratification represented by the gradient Richardson number and the apparent von Kármán parameter, shear velocity, and the slope of the streamwise velocity profiles reveal strong linear relationships. An exponential relationship between thermal stability and the apparent roughness length is also revealed. Profiles of the streamwise and vertical velocity and turbulence intensity, as well as the dimensionless Reynolds stress, are influenced by the gradient Richardson number. These findings have implications for producing accurate models of sediment entrainment and transport by wind in non-neutral conditions.

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Interface exchange and health assessment of endocrine disruptors in atmosphere and surface water in Suzhou, China

Minhao WANG (PhD)

SUPERVISORS Lei Han, Bailiang Li, Peng Zhao (XJTLU)
Haifei Zhang (UoL)

ACADEMY/SCHOOL Design School

Endocrine disruptors are widely present in the environment and are defined as a subset of endocrine disruptors due to the biological activity of environmental estrogens (exogenous estrogens). Many environmental estrogens have been shown to have various toxic effects, especially cytotoxicity and organ toxicity. This study evaluates the interface exchange process of chosen xenoestrogens and their health risks caused by non-dietary exposure in adults. The results showed significant differences in the air-water exchange direction of different exogenous estrogens. Furthermore, the non-dietary intake and carcinogenic risks of six environmental estrogens in atmospheric fine particulate matter are acceptable. This result provides a comprehensive knowledge of the pollution profile and environmental risks of environmental estrogen in the Taihu Lake Basin. It promotes the optimization and implementation of environmental estrogen management policies.

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Top predator as conservation tools: The effectiveness of surrogate for protecting sympatric species

Peiyun LI (PhD)

SUPERVISORS Lingyun Xiao, Yi Zou, Johannes Knops (XJTLU)
Jakob Bro-Jorgensen (UoL)
Zhi Lyu (PKU: Peking University)

ACADEMY/SCHOOL School of Science

Prioritizing conservation funds and efforts towards charismatic umbrella species as surrogates for sympatric species protection is a common practice in many regions of the world. However, the practical value of surrogate species conservation is rarely evaluated quantitatively based on species-specific environment requirements at an appropriate spatial scale. Our research focused on snow leopards (Panthera uncia) to investigate the different habitat requirements of each mammal species and tried to understand whether snow leopard habitat protection would benefit the overall mammal richness. We found that the enhancement of habitat quality for snow leopards would have limited benefit for the entire mammal community but provide some benefit for endemic species. Our research sheds light on other regions where most conservation resources went to a few flagship species. A conservation strategy of selecting multiple surrogate species based on their habitat similarity to other species should be recommended as showcased in this study.

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Direct and indirect effects of environmental factors and food resources on breeding fitness of an avian species across an urban landscape

Sihao CHEN (PhD)

SUPERVISORS Eben Goodale (XJTLU)
Samantha Patrick (UoL)
Emilio Pagani-Núñez (Edinburgh Napier University)

ACADEMY/SCHOOL School of Science

Human disturbances, such as land-use change, urban heat island, noise pollution and artificial light at night are often considered uniformly negative influences on wildlife in urban areas. However, few studies evaluated how the effects of these disturbances (i.e., environmental factors) on avian species vary in direction and magnitude. Here, we assessed the direct and indirect effects of these environmental factors on the breeding fitness of the Barn Swallow Hirundo rustica in Suzhou China. Structural equation modelling results indicated that the urban heat island effect directly advanced laying date. Land-use change and artificial light negatively effected food resources. But because more food resources delayed laying dates, these factors indirectly advanced laying dates. We also found a negative direct effect of artificial light at night on the number of fledglings. Our results demonstrate how interrelated components of an urban landscape can vary and produce mixed effects on biodiversity.

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Exploration of the interactions between Se and Cd in plants based on Se speciation perspective

Wenyao SHI (PhD)

SUPERVISORS Linxi Yuan (XJTLU)
Roy Goodacre (UoL)

ACADEMY/SCHOOL School of Science

In China, Se-rich soil often contain high concentrations of Cd. Studies have been conducted to evaluate the detoxifying effects of selenium on cadmium and to assess the potential health risks associated with these two elements. This study aimed to scrutinize the interactive effects between diverse Se species and Cd. Therefore to deepen understanding of the health and environmental implications of these elements. While Different plants exhibit diverse tolerance and responses to Se and Cd, either enhancing growth or exhibiting stress/toxicity. A. Indirect interaction: Selenium (Se) species like Se4+, Se6+, nano Se, and SeMet can indirectly interact to detoxify cadmium (Cd) in plants, thereby improving antioxidative systems and mitigating oxidative stress. B. Direct interaction: Direct Se-Cd interaction might form CdSe/CdSeO3 within plant root systems. Evidence of Se-Cd interactions exists, but the mechanisms between organic Se, Cd, and chelates in plants need further exploration to understand absorption and transformation pathways.

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Exploring the selenium compositions and bacterial activities in environmental matrix from selenium-mine seepage area, Yutangba, Enshi, China

Yidan WANG (PhD)

SUPERVISORS Linxi Yuan, Sekar Raju (XJTLU)
Roy Goodacre (UoL)

ACADEMY/SCHOOL School of Science

Enshi, Hubei Province, China, known as the "world capital of selenium (Se)," witnessed a Se poisoning incident in 1963 at Yutangba. Previous research mainly concentrated on Se migration in the soil-plant system, neglecting the role of the environmental matrix in Yutangba. In this study, we comprehensively investigated Se in seepage water, surface sediments, and bacterial activities. Seepage water from Stream-1, Stream-2, and Stream-3 had average Se concentrations of 24.28 μg L-1, 49.83 μg L-1, and 8786.08 μg L-1, respectively, significantly exceeding the WHO's recommended 10 μg L-1 for drinking water. Surface sediments contained 260.42 mg/kg DW in Stream-1, 32 mg/kg DW in Stream-2, and 118.9 mg/kg DW in Stream-3, surpassing Se-rich areas globally. Bacterial activities correlated with seepage system biomineralization, implying specific microorganisms' involvement in Se geochemical cycles. This research offers perspectives on the Se biogeochemical cycle in high Se ecosystems, providing valuable insights to prevent future local selenosis.

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High performance IPMC Actuator based on novel 2D electrical-conductive MOF composites

Yingyi WANG (PhD)

SUPERVISORS Sujie Qin (XJTLU)
Yaochun Shen (UoL)

ACADEMY/SCHOOL School of Science

Existing ionic artificial muscles still require a technology breakthrough for much faster response speed, higher bending strain, and longer durability. Here, we report an artificial muscle based on 2D MOF, Zn-CAT, with poly(3,4 ethylenedioxythiophene)-poly(styrenesulfonate), showing ultrafast rise time of within 1.5 s in DC responses, extremely large bending strain up to 1.22% in very low input voltage regime (0.1 to 3V), long-term cyclic stability of 97% up to 10,000 cycles, markedly reduced phase delay, and very broad frequency bandwidth up to 20 Hz with good structural reliability without delamination under continuous electrical stimuli. These successful demonstrations elucidate the wide potential of MXene-based soft actuators for the next-generation soft robotic devices including wearable electronics and artificial muscles.

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Thrive in the city: Increasing competition between passerines and related species along transformation gradients

Yu ZENG (PhD)

SUPERVISORS Yi Zou (XJTLU)
Samantha Pattrick, Kate Parr (UoL)

ACADEMY/SCHOOL School of Science

Human-driven habitat transformation has become a dominant force shaping biodiversity patterns and ecosystem dynamics across the globe in the last couple of centuries and usually causing the loose of habitat for wildlife. Moreover, specialists are substituted by generalists along the transformation gradients resulting in sever biotic homogenization in transformed habitat. According to the niche theory, more intense competition would be expected between species if they are more similar and it would be expected to enhance the competition by low habitat productivity. In this study, we conducted a two year-round experiment, using transect method to record the behaviors and analyze the niche structure adopting birds as model to study how the competition behaviors shifted along transformation gradients in 30 sites in Suzhou, China. Results showed that, competition between avian communities increased along transformation gradients with constrained habitats and clustered niche structure, demonstrating the negative effect of transformed habitat on wildlife.

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Interactions of Se and Sb in plant are Se-Sb molar ratio-dependent rather than dose-dependent

Yuhua DUAN (PhD)

SUPERVISORS Linxi Yuan (XJTLU)
Roy Goodacre (UoL)

ACADEMY/SCHOOL School of Science

Antagonism between selenium (Se) and antimony (Sb) has been demonstrated in rice and maize spices whereas a mutual suppression pattern for Se and Sb has not been identified. Therefore, we studied and concluded that the application of exogenous Se reduced the uptake and transport of Sb, and conversely exogenous Sb promoted Se absorption. When the R(Sb/Se)≈1, the changes in Sb/Se concentrations, transfer factors and physiological levels reached the lowest values simultaneously. In addition, Se supply could effectively alleviate the toxicity of high Sb level at R (Sb/Se)>10 in all physical parameters. This study is the first report of a mutual effect of Se and Sb in their accumulation and translocation depends on R(Sb/Se) rather than their individual doses, which might be related to the formation of soluble Sb-Se complexes in roots and shoots. This study contributed to the remediation and treatment of combined Se and Sb pollution in farmland systems.

