UNNC – SUAT Doctoral Training Partnership

It's essential that you have contacted the potential UNNC and/or SUAT supervisors before submitting an application.

Formal applications should follow the instructions in 'How to apply' section.

Research areas

- Biomedical Engineering
- Composite
- Electrical and Electronic Engineering
- Machines and Control
- Advanced and Intelligent Manufacturing
- Artificial Intelligence and Optimisation
- Big Data Analysis and Information System
- Advanced Energy and Environmental Materials

Available PhD topics

PhD topic	**Construction of a Systematic Biological Research Framework for Multi-omics Integration, Cross-scale Modeling, and Intelligent Virtual Cells**
SUAT Supervisor	Prof.Yang Min
UNNC Supervisor(s)	Dr Kian Ming Lim
Short introduction & description of the PhD project	This project proposes to address three major scientific challenges: multi-omics data integration, cross-scale biological modeling, and intelligent virtual cells, and proposes a systematic research framework. First, to address the limitations of current knowledge graphs, which are often restricted to a single omics layer and struggle to handle multimodal heterogeneity, we aim to construct a multimodal biological knowledge graph. This will enable structured representations of cross-omics associations and fill the theoretical gap in modeling relationships across omics data. Second, to overcome the inability of traditional models to provide a unified description of molecular, cellular, and multicellular coupling mechanisms, we propose a molecular–cellular–multicellular collaborative modeling approach. This approach will establish a unified cross-scale biological foundation model, breaking through the theoretical bottleneck caused by scale fragmentation. Third, to address the limitations of existing virtual cells, which rely on static rules and lack autonomous decision-making capabilities, we introduce a multi-agent methodology to endow virtual cells with dynamic perception and adaptive regulation capabilities.
Contact points	Informal inquiries may be addressed to Dr Kian Ming Lim (Kian-Ming.Lim@nottingham.edu.cn) and Prof.Yang Min (yangmin@suat-sz.edu.cn).

PhD topic	**Fiber-optic sensors for soft robots and stretchable electronics**
SUAT Supervisor	Prof. Zhengkun Yi
UNNC Supervisor(s)	Dr. Jing Wang
Short introduction & description of the PhD project	Soft robots are capable of mimicking complex motions of human beings and animals. Embedded soft sensors are important for soft robots to sense and response to its surroundings. Unfortunately, most sensors are made out of conventional electronics, which is rigid and is not suitable for soft robotic applications. Alternatively, fiber-optic sensor has a number of unique advantages compared with its electronics counterpart. Fiber-optic sensors have been a powerful tool for sensing a wealth of physical quantities such as strain, pressure, vibration, temperature and so on. This project will aim to develop fiber-optic sensor for soft robots and stretchable electronics., including 1) the development of novel fiber-optic sensor with large strains that can be used for soft robotics and stretchable electronics, 2) the development of advanced machine learning methods for interpreting optical signals, and 3) integration of the developed sensors and algorithms for various applications such as soft robot hand, tactile glove, exoskeleton robots.
Contact points	Informal inquiries may be addressed to Prof. Zhengkun Yi (zk.yi@siat.ac.cn) and Dr. Jing Wang (Jing.Wang@nottingham.edu.cn).
PhD topic	**Perovskite-Based Multi-Junction Photovoltaics Driving CO_2 Reduction**
SUAT Supervisor	Prof. Zaiwei Wang
UNNC Supervisor(s)	Dr. Mengxia Xu
Short introduction & description of the PhD project	Perovskite-based multi-junction photovoltaics represent a transformative approach to solar-driven CO_2 reduction, offering a pathway to sustainable fuel production. By stacking multiple light-absorbing layers with tunable bandgaps, these devices achieve exceptionally high power conversion efficiencies, exceeding 33% in tandem configurations. This high efficiency enables the generation of sufficient voltage and current to drive energy-intensive electrochemical CO_2 reduction reactions. Utilizing earth-abundant materials and low-cost processing techniques, this technology promises an economically viable route to convert greenhouse gases into value-added chemicals like carbon monoxide or ethylene. Integrating advanced photovoltaics with efficient electrocatalysts paves the way for artificial photosynthesis, closing the carbon cycle while producing renewable fuels.
Contact points	Informal inquiries may be addressed to Prof. Zaiwei Wang (zw.wang3@siat.ac.cn) and Dr. Mengxia Xu (mengxia.Xu@nottingham.edu.cn).
PhD topic	**Roles and regulations of cell mass density in rewiring genetic circuitry**
SUAT Supervisor	Dr. Yuping Chen
UNNC Supervisor(s)	Dr. Mainul Haque
Short introduction & description of the PhD project	Cytoplasmic density is a global physical property of a cell that can modulate gene expression, as our prior work showed it exerts biphasic control over translation. Through experimental evolution in yeast, we generated stable mutants with altered density set-points, linked to mutations in metabolic genes and ploidy variations.