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Soil quality, microbial community composition and function of artificial restored grassland in different restoration years on the Qinghai-Tibet Plateau are difficult to return to the state of natural non-degraded alpine meadow

Ziao LIU (PhD)

SUPERVISORS Li Li, Zheng Chen (XJTLU)
Raj Whitlock (UoL)

ACADEMY/SCHOOL School of Science

The rapid and large-scale degradation of Tibetan alpine meadows has severe ecological and socio-economic implications. In order to restore the ecological function of degraded grassland, large-scale grassland conservation and restoration projects have been implemented. The evaluation of the effect of grassland restoration can be carried out from various angles. This study evaluate the effect of grassland restoration by comparing the soil quality, soil microbial community composition and functions in different restoration years with that of the extreme degraded grassland and non-degraded grassland. Based on my results, the restoration effect deteriorates with the increase of repair years, and no matter what the repair stage, it can not be restored to the natural state of non-degradation grassland.

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Potential reactive oxygen species driven methane production at the soil-water interfaces

Ziyan LIU (PhD)

SUPERVISORS Zheng Chen (XJTLU)
Haifei Zhang (UoL)

ACADEMY/SCHOOL School of Science

Methane is a potent greenhouse gas that contributes to roughly 30% of global warming. Wetlands are the largest natural sources of methane and account for about one-third of total methane emission. Therefore, understanding the processes that form methane in the wetlands is of growing environmental significance. It has been known for long that methane is strictly formed under anaerobic condition by a specific group of Archaea. However some recent evidences show that oxic methane production exists, and a pathway driven by reactive oxygen species(ROS) has been reported. In this project, it is hypothesized that ROS-driven methane formation occurs in submerged environments where both ROS and organosulfur compounds are present. In the microcosm experiments, ROS formation was confirmed after the sediments and paddy soils incubated anaerobicly was exposed to oxygen. In the meanwhile, potential ROS-driven methane formation was observed. However, this finding needs to be further validated with new experiment design and method development.

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Exploring pandemic response in China: A systematic analysis of policy dynamics and state-society relationship

Alessia ORAZZO (PhD)

SUPERVISORS Alessandra Cappelletti (XJTLU)
David Dolowitz (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

In continuity with previous studies on the pluralisation and "fragmentation" of the Chinese political system, this project holds that the recent development of the PRC's pandemic governance is having far reaching consequences that go beyond the healthcare sector, contributing to a redefinition of the dynamics taking place among the different administrative levels of the State and between the State and the population. More specifically, the analysis of the Chinese pandemic response at a local level could help us understand and appreciate the complexity of the country's political system, and whether the State/Party's political interests can be influenced by a bottom-up process (or even by citizens' actions and behaviour).

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Responding to regional security threats in Southern Africa: The case of Cabo Delgado

Ayodele Stephen OWOLABI (PhD)

SUPERVISORS Debora Malito (XJTLU)
Obert Hodzi, David Dolowitz (UoL)

ACADEMY/SCHOOL School of Humanities and Social Sciences

Studies investigating SADC's role in security management often highlight institutional incapacity and member states' lack of political will as major challenges undermining its effectiveness. However, the existing literature often overlooks the correlation between these challenges and the centrality of regional powers' roles in regional security management. Based on the proposition that regional powers' supporting role is pivotal to the effectiveness of ROs, this paper analyses why SADC failed to achieve a timely response to the Cabo Delgado insurgency in Mozambique. Based on desk and field research data, the paper argues that SADC's efforts toward a regional response were undermined by the limits of its security architecture, which the Mozambican government exploited, and because of South Africa's reluctance to support a regional intervention. The paper also argues that, independently, SADC does not have the capacity to effectively manage regional security threats, except a non-reluctant South Africa supports its efforts.

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Trans-Himalayan multi-dimensional connectivity network: Connecting China with South Asia

Bidhur DHAKAL (PhD)

SUPERVISORS Sergey Biryukov

UNIVERSITY/INSTITUTE East China Normal University /
School of Politics and International Relations

Two emerging economies of the world bordering each other by the Himalayas; China and India have huge potential for diverse markets. BCIMEC, which was announced by China and India during Premier Li Keqiang's visit to India in May 2013, was put on hold because of the Indian Reservation on the BRI. Nepal-China Trans-Himalayan Multi-dimensional Connectivity Network, including the Nepal-China cross-border railway incorporated by the Leaders' Roundtable of the 2nd Belt and Road Forum for International Cooperation, will aid in closing this gap. On the one side, the CPEC will provide access to another sizable market while also connecting a portion of South Asia via Pakistan and the Trans-Himalayan corridor to other portions. China's 14th five-year plan aims to transform Tibet as a passageway to South Asia. With available secondary data and primary sources this paper examines the prospects, opportunities, and challenges of Trans-Himalayan connectivity under the framework of BRI.

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Public diplomacy of Vietnam in the 21st Century: An approach of a socialist non-major power

Le Ngoc THAO NGUYEN (PhD)

SUPERVISORS Tracey Fallon

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China /
School of International Studies

Contemporary public diplomacy (PD hereafter) was introduced in the Cold War and gained popularity in American hegemonic period, yet fundamental changes in the 21st century have brought the US-centric crisis-driven and policy-oriented PD under scrutiny, including the need to bring more voices with their own peculiarities to compensate the domination of the US experience. Against this backdrop, this thesis provides an in-depth research into Vietnam's PD between 2011 and 2021 exploring its characteristics and examining potential accounts for its PD strategy formation. Using constructivism as the theoretical framework, the research seeks to find out how the complex confluence of Vietnam's national identities, being socialist, post-colonial, and emerging power, shape Vietnam's PD. The thesis follows qualitative approach where data is drawn from policy papers, elite discourses, news content, and semi-structured interviews with Vietnamese PD practitioners. The data is then congruent by thematic analysis to meet the research objectives.

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Navigating limited nuclear war scenarios: Risks, deterrence, and complex decision-making

Md Arifur RAHMAN (PhD)

SUPERVISORS Jun Liu

UNIVERSITY/INSTITUTE East China Normal University / School of Politics and International Relations

In current geopolitics, the notion of limited nuclear war (LNW) employing low-yield nuclear weapons is a challenging and high-risk scenario. The present discussion looks into the factors that influence the choice of initiating LNW, the risks of escalation, and the potential results in various circumstances. Key considerations include the definition of low-yield weapons, the strategic objectives of involved states, and the challenges in distinguishing between low-yield and high-yield nuclear weapons in the heat of conflict. The use of LNW raises serious concerns about inadvertent escalation and highlights the crucial need of diplomacy, effective communication, and conflict avoidance measures in nuclear deterrence.

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Assessing energy justice in China's sustainable energy transition: A political ecology approach

Siyu YU (PhD)

SUPERVISORS Maria Julia Trombetta

UNIVERSITY/INSTITUTE University of Nottingham Ningbo China / School of International Studies

The introduction of a political ecology perspective is necessary to scrutinize power dynamics in the ongoing global sustainable energy transition. The main objective of this project is to understand how power relations shape sustainable energy transition knowledge, energy governance, and policy outcomes in China's sustainable energy transition through a political ecology lens. This project uses a comparative approach to examine how the three dominant power approaches in political ecology – poststructuralist, Neo-Marxist, and actor-oriented approaches – can be applied to the empirical case of China's sustainable energy transition, in order to explore how these approaches can complement each other to present multiple dimensions of power relations in a political ecological problem. The analysis of power dynamics in China's energy policy formulation and implementation also brings some energy justice insights.

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EU's digital public diplomacy in China during the Covid-19 pandemic

Xiangdong CHEN (PhD)

SUPERVISORS Alessandra Cappelletti, Ji You (XJTLU)
Ekaterina Balabanova (UoL)
Evangelos Fanoulis (External)

ACADEMY/SCHOOL School of Humanities and Social Sciences

The COVID-19 pandemic has brought digital public diplomacy (DPD) to the forefront of academic and practitioner interest, given the digitalization of diplomatic activities. The existing literature, however, continue to concentrate on the results of DPD, generated knowledge for practitioners only. This thesis view DPD as a power-laden arena of information competition, which lead knowledge and hegemony construction, analyzing the EU's DPD activities towards China during the COVID-19 from a processual perspective. This chapter aims to establish the theoretical framework of this thesis. Guided by Michel Foucault's theoretical toolkits, particularly Foucauldian governmentality, this framework employs an archaeological and genealogical approach to problematize EU DPD. It then articulates poststructuralist discourse theory and psychoanalysis, providing approaches to explore the construction of inclusion and exclusion in drawing political boundaries during crises, and to examine how power becomes embedded in social relations through diverse governance techniques and the development of fantasies, which ultimately conceal the fundamental contingency of social relations and naturalize relations of domination.

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Tunable triboelectric pressure sensor based on PVA-PA hydrogel for holistic health monitoring

Bohan LU (PhD)

SUPERVISORS Yina Liu (XJTLU)
Yi Zhang (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

To reduce the risks of noncommunicable chronic diseases (NCDs), real-time and long-term monitoring capabilities are required for sensors in the Internet of Healthcare (IoH). However, the effects of Young's modulus variation in electrode materials on sensitivity enhancement and the widening of detection range have not been systematically investigated. In order to discover the effects on pressure sensor performance and customize the sensor according to its application, a tunable triboelectric pressure sensor based on PVA-PA hydrogel was fabricated. In this study, we adjust the Young's modulus of bottom electrode for controlling the sensing performance of triboelectric pressure sensor, realizing the sensitivity of 554 mV/kPa with low Young's modulus hydrogel, while the detection range of 650 kPa with high Young's modulus hydrogel. Furthermore, the COMSOL simulations are also conducted to clarify the effectiveness of this strategy. This strategy enabled the construction of pressure sensor systems for both pulse and plantar pressure monitoring using the same material type. As a result, whole-body health monitoring from small pulse to large foot pressure was achieved.

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A model for predicting default risk and judging quasi default state in financial bond market based on dual ensemble learning theory

Chongwen TIAN (PhD)

SUPERVISORS Rong Li, Yi Hong (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

There are mainly various default risks in the financial market. Financial bonds also have clear default risks, which can cause huge economic losses to investors. This study uses Stacking and Weighted Voting ensemble learning methods to evaluate financial bond default data. This article uses basis learners such as logistic regression, random forest, support vector machine, neural network, decision tree, KNN, Bayesian, GBDT, etc. The results indicate that the dual Stacking ensemble model composed of two consecutive uses of the Stacking algorithm has the highest prediction accuracy and the lowest over-fitting. At the same time, the Stacking algorithm expands the original two response variables to five. We can determine which bonds are in a quasi default state by comparing the data. These empirical research results can help investors better judge the default risk of a bond to reduce unnecessary losses.

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Stochastic mortality model with respect to mixed fractional Poisson process: calibration and empirical analysis of long-range dependence in actuarial valuation

Haoran JIANG (PhD)

SUPERVISORS Zhehao Zhang, Jia Zhai (XJTLU)
Corina Constantinescu (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

We propose a stochastic mortality process driven by the mixture of Brownian motion and modified fractional Poisson process to capture the long-range dependence (LRD) of mortality rates. The survival probability under this new stochastic mortality model keeps flexibility and consistency with existing affine-form mortality models, which makes the model convenient in evaluating mortality-linked products under the market-consistent method. The formula of survival probability also considers the historical information from survival data, which enables the model to capture past health records of policyholders. The LRD feature is reflected by our proposed model in the empirical analysis, which includes calibration and prediction of the survival curve based on recent generation data in Japan. Finally, the consequent empirical analysis of annuity pricing illustrates whether this feature is involved in actuarial valuation.

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Self-supervised learning of versatile multimodal representations from unlabeled videos

Jiahao QIN (PhD)

SUPERVISORS Lu Zong (XJTLU)

ACADEMY/SCHOOL School of Mathematics and Physics

Self-supervised learning from unlabeled multimodal data is a promising approach to obtain versatile representations without manual annotations. Here we introduce MultiModal Versatile (MMV) networks that learn from videos containing visual, audio, and text streams. We design the networks to embed modalities into a common vector space, enabling semantic comparison via dot products. The visual and audio spaces capture fine-grained details, whilst the text space is semantically coarse to reflect abstraction. Training uses a self-supervised contrastive loss that aligns positive multimodal pairs from the same video locations and pushes apart negative pairs. A novel deflation technique allows efficient adaptation of the video network to static images. Without using labels, MMV networks achieve state-of-the-art self-supervised performance on downstream tasks including UCF101, HMDB51, Kinetics600, ESC-50, and AudioSet. They also enable strong zero-shot text-video retrieval on MSRVTT and YouCook2. The simplicity yet strong performance demonstrates the power of leveraging readily available multimodal signals for versatile self-supervised learning without supervision. This work opens promising research directions in multimodal representation learning.

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Predicting Chinese bond risk premium with machine learning

Jiahui XI (PhD)

SUPERVISORS Conghua Wen, Lu Zong, Jia Zhai (XJTLU)

ACADEMY/SCHOOL School of Mathematics and Physics

This study investigates whether bond yield curve and macroeconomic factors have nonlinear relationships with bond risk premia in Chinese bond market. We apply machine learning approaches to forecast Chinese treasury bond one-year holding period excess returns. Our results show that bond yield curve has significant nonlinear predictive relationships with bond risk premia. We find evidence that "monetary policy" and "tax" macroeconomic groups have stronger nonlinear relationships with risk premia while"invest" macroeconomic factors matter more for bonds with longer maturities. This paper provides statistical evidence for significant relationship between expected bond risk premia and several economic drivers including range of forecast of GDP and bond volatility variables. We further document the economic values of our forecasting results by showing they can generate statistically higher certain equivalent values than those from the benchmark forecast.

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Integration of machine learning models in least squares Monte Carlo simulation method for accurate pricing of convertible bonds

Jiangshan ZHU (PhD)

SUPERVISORS Rong Li, Yi Hong (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

In this paper, we explore a novel model for pricing Chinese convertible bonds, which synergistically integrates machine learning techniques with the conventional model. Longstaff and Schwartz's (2001) least squares Monte Carlo method (LSM) has gained popularity in pricing convertible bonds due to its effectiveness in handling multiple state variables and complex path dependencies through simple regression analysis. In our approach, we integrate machine learning techniques, specifically Support Vector Regression (SVR) and Random Forest (RF), instead of the traditional simple regression within the LSM framework. This integration aims to improve precision and predictive capabilities in convertible bond pricing. Using simulated data and real data obtained from the Chinese convertible bond market respectively, the results have shown that our proposed model outperforms the classic LSM, which allows us to confirm its efficacy. The development of the pricing model incorporating machine learning techniques is particularly effective for the complex pricing system of Chinese convertible bonds. Our study contributes to adding to the body of knowledge on pricing convertible bonds and deepens the application of machine learning in the field in an integrated and supportive way.

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Economic scenario generation for bond yields in China with the Smith-Wilson method

Jiawei DU (PhD)

SUPERVISORS Yi Hong, Youzhou Zhou (XJTLU)
Yi Zhang (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

This study presents a novel model, known as the SW-PCVAR(1) model, to tackle the problem of bond yield scenario generation under given conditions. The proposed method combines the Smith-Wilson method, principal component analysis, and firstorder vector autoregressive models to generate bond yield scenarios with specified first and second-moment conditions at a future time point. By implementing this method, we conduct simulations of interest rate scenarios for Chinese government bonds at a weekly frequency from December 2009 to March 2023 under the specified moment conditions. The results demonstrate that our model achieves exceptional simulation performance, with an average absolute relative error of less than 2% compared to the targeting values. This study represents a pioneering effort in implementing interest rate scenario generation using the Smith-Wilson method, and its findings hold significant implications for insurance companies and other major financial institutions.

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Distortion-disentangled contrastive learning

Jinfeng WANG (PhD)

SUPERVISORS Jionglong Su, Jia Meng (XJTLU)
Xu Zhu (UoL)

ACADEMY/SCHOOL School of AI and Advanced Computing

Self-supervised learning is well known for its remarkable performance in representation learning and various downstream computer vision tasks. Recently, Positive-pair-Only Contrastive Learning (POCL) has achieved reliable performance without the need to construct positive-negative training sets. It reduces memory requirements by lessening the dependency on the batch size. The POCL method typically uses a single objective function to extract the distortion invariant representation (DIR), which describes the proximity of positive-pair representations affected by different distortions. This objective function implicitly enables the model to filter out or ignore the distortion variant representation (DVR) affected by different distortions. However, some recent studies have shown that proper use of DVR in contrastive can optimize the performance of models in some downstream domain-specific tasks. In addition, these POCL methods have been observed to be sensitive to augmentation strategies. To address these limitations, we propose a novel POCL framework named Distortion-Disentangled Contrastive Learning (DDCL) and a Distortion-Disentangled Loss (DDL). Our approach is the first to explicitly and adaptively disentangle and exploit the DVR inside the model and feature stream to improve the overall representation utilization efficiency, robustness, and representation ability. Experiments demonstrate our framework's superiority to Barlow Twins and Simsiam in terms of convergence, representation quality (Including transferability and generality), and robustness on several benchmark datasets.

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Firms fundamentals analysis based on copula entropy

Junwei WEI (PhD)

SUPERVISORS Conghua Wen, Chengxiu Ling (XJTLU)
Jinglai Li (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

Most existing studies for fundamental analysis of quarterly financial reports ignored the valid and expiration dates and the change of computational formula of financial statement items. Because of these neglects, are there predictive items of stock returns that might be identified as meaningless? And did the ability to predict returns of discovered factors diminish as the period of data becomes longer? To investigate these problems, we use the entropy of the copula function to measure the dependence of statement items and stock returns in every four quarters since 1991. We then construct models based on entropy to predict returns. Experimental results show that the dependence of financial items and returns changed over time, and the models based on entropy discover new predictive factors that were less mentioned before.

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Spatio-temporal joint modelling on moderate and extreme air pollution in Spain

Kai WANG (PhD)

SUPERVISORS Chengxiu Ling, Ying Chen (XJTLU)
Corina Constantinescu (UoL)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Very unhealthy air quality is connected with various diseases, necessitating appropriate extreme analysis and forecasting. This study models the spatial and temporal pattern of moderate and extremely poor PM10 concentrations in mainland Spain from 2017 to 2021. We first propose a series of Bayesian hierarchical extreme models of annual maxima PM10 concentrations, including the orographic, meteorological and artificial fixed effect, and the spatio-temporal random effect with the Stochastic Partial Differential Equation approach and a lag-one auto-regressive component. We bring the structure of the best-performing model to establish the joint Bayesian model of mean and maxima PM10 concentrations, revealing certain predictors (precipitation, vapour pressure and population density) influence comparably while the other predictors (altitude and temperature) impact reversely in the different scaled pollution. The excursion functions identify air quality hot spots, highlighting Madrid and northwestern and southern regions are at risk of severe pollution, simultaneously exceeding the warning risk threshold.

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Extreme limit theory of competing risks under power noralization

Kaihao HU (PhD)

SUPERVISORS Chengxiu Ling (XJTLU)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

Advanced science and technology provide a wealth of big data from different sources for extreme value analysis. Classical extreme value theory was extended to obtain an accelerated max-stable distribution family for modelling competing risk-based extreme data in Cao and Zhang (2021). In this paper, we establish probability models for power normalized maxima and minima from competing risks. The limit distributions consist of an extensional new accelerated max-stable and min-stable distribution family (termed as the accelerated p-max/p-min stable distribution), and its left-truncated version. The limit types of distributions are determined principally by the sample generating process and the interplay among the competing risks, which are illustrated by common examples. Further, the statistical inference concerning the maximum likelihood estimation and model diagnosis of this model was investigated. Numerical studies show first the efficient approximation of all limit scenarios as well as its comparable convergence rate in contrast with those under linear normalization, and then present the maximum likelihood estimation and diagnosis of accelerated p-max/p-min stable models for simulated data sets. Finally, two real datasets concerning annual maximum of ground level ozone and survival times of Stanford heart plant demonstrate the performance of our accelerated p-max and accelerated p-min stable models.

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Theoretical basis of the standard model: A unified theory based on division algebras

Liam GOURLAY (PhD)

SUPERVISORS Niels Gresnigt, Thijs Kouwenhoven (XJTLU)

ACADEMY/SCHOOL School of Mathematics and Physics

Using Cayley-Dickson algebras, an algebraic representation of three generations of fermions from the Standard Model can be generated that transform correctly under the strong force SU(3) symmetry. In particular, the sedenions can be used to expand a previous model that was able to get one generation of fermions from the octonions. Minimal ideals can be formed that represent one generation of fermions, this can then be expanded via the S3 automorphism. The left action of the complex sedenions allows the CL(6) algebra that represents one generation to be expanded to a CL (8) algebra. This current model has several interesting features but needs more work to correctly transform under the Standard Models U(1) symmetries.

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Interference mitigation in autonomous driving

Lulu LIU (PhD)

SUPERVISORS Fei Ma, Conghua Wen (XJTLU)
Linglong Yuan (UoL)
Yutao Yue (JITRI: Jiangsu Industrial Technology Research Insitute)

ACADEMY/SCHOOL School of Mathematics and Physics

Frequency modulated continuous wave (FMCW) is the most common wireless signal generated by vehicle radar. Target location and speed detection can be achieved by the beat frequency between the transmitted signal and the received signal. In fact, however, the received signal includes not only the target echo but also the noise and clutter. The noise generally comes from the thermal noise of the receiver, which can be approximated as additive white noise with Gaussian distribution. Although clutter is more difficult to filter out because it behaves like a target rather than a target of interest, such as reflections from rain, the ground, road signs, and plants. In addition, when there are multiple automotive radars operating in the same frequency band at close range, there may be harmful mutual interference with each other. Furthermore, with the application and popularization of millimetre-wave radar in autonomous driving, the bandwidth of 76-79 GHz on the road is obviously not sufficient to completely avoid the interference between radar signals. Noise, clutter and interference are crucial issues since they could increase the noise floor, decrease sensitivity and produce false detections. Nevertheless, traditional methods rely on prior knowledge of basic algorithms, handcrafted features, and distributions. These methods can hardly achieve a satisfactory result. Due to the rapid development of deep learning, this project aims to propose an effective method utilizing deep learning to suppress and mitigate the adverse effects caused by noise, clutter and interference.

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On term structure of government bond yields in China

Maochun XU (PhD)

SUPERVISORS Yi Hong (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

The study introduces a novel framework for model estimation, incorporating the unscented Kalman filter (UKF) for robust model estimation, quasi-maximum likelihood estimation for non-normal pricing residuals, and bootstrap bias correction for model parameters. Monte-Carlo simulations affirm the robustness of the UKF algorithm in generating bias-corrected model estimates. The research extensively analyzes one-, two-, and three-factor models and finds that the three-factor model effectively characterizes bond yield dynamics and accurately prices government bonds both in-sample and out-of-sample. Moreover, it reveals that short-, medium-, and long-term risk factors in the government bond market are negatively priced, with short-term risk premiums becoming statistically significant. Utilizing these model estimates, the paper demonstrates how scenario-based risk management of interest rates can be achieved, generating a diverse range of economic scenarios for bond yields by incorporating investor market views across various time horizons.

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Multivariate time series spatial extreme clustering with voformer-EC neural networks

Ning XIN (PhD)

SUPERVISORS Md Maruf Hasan, Jionglong Su (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of AI and Advanced Computing

This study introduces the Voformer-EC model as a novel approach to address this problem, enhancing the analysis of drought-related multivariate time series data. The Voformer-EC model simultaneously accounts for time series shape and operational efficiency, utilizing the Voformer architecture to extract time series features and implementing Extreme Clustering. Utilizing sum-mer precipitation and temperature patterns from 2012 to 2014, the Voformer-EC model was applied to identify drought-prone regions and facilitate targeted risk mitigation strategies. The most drought-prone areas were identified through com-prehensive analysis during the study period. The results demonstrate the model’s exceptional accuracy and efficiency, offering a powerful tool for informing interven-tions and enhancing resilience against drought impacts providing valuable insights into the spatial distribution of drought risk.

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A note on closed-form spread option valuation under log-normal models

Nuerxiati ABUDUREXITI (PhD)

SUPERVISORS Hasanjan Sayit (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

In the papers \cite{CarmonaandDurrleman2003a} and \cite{bjerksund2014closed}, closed-form approximations for spread call option prices were studied under the log-normal models. In this paper, we give an alternative closed-form formula for the price of spread call options under the log-normal models also. Our formula can be seen as a generalization of the closed-form formula presented in \cite{bjerksund2014closed} as their formula can be obtained by selecting special parameter values for our formula. Numerical tests show that our formula performs better for a certain range of model parameters than the closed-form formula presented in \cite{bjerksund2014-closed}.

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Asymptotics for the conditional higher moment coherent risk measure with weak contagion

Qingxin YI (PhD)

SUPERVISORS Jiajun Liu, Fei Ma (XJTLU)
Yi Zhang (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

Various measures have been proposed in the existing literature to evaluate extreme risk exposure under the effect of an observable factor. Due to the nice properties of the higher-moment (HM) coherent risk measures, we propose a conditional version of the HM risk measure (CoHM) by taking into account the information of an observable factor. We conduct the asymptotics for this measure of extreme risks at high condence levels under the weak contagion of risk, which are further applied to the special case of the Conditional Haezendonck-Goovaerts risk measure (CoHG). Numerical illustrations are also provided to examine the accuracy of the asymptotic formulas and to analyze the sensitivity of the risk contribution based on the Haezendonck-Goovaerts risk measure.

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Investigating the dissemination mechanisms of the 2020 COVID-triggered financial crisis: A copula-based approach

Ruijun ZONG (PhD)

SUPERVISORS Lu Zong, Conghua Wen (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

This study delves into the intricate dynamics of the financial crisis instigated by the 2020 Covid pandemic, with a keen emphasis on its dissemination through global stock indices. Utilizing data from 19 countries (i.e., Australia, Canada, China…), each represented by its stock index in native currency, we initially test for the presence of contagion using Kendall's tau across precrisis and crisis periods. Our findings suggest significant increases in Kendall's tau in crisis. To decipher the channels of contagion propagation (i.e., wealth constraints vs. portfolio rebalancing), we employ a time-varying SJC copula framework, focusing on the differential behavior of lower and upper tail dependences. A novel aspect of our analysis computes the time-specific probability of heightened lower tail dependence over its upper counterpart. Through this, we not only understand the contagion mechanisms but draw insights into the role of currency in modulating crisis transmission.

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Quantitative analysis on the behavior of financial analysts and reports under Hawkes process

Ruina XING (PhD)

SUPERVISORS Zhehao Zhang, Stephen Gong (XJTLU)
Corina Constantinescu, Xiaoxia Ye (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

This study explores the impact of financial analysts' research report on stock return and the factors that might affect the number of reports. The strategy employs the Hawkes model and Cox model to describe the arrival times for research reports that perform a cluster behavior. With the parameters estimated by Generalized Method of Moment, we investigate the association between research reports and stock returns. To analyze the degree of self-exciting between different analysts and stocks, we consider analysts with different educational background, and group stocks by their firm size, age, region, etc. Besides, following the CAPM and Fama -French three-factor model, we build the number of reports as an additional factor. We find that the number of reports effect is significant in Chinese stock market.

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Combining transformer based deep reinforcement learning with black-litterman model for portfolio optimization

Ruoyu SUN (PhD)

SUPERVISORS Hasanjan Sayit, Jionglong Su (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

Portfolio optimization is a quantitative investment strategy that aims to construct an optimal portfolio of assets based on investor's objectives. It involves the transaction of a set of assets to maximize expected returns or minimize risk, subject to certain constraints such as budget, liquidity, and regulatory requirements. Since deep reinforcement learning (DRL) algorithms are able to learn from experience, allowing them to adapt to changing market conditions and adjust trading strategies accordingly, these algorithms demonstrate great potential in the field of portfolio optimization. In this research, the DRL agent is trained to apply the Black-Litterman (BL) model for portfolio management, termed as BL-based DRL agent (BDA). The BL model is a Bayesian model used in portfolio optimization for combining subjective views regarding the return expectation of portfolio assets with the market’ s prior information in a manner that results in intuitive, diversified portfolios. Compared to traditional DRL agents for portfolio management, BDA can effectively utilize the correlation between assets and apply long/short operations to hedge the risk. Empirical results from four experiments show that BDA achieves outstanding out-sample performance in Accumulated return, Sharpe ratio, and Sortino Ratio compared to seventeen traditional and two DRL strategies. The Accumulated Return of BDA is more than twice of other compared strategies in each experiment. In terms of return per unit of risk, BDA can achieve at least 25% higher Sharpe ratio and Sortino ratio than other strategies. Moreover, we replace the BL model with the conventional Softmax function in our DRL algorithm for comparison with BDA to assess the risk-control ability of the BL model on the DRL agent. Empirical findings indicate that utilizing the BL model enables the DRL agent to achieve a minimum of 50% higher return per unit of risk in comparison to the Softmax-based Deep reinforcement learning agent. These findings underscore the significance of utilizing the BL model by DRL agents for effective risk management in financial applications.

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Design of photothermally driven soft robots

Shaobo HE (PhD)

SUPERVISORS Chen Xuan (XJTLU)
Paolo Paoletti (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

Photothermal materials can deform in response to heat and light, thus the mechanical responses can be originated from either the thermal expansion due to temperature rise under light or photo-chemical reactions that trigger macroscopic deformations directly. Because of its capability to change shape under photo-thermal stimuli, the potential to develop into photothermally driven soft robots is appealing and smart remote control of such photothermally driven robots also has promising engineering applications. The project is aimed to study the photo-thermal-mechanical response of such material and a mathematical theory describing such behavior will be developed and implemented in computer simulations. Soft biomimetic robots capable of walking or swimming like animals in nature will be designed via simulation based on the above theory, together with experiments done by external collaborators to perform various tasks for humans

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Cipher-prompt: Towards a safe diffusion model via learning cryptographic prompts

Sidong JIANG (PhD)

SUPERVISORS Rui Zhang, Xinheng Wang (XJTLU)
Xinping Yi (UoL)
Kaizhu Huang (DKU: Duke Kunshan University)

ACADEMY/SCHOOL School of Mathematics and Physics

The growing concerns surrounding the security and privacy implications of advanced generative models, especially in the context of producing unsuitable imagery, such as explicit, violent, or politically sensitive material, have become increasingly prominent. Our research introduces a novel, efficient methodology, referred to as Cipher-prompt, which is designed to inhibit the generation of images by diffusion models that are contextually linked to sensitive prompts. Cipher-prompt utilizes an untargeted attack objective to optimize a black-box model and generate perturbations that maximize the semantic distance between the protected class and the generated images. Therefore, Cipher-prompt does not require retraining or fine-tuning of the generative model or images as the training dataset. We have rigorously tested Cipher-prompt's performance through a series of qualitative and quantitative assessments, focusing on the rates of protection failure and the extent of any unintended consequences. The empirical data underscores the capability of Cipher-prompt to effectively reduce risks while preserving the functional benefits of diffusion-based image generation models.

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Application of neural network in medical images analysis

Sikai GE (PhD)

SUPERVISORS Fei Ma, Zili Wu (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

The initial stage of analyzing kidney-related images typically involves accurate kidney segmentation. While several semi-automated methods for segmenting kidneys in 2D ultrasound images have been suggested, there's been limited exploration in fully automated techniques. The challenges in this process arise from the kidney's variable shape and low image contrast. In response, we developed a cutting-edge segmentation model based on U-Net for real-time kidney and prostate segmentation in ultrasound images. This network was benchmarked against the standard U-Net and other comparable deep learning models. The results showed a promising segmented map with a DICE score of 0.95, indicating the efficiency of our deep learning network for automated segmentation in 2D ultrasound kidney images. Furthermore, we investigated the use of this segmentation in actual surgical procedures.

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Continuous-stage adapted exponential methods for charged-particle dynamics with arbitrary magnetic fields

Ting LI (PhD)

SUPERVISORS Bin Wang

UNIVERSITY/INSTITUTE Xi'an Jiaotong University / School of Mathematics and Statistics

This paper is devoted to the numerical symplectic approximation of the charged-particle dynamics (CPD) with a homogeneous magnetic field and its extension to a non-homogeneous magnetic field. By utilizing continuous-stage methods and exponential integrators, a general class of symplectic methods is formulated for CPD under a homogeneous magnetic field. Based on the derived symplectic conditions, two practical symplectic methods up to order four are constructed where the error estimates show that the proposed second order scheme has a uniform accuracy in the position w.r.t. the strength of the magnetic field. Moreover, the symplectic methods are extended to CPD under a non-homogeneous magnetic field and three algorithms are formulated. Rigorous error estimates are investigated for the proposed methods. Numerical experiments are provided and the numerical results support the theoretical analysis and demonstrate the remarkable numerical behavior of our methods.

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Extremes for tail moment risk measures

Weiran LI (PhD)

SUPERVISORS Jiajun Liu (XJTLU)

ACADEMY/SCHOOL School of Mathematics and Physics

Heavy-tailedness and tail dependence have become crucial when addressing risks of a financial or insurance company associated with extreme events. We investigate the asymptotic properties of four types of risk measures, specifically the tail moment (TM), joint tail moment (JTM), and their corresponding tail central moments by addressing the impacts of heavy-tailedness and extreme dependence. We derive the asymptotic expressions to estimate the TM and JTM efficiently, which is further examined by a numerical study with relative errors. The comparison of different risk measures also includes to evaluate their sensitivity under different economic situation.

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Stabilizing non-linear affine system using SM control technique

Weisheng LIU (PhD)

SUPERVISORS Gang Liu, Chi-Kun Lin, Qiang Niu (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

Outdoor disturbances and parametric uncertainties are inherent to most practical systems, and how to construct a robust controller for stabilizing these systems is a long-standing problem. The sliding mode control technique (SMC) is considered the most viable approach considering its robustness towards non-linear systems including uncertainties and disturbances. This project will focus on the construction of sliding mode controller and validation of its robustness and the sliding mode existence by Lyapunov function test. The example of stabilizing problem for non-linear affine system are presented and the results of simulation process will be generated by MATLAB.

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Reliability test for degradation data based on ranked set sampling

Wenhan ZHANG (PhD)

SUPERVISORS Xiaojun Zhu, Zili Wu (XJTLU)

ACADEMY/SCHOOL School of Mathematics and Physics

We consider test for the two null hypotheses for H0 : SX(t) = α and H0 : SX(t) = SY (t), two widely useful tests in reliability, based on ranked set sampling. We derive the likelihood ratio test as well as the associated exact and asymptotic results. Considering a fixed significance level and power of the test, we show that the proposed test statistic outperforms the existing test. In small sample cases, the proposed test leads to a much narrower confidence interval for the reliability function SX(t). Then, the test statistics obtained from simple random sampling and ranked set sampling schemes are compared through which, the efficiency of using ranked set sampling is demonstrated. For illustration, we apply the proposed test to a degradation data from the reliability literature. Upon using ranked set sampling, the cost of measurement gets reduced and efficiency gets improved, suggesting the importance and use of ranked set sampling data in reliability experiments and their design.

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Forecasting implied volatility: The role of long-memory

Yinuo WANG (PhD)

SUPERVISORS Conghua Wen, Jia Zhai (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

This paper primarily investigates the prediction of implied volatility in the Chinese and U.S. options markets, exploring whether implied volatility is path-dependent. We begin by utilizing historical implied volatility,moneyness and time-to-maturity as input features for our models, comparing the predictive performance of linear models and nonlinear machine learning models. Furthermore, to assess the role of long memory in forecasting, we employ various lengths of time series as inputs. To achieve this, we develop a hybrid model named LSTM-ML, where the LSTM component captures dynamic latent information from volatility time series to generate temporal features. Empirical results indicate that the linear Ridge model demonstrates superior and stable predictive performance, especially when the features capture long-memory patterns. Conversely, the new hybrid model does not exhibit significantly stronger fitting capabilities. Finally, we construct a trading strategy to illustrate the profitability of the model's predictive results.

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Skyrmion-based racetrack multilevel data storage device manipulated by pinning

Yunxi JIANG (PhD)

SUPERVISORS Hao Yu, Chen Xuan (XJTLU)
Hem Sharma (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

Magnetic skyrmions are particle-like topological protected spin structures that can be driven by electric current. We demonstrate a single skyrmion-based multilevel data storage device that could also work as the potential artificial synapse for neuromorphic computing. Four pinning sites are designed to situate the skyrmion in selective regions, whose resistances rise owing to the anisotropic magnetoresistance (AMR) induced by the skyrmion. Skyrmion's position could denote the data levels when the device works as a multilevel data storage device. Pinning sites' positions represent the synaptic weights when it functions as the artificial synapse. Multilevel data storage device's data level change or the synapse's potentiation and depression is realized by the electric current applied parallel to the track. Our work shows that the AMR could help to detect a single skyrmion without the magnetic tunnel junction. Moreover, the skyrmion manipulated by pinning provides an approach for precise control and helps realize skyrmion-based in-memory computing.

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Relative asset valuation: A global perspective

Zhendong ZHANG (PhD)

SUPERVISORS Yi Hong (XJTLU)

ACADEMY/SCHOOL School of Mathematics and Physics

This paper empirically studies whether the firm values can be priced by relative valuation and how the values are priced in a factor model in the global markets. The results show that the model can persistently and steadily predict the firm relative value, measured by the Tobin's Q-ratio.

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Idiosyncratic risk and the cross-section of cryptocurrency returns

Zheng TAO (PhD)

SUPERVISORS Lu Zong, Jia Zhai, Conghua Wen (XJTLU)
Linglong Yuan (UoL)

ACADEMY/SCHOOL School of Mathematics and Physics

Within the global financial markets, the cryptocurrency market has emerged as a force that cannot be ignored. From the birth of Bitcoin to the rise of Ethereum, Ripple, and countless other types of cryptocurrencies, this field has generated widespread attention and debate. Cryptocurrencies have outperformed all traditional assets, which is reflected in their high returns, despite their extreme risks, and being susceptible to market manipulation, withdrawal fees, and the risk of hacker attacks. Some studies have considered the return and volatility attributes of cryptocurrencies, emphasizing their speculative behaviors, without overlooking their hedging and safe harbor properties with respect to stock risks, and their role as measures of various economic uncertainties. Despite the extensive research in the cryptocurrency market, little attention is currently paid to the idiosyncratic volatility of cryptocurrencies.

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Asymptotic behaviour of Ewens Pitman model

Zhiqi PENG (PhD)

SUPERVISORS Youzhou Zhou (XJTLU)

ACADEMY/SCHOOL School of Mathematics and Physics

The Ewens-Pitman partition structure, a fundamental model in Bayesian nonparametrics, describes the distribution of partitions arising from a sample of a population with an infinite number of potential types. This model is characterized by two parameters, often denoted as \(\theta\) and \(\alpha\), which control the diversity and the abundance of the clusters in the partition. The asymptotic behavior of this model is of particular interest as it provides insights into the richness and the probability of new cluster formation as the sample size grows. Studies have shown that as the sample size tends to infinity, the number of clusters grows logarithmically if \(\alpha = 0\) and polynomially if \(\alpha > 0\). This abstract aims to encapsulate the essence of the Ewens-Pitman model's asymptotic properties, highlighting the delicate balance between the parameters that govern the emergence of new types and the growth of existing ones in a population. Understanding these properties is crucial for applications in genetics, ecology, and other fields where modeling the diversity of an infinite population is essential.

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Unhealthy diets increase the likelihood of being overweight or obese among African migrant students in China, but not among African non-migrant students: a cross-sectional study

Anita NYARKOA WALKER (PhD)

SUPERVISORS Qing Feng

UNIVERSITY/INSTITUTE Nanjing Medical University / School of Public Health

We used cross-sectional data to compare the dietary habits, quality, and risk factors for overweight or obesity between African migrant students in Nanjing (China) and non-migrant students in Africa. Dietary consumption and quality were evaluated using a food frequency questionnaire and global diet quality score metrics. Through cross-tabulation, the variations in dietary habits and quality between the groups were explored. Then, risk variables for overweight or obesity were determined with binary logistic regression. Of the 678 students, 46.7 % were between 18 to 25 years. The non-migrant African students' diets lacked a variety of fruits and vegetables. In contrast, the migrants consumed more high-fat dairy, processed meats, sweets, ice creams, sugar-sweetened beverages, and juice. Consequently, consuming red meat, processed meats, refined grains, baked foods, sweets, and ice cream induced overweight or obesity among only African migrant students. Controlling Western diet consumption reduces obesogenic conditions among African migrant students in China.

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Interactive effect of dyslipidemia and increased high-sensitivity C-reactive protein on cardiovascular diseases: A 12-year prospective cohort study

Solim Essomandan Clémence BAFEI (PhD)

SUPERVISORS Chong Shen

UNIVERSITY/INSTITUTE Nanjing Medical University / School of Public Health

This prospective cohort study aimed to assess the interaction of dyslipidemia and high-sensitivity C-reactive protein (hs-CRP) on CVD. We enrolled 4,128 Chinese adults at baseline in 2009 and followed them up until May 2022 to collect CVD events. Cox-proportional hazard regression analysis estimated the hazard ratios (HRs) of the associations. The additive interactions were explored using the relative excess risk of interaction (RERI) and the multiplicative interactions were assessed with HRs (95% CI). The results showed that among participants with normal hs-CRP (< 1 mg/L), TC $\geqslant$ 240 mg/dL, LDL-C $\geqslant$ 160 mg/dL, non-HDL-C $\geqslant$ 190 mg/dL, ApoB < 0.7 g/L, and LDL/HDL-C $\geqslant$ 2.02 were related to CVD [HRs: 1.75, 2.16, 1.95, 1.37, and 1.30, all $P < 0.05$, respectively]. While in the population with increased hs-CRP, only ApoAI > 2.10 g/L had a significant association with CVD (HR: 1.69, $P < 0.05$). Interaction analyses showed that increased hs-CRP had multiplicative and additive interactions with LDL-C $\geqslant$ 160 mg/dL and non-HDL-C $\geqslant$ 190 mg/dL on the risk of CVD (HRs: 0.309, and 0.505; RERIs: -1.704 and -0.69, respectively, all $P < 0.05$). Further large-scale cohort studies with trajectories measurement of lipids and hs-CRP might verify our results as well as explore the biological mechanism behind that interaction.

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Soil-transmitted heavy metal exposure and cognitive decline in the elderly: A seven-year cohort study in China

Bingjie QU (PhD)

SUPERVISORS Ying Chen, Linxi Yuan (XJTLU)
Roy Goodacre (UoL)

ACADEMY/SCHOOL XJTLU Wisdom Lake Academy of Pharmacy

This cohort study explores the relationship between soil concentrations of eight heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc) and cognitive disorders in the elderly Chinese population (aged 45 and above). Spanning seven years from a 2011 baseline, the study included 13181 participants with follow-up assessments in 2013, 2015, and 2018. Logistic regression models pinpointed cadmium and lead as significantly associated with cognitive impairments. Through latent class analysis, six geochemical exposure patterns were identified: Minimal (12.45%), Lower Intermediate (31.01%), Upper Intermediate (24.13%), Disproportionately High Lead (5.58%), Disproportionately High Cadmium (4.42%), and Maximum (22.42%) exposure clusters. Individuals in regions with upper intermediate and maximum cadmium and lead exposures were found to have a 1.3 to 1.5-fold increased risk of cognitive disorders compared to the Minimal Exposure Cluster.

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Evaluation of multiple organophosphate insecticide exposure in relation to altered thyroid hormones in NHANES adult population

Massira Ousseni DIAWARA (PhD)

SUPERVISORS Yankai Xia

UNIVERSITY/INSTITUTE Nanjing Medical University / School of Public Health

This study's objective was to evaluate the association between individual and mixture of urinary OPI metabolites and changes in serum thyroid hormone (TH) concentrations. The analyzed data was 1,434 participants from the NHANES cycle 2007-2008. Generalized linear model regression (GLMR), weighted quantile sum (WQS), and adaptative least absolute shrinkage and selection operator (adaptative LASSO) regression were used to investigate the associations between urinary OPI metabolites and altered THs. Among the male subjects, five metabolites were inversely associated with FT3, meanwhile, higher Tg was related to DMP. Additionally, the metabolites mixture induced FT3 down-regulation (-0.21 [95% CI: -0.31, -0.11]) and increased Tg concentration (0.12 [95% CI: 0.02, 0.21]). Consistently, DMTP was significantly the strongest contributor in the FT3 model (mean weight= 3.449e-01 and β =-0.022), and DMP represented the highest metabolite in the Tg model (mean weight= 9.873e-01 and β =-0.020). However, here was no statistically significant association found among females.

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Study on the mechanism of Celastrus Orbiculatus extract inhibiting gastric cancer metastasis through the regulation of lactylation by splicing factor PTBP1

Miao ZHU (PhD)

SUPERVISORS Yanqing Liu

UNIVERSITY/INSTITUTE Yangzhou University / Medical College

Glycolysis is the main metabolic mode of tumor, and lactylation, a metabolite of lactic acid, is an important biological behavior that drives tumor development. Traditional Chinese medicine blames "blood stasis" for the pathogenesis of glucose metabolism disorder, which is similar to the pathogenesis of gastric cancer. Blood stasis is the main collateral disease feature of gastric cancer, and rattan drugs are often used to treat collateral blood stasis syndrome in clinic. We found that Celastrus orbiculatus extract (COE) can effectively inhibit the invasion and metastasis of gastric cancer by regulating polypyrimidine domain-binding protein 1(PTBP1). PTBP1 cleaves G6PC3 to participate in lactic acid modification, thus affecting the malignant biological behavior of gastric cancer cells. PTBP1 knockout models of cells and mice were constructed, and the molecular mechanism of COE regulating splicing factor PTBP1 inhibiting lactylation of gastric cancer cells was studied, which laid a theoretical foundation for the application of COE.

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Cooking fuel use and non-communicable disease burden in China: A systematic review and meta-analysis

Mobolaji Timothy OLAGUNJU (PhD)

SUPERVISORS Chong Shen

UNIVERSITY/INSTITUTE Nanjing Medical University / School of Public Health

The extensive use of solid fuels for cooking in China, particularly in rural areas, has been linked to a range of health issues due to the release of harmful compounds. Despite this, the transition to non-solid fuels has been slow, especially in rural regions. A systematic review and meta-analysis was conducted to study the association between exposure to indoor air pollution and the development of non-communicable diseases (lung cancer, chronic obstructive pulmonary disease, stroke, and ischaemic heart disease) in China. The study included 16 articles. The burden of COPD attributed to exposure to ambient air pollution reported across 10 studies reflected a statistical significance. Common effect model reported for COPD, Lung Cancer, and the overall burden of the NCDs an OR 6.24 (6.08-6.39), 1.58 (1.49-1.67), and 4.26 (4.15-4.37). There is an urgent need to reduce the burden of NCDs attributed to ambient exposure of unclean cooking fuel.

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Prenatal organophosphate exposure is associated with children cognition and motor activities: A meta-analysis

Mohammed Ebraheem Mohammed Abu-Bakr AL-QUDAIMI (PhD)

SUPERVISORS Yankai Xia

UNIVERSITY/INSTITUTE Nanjing Medical University / School of Public Health

Background: Organophosphate (OP) pesticide exposure in general population has become a global issue but its association with neurodevelopment in children was controversial.
Objective: This meta-analysis was performed to evaluate the relationship between prenatal OP exposure and children neurodevelopment.
Methods: Relevant articles were retrieved from the Web of Science, PubMed, and Cochrane Library up to February 3, 2023. Only human cohort studies in English that investigate the relationship between prenatal OP exposure and neurodevelopment in children were included.
Results: A total of 4203 studies were retrieved from the three databases, Web of Science, PubMed, and Cochrane Library. Only 15 articles with an overall sample size of 6443 were eligible for inclusion in the meta-analysis. 12 subgroup analyses were conducted based on the types of OP metabolites [dialkylphosphate (DAP), diethyl phosphate (DEP), and diethyl phosphate (DMP)] and neurodevelopment outcomes (cognition, behavior, motor activity, and social behavior and autism) by using either random or common effect models. The pooled estimates from subgroup analyses revealed negative associations between prenatal concentrations of DAP and cognition, DEP and cognition, DAP and motor activity, and DEP and motor activity (effect size β: −1.96, 95% CI: −3.18, −0.73, $p < 0.01$; β: −0.03, 95% CI: −0.05, − 0.00, $p = 0.03$; β: −0.04, 95% CI: −0.08, −0.00 $p = 0.04$; and β: −0.05, 95% CI: −0.09, −0.01 $p = 0.03$ respectively). No statistically significant association was detected in other subgroup analyses.
Significance: Our study indicated DAP and DEP metabolites were significantly associated with children's cognition and motor activity. These findings have significant implications that would help to design a new pesticide and regulate and restrict the utilization of OP, keeping a balance between children's health protection and the promotion of agricultural development.

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The impact of crisis and COVID 19 on Syrian children growth, health awareness and nutritional practices. A cross-sectional study

Seba HARPHOUSH (PhD)

SUPERVISORS Zhong Li

UNIVERSITY/INSTITUTE Nanjing Medical University / School of Public Health

Background and Aims. Despite the great steadfastness that Syria has achieved in the face of more than a decade of stifling crisis followed by the global COVID-19 pandemic, the heavy impacts of these long rough years are certain and crucial on the health and nutrition levels, specially on vulnerable groups like women and children. The purpose of the current study was to evaluate growth development and give an insight about the public health awareness and nutritional practices among Syrian primary schools children.
Methods. A cross-sectional study was conducted among private and public primary schools students aged 6 to 9 years old in Homs governorate in January to April 2021, anthropometric measures were taken and data about nutritional practices and health awareness were assessment by conducting two surveys answered by parents and students.
Results and Discussion. According to our assessment, the prevalence of stunting is estimated to be 13.8% for school age children in Homs city, with a significantly higher prevalence for public school children 21.6% and significantly decreased HAZ, in the same manner the prevalence of underweight was higher in public school with significantly decreased WAZ.
☒Those results imply to a chronic malnutrition based on socioeconomic indicators.
☒Differences in nutritional practices and health awareness were recorded between public and private schools students under socioeconomic impact.

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Does social support moderate the effect of pandemic shocks on NSSI? Evidence from the post-lockdown period in China

Ziwei QIANG (PhD)

SUPERVISORS Xueyan Yang

UNIVERSITY/INSTITUTE Xi'an Jiaotong University / School of Public Policy and Administration

This study examines the differential impacts of internal and external pandemic shocks on the risk of non-suicidal self-injury (NSSI), with a focus on the moderating role of social support. Utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) on post-lockdown data from China, the research identifies that while external shocks, directly and indirectly, affect NSSI risk via psychological distress, internal shocks operate exclusively through distress. Social support is found to significantly mitigate the influence of external shocks but has a less pronounced effect on internal shocks. These insights are crucial for targeted interventions to reduce NSSI risk during pandemics.

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To whom do we entrust the memories of our colonial past? – The dissonance of prison heritage in Qingdao and Dalian in postcolonial China

Beixi SUN (PhD)

SUPERVISORS Yiwen Wang (XJTLU)
Barry Godfrey, Katherine Roscoe (UoL)

ACADEMY/SCHOOL Design School

Heritage is a process of memory and construction, and this process is often selective and biased. The interpretation of heritage sites associated with colonial history are often treated as political events by governments. In some narratives of colonial heritage sites, particular aspects of the colonial past have been selectively highlighted to fulfill the political ideology or interests. Colonial prisons in China, for example, are often used as a place for invoking the collective memories of China as a victim of imperialism, a base for patriotic education and a destination of 'red tourism'— arousing Chinese nationalism and anti-Japan antagonism through tourism. However, there is also a need to curate it as a dark-tourism site, fulfilling the expectation and curiosity of young-generation thrill seekers and international visitors, performing the education and entertainment function of penal tourism, which has been long ignored in current heritage interpretation. Therefore, this research seeks to investigate the dissonance – conflicting views of different stakeholders — embodied in the colonial prisons in China and explore the socio-cultural and educational implications of this long-ignored dissonance.

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Design research on university campus environment to promote students' mental health

Kunlun REN (PhD)

SUPERVISORS Bing Chen, Junjie Xi (XJTLU)
Manuela Madeddu (UoL)

ACADEMY/SCHOOL Design School

This research aims to analyze ways in which the university campus design can affect students' mental health and provide a design guideline that can spport future renovation of existing campus and new campus design to promote students' mental health. There are a large amount of studies verifying and interpreting the relationship between human mental health and natural environments or specific urban environments. However, fewer studies have focused on university campus. Based on the literature review and case studies, students' perception needs and activities relating to mental health will be identified. The corresponding design approaches will also be explored. To verify the effectiveness of the design approaches, a VR based experiment will be conducted. Both of the subjective and objective responses will be recorded as indicators of mental health. Findings of the experiment will guide the revision of the design approaches. Finally, a university campus design guideline that can promote students' mental health will be established.

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Sustaining urban commons: An institutional approach to securing the longevity of community gardens in the Yangtze Delta

Lin JI (PhD)

SUPERVISORS Ying Chang, Ju Hyun Lee (XJTLU)
Thomas Moore (UoL)

ACADEMY/SCHOOL Design School

Community gardens in China face management challenges that threaten their longevity. This study focuses on the management issues of community gardens, from an institutional approach to urban green commons. After the literature review, this study identifies the stakeholders and actors of representative community gardens in three cities of the Yangtze Delta by questionnaire and interviews, then, followed by a documents analysis of the statutory and legal norms and regulations that define the property rights, responsibilities and obligations of different stakeholders and perceived ownership, rights and obligations of participants. The main focus of this study is to identify the explicit and implicit institutional variables that impede the longevity of community gardens and to propose opportunities that establish clear definitions of rights, responsibilities and obligations to regulate inclusive and collective governance of community gardens. By enriching the understanding of the urban green common and its practical application at the micro-neighbourhood level, this study will contribute to the longevity of community gardens in China.

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Assessing the County-to-District Reform reform

Peiao TAN (PhD)

SUPERVISORS Rui Wang (XJTLU)

ACADEMY/SCHOOL Design School

This research will attempt to assess the effect of County-to-district mergers (chexian gaiqu), a major and frequent form of ' administrative division adjustment' (ADA)regional development of cities and counties during last decade, on the population urbanization. It draws from the classical theories from urban and regional economies, decentralization, together with the China-specific development and political theories, to answer the emerging questions. The primary focus is how CTD reform affect the population urbanization, and how the effects vary with geographical, fiscal and economic factors.

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Governance of public-private partnership megaproject(s) in the changing conditions in China: The case of Jiangsu Province

Po Shan YU (PhD)

SUPERVISORS Sophie Sturup, Xuefeng Wang (XJTLU)
Alex Nurse (UoL)

ACADEMY/SCHOOL Design School

The abstract of the research study, titled "Governance of Public-Private Partnership Megaproject(s) in the Changing Conditions in China: The Case of Jiangsu Province," investigates the interplay between the governance structure of Chinese Public-Private Partnerships (PPPs) and the adaptive capabilities of participating parties. This study aims to address four research questions. Firstly, it examines how the Chinese PPP governance structure influences the adaptive capabilities of parties involved in PPPs. Secondly, it explores the perspectives of the Chinese government on adaptive capabilities and their goals in this regard. Thirdly, it investigates the extent to which the implementation of adaptive capabilities in practice aligns with the initial plans and expectations. Finally, the study compares and analyzes the degree of alignment or divergence between the government's conceptualization of adaptive capabilities and the research study's own version. By addressing these research questions, the study provides insights into the governance and adaptive capacity of PPPs in the context of Jiangsu Province and contributes to the evolving field of PPP research in China.

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Getting public transport networked: How to improve theimple-mentation of this "wicked" problem

Shaohua HU (PhD)

SUPERVISORS Sophie Sturup (XJTLU)
Olivier Skyes, Rhiannon Corcoran (UoL)

ACADEMY/SCHOOL Design School

This research aims to underscore the critical need for a Networked Public Transport system, capable of rivaling private car usage in order to combat escalating atmospheric pollution and traffic congestion. Despite its global popularity, implementation faces resistance due to insufficient integration with public policy frameworks. Through diverse case analyses, this study seeks to address three key questions: 1) What guiding principles should govern Networked Public Transport organization? 2) Is adherence to these principles alone adequate for success? 3) What additional measures are necessary for effective implementation? The research advocates for a Networked system founded on complexity, syncretism, and self-determination, emphasizing their theoretical significance.

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Spatio-temporal evolution of key areas of territorial ecological restoration in resource-exhausted cities: A case study of Jiawang District, China

Shuai TONG (PhD)

SUPERVISORS Xiang Ji

UNIVERSITY/INSTITUTE China University of Mining and Technology /
School of Mechanics and Civil Engineering

Resource-exhausted cities usually face problems of environmental degradation, landscape fragmentation, and impeded ecological mobility. By clarifying the spatial heterogeneity of ecological restoration needs, efficient and coordinated ecological protection and restoration can be carried out. This study selected Jiawang District, a typical resource-exhausted city, and constructed an ecological security evaluation framework to determine the ecological source area from the three aspects of ecosystem service importance, ecological sensitivity, and landscape stability. The resistance surface was corrected with ecological sensitivity evaluation data, and ecological corridors and ecological nodes were identified using circuit theory. Finally, it explored the spatial and temporal evolution of the key areas of territorial ecological restoration in Jiawang District.

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Evaluating and developing the child-friendliness of public open space in residential aresa

Suyuan TONG (PhD)

SUPERVISORS Lin Lin, Shih-Yang Kao (XJTLU)
Thomas Fischer (UoL)

ACADEMY/SCHOOL Design School

China has the most significant number of children worldwide, and over 180 million live in urban areas. Creating a livable and playful environment for children is essential for children's growth and development. Children who are living in urban areas are facing several challenges that are affected by the built environment, such as declining health conditions, personal injury accidents, lack of interactions with nature, and various mental problems. In addition, with the development of the concept of Children Friendly City, increasing people pay attention to children's rights and justice in residential areas. Therefore, it is urgent to improve urban design elements and create a supportive living environment for children. This study carries out systematic research on built environment elements from the view of child-friendliness and tries to provide approaches to improve the current environmental design of residential areas to create a healthy and friendly residential space for children.

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Accessibility, congestion, and air pollution in residential location choice

Xiaohan YU (PhD)

SUPERVISORS Hyung-Chul Chung, Sophie Sturup (XJTLU)
Alex Lord (UoL)

ACADEMY/SCHOOL Design School

Taking Suzhou as the study area, this research investigate the trade-off effect of accessibility, traffic congestion, and air pollution on residential location choice by addressing following three research questions: (1) How does the trade-off impact amongst accessibility, traffic congestion, and air pollution affect housing price in terms of different spatial locations and temporal changing? (2) What is the heterogeneity of neighborhoods and households in relation to the access-congest-air and housing price patterns? (3) What are the reasons behind residential location choice based on neighborhood profiling in research question 2? By applying quantitative regression analysis and qualitative in-depth interview methods, the findings of this study will highlight the heterogeneity of the trade-off impact on housing price and location choice. This study aims to contribute to understanding of the spatial implication of urban transportation infrastructure provision and policy in China, and more generally to new urban transportation policy discussion at both national and international level.

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The measurement of 15-minute community life circle: Analysis of the spatial pattern and social equity issues – a case study of Suzhou, China

Zhonghui JIANG (PhD)

SUPERVISORS Hyung-Chul Chung, Ju Hyun Lee, Lin Lin (XJTLU)
Alex Lord (UoL)

ACADEMY/SCHOOL Design School

In China, the 15-minute community life circle (15-min CLC) has been strongly advocated and widely discussed. However, the current study is premature in the measurement of 15-min CLC. This study proposes an improved measure 15-min CLC method with the help of Baidu map API, and takes Suzhou as a case study. By reducing the walking speed to simulate the travel situation of the elderly, this study finds that the service facilities available to the elderly in the 10-minu CLC have the most serious decline. Both global and local models indicate that some community environmental features are spatially associated with the walking accessibility of 15-min CLC.