	This project will test the hypothesis that these genetic changes rewire the cell cycle oscillator to function at a new cytoplasmic density. We will combine live-cell imaging of cell cycle reporters with mathematical modeling to understand how density variations perturb the oscillator's nonlinear dynamics. The goal is to establish how genetic circuits adapt to maintain robust proliferation across different biophysical states, linking a key physical parameter to core regulatory logic.
Contact points	Informal inquiries may be addressed to Dr. Yuping Chen (yp.chen3@siat.ac.cn) and Dr. Mainul Haque (Mainul.Haque@nottingham.edu.cn).
PhD topic	**Research on Real-time Personalized Specific Absorption Rate Prediction in Ultra-High Field MRI Based on Deep Learning**
SUAT Supervisor	Prof. Ye Li
UNNC Supervisor(s)	Dr Hailin Huang
Short introduction & description of the PhD project	Magnetic Resonance Imaging (MRI), particularly at ultra-high field strengths (e.g., 7T), requires stringent control of Specific Absorption Rate (SAR) during scanning to ensure patient safety. However, current SAR estimation methods, which are based on standardized human models, often neglect inter-individual anatomical and biophysical variations. While conservative, this approach severely constrains the clinical potential of advanced imaging sequences. This project aims to leverage artificial intelligence to break through the bottleneck of fast and accurate personalized SAR prediction and to develop a deep learning surrogate model capable of real-time three-dimensional SAR distribution prediction for individual patients during scanning. The study will first construct a multi-source heterogeneous electromagnetic–anatomical database by integrating generalized anatomical models, tissue electromagnetic properties, and **high-fidelity localized finite element simulation data**, forming a **multi-scale simulation** framework. Building on this, a **Physics-Informed Neural Network (PINN)** will be developed, embedding Maxwell's equations and boundary conditions into the training process to efficiently capture the complex interactions between electromagnetic fields and biological tissues. This approach addresses the limitations of traditional **full-wave electromagnetic simulations**, which are computationally expensive and impractical for patient-specific real-time prediction. In parallel, attribution and saliency analysis will be employed to identify the anatomical structures and tissue properties most responsible for SAR hotspots, thereby enhancing model interpretability and advancing the understanding of electromagnetic–biophysical interactions. Ultimately, this project will integrate data-driven AI modeling with physical principles to construct an intelligent real-time SAR prediction framework. The outcomes will not only provide theoretical and technical support for dynamic, personalized optimization of MRI scanning parameters, but also guide RF coil design and sequence development. The proposed framework is particularly promising in high-SAR risk scenarios such as ultra-high field brain imaging, pediatric/fetal imaging, and multi-nuclear MRI, with significant potential to improve safety, diagnostic efficiency, and image quality in MRI examinations.
Contact points	Informal inquiries may be addressed to Dr Hailin Huang (hailin.huang@nottingham.ac.uk) and Prof Ye Li (liye1@siat.ac.cn).

PhD topic	**Study on Micro-nano Interface Design and Performance of Silicon Anode for High Energy Density Solid-state Batteries**
SUAT Supervisor	Wen Yang
UNNC Supervisor(s)	Di Hu
Short introduction & description of the PhD project	In view of the anode interface degradation (interface side reaction and interface failurebehavior) caused by the volume expansion of Si anode in solid-state lithiumbattery, which has seriously affected the 1st-coulomb efficiency, rate performance,long-term cyclability of lithium battery, this project proposes the topic of "Design of micro-nano interface of silicon anode and their electrochemical performance for high energy solid state lithium battery ," It is presented to the micro-nano design of the silicon anode and introduce the "rigid and flexible" multifunctional artificial SEI layer improve the structural stability of the anode material. The micro-nano design shortens the electron/ion transport distance of Si. It relieves thevolume expansion and the stress caused by Si to realize the chemical stability of the interface. Introducing rigid artificial SEI such as LiF will inhibit the interface side reaction and decomposition of sulfide-based electrolyte; Flexible organic artificial SEI buffers the mechanical strain caused by volume expansion/contraction of Si anode. The interface failure of electrode material and solid electrolyte during a long cycle can be solved by integrating surface-functioned silicon anode and polymer solid-state electrolyte/organic electrode material and functional binder to form a 3D cross-liking integrated electrode structure. This project will reveal the key factors that determine the interface stability of the silicon anode and the interface ion transport mechanism and lay a foundation for promoting the development and industrialization of the silicon in solid-state lithium battery.
Contact points	Informal inquiries may be addressed to Dr. Di Hu (Di.Hu@nottingham.edu.cn) and Prof. Dr. Wen Yang (yangwen@suat-sz.edu.cn).
PhD topic	**Using stem cells, primary cells, and microfluidic chips to synthetically construct an in vitro biomimetic human organ - tissue system - "organ - on - a - chip"**
SUAT Supervisor	Prof. Longlong Si
UNNC Supervisor(s)	Dr Yong Ren
Short introduction & description of the PhD project	The physiological and pathological mechanisms of human organs have always been one of the core areas of biomedical research. However, traditional research methods, such as animal experiments and two - dimensional cell culture, have many limitations. For example, there are physiological differences between animal models and humans, and the two - dimensional culture environment cannot accurately simulate the complex three - dimensional microenvironment in the body. As an emerging in vitro bionic platform, the organ - on - a - chip technology provides a new way to solve these problems. By combining microfluidic chip technology and cell biology, it can construct a microsystem in vitro that highly mimics the physiological functions of human organs, which has a profound impact on fields such as drug screening, disease modeling, and tissue engineering. The aim of this study is to use stem cells and primary cells, combined with microfluidic chip technology, to construct an organ - on - a - chip with greater physiological relevance, and promote the development of this technology and its transformation into clinical applications.

Contact points	Informal inquiries may be addressed to Dr Yong Ren (Yong.Ren@nottingham.edu.cn) and Prof Longlong Si (ll.si@siat.ac.cn).
PhD topic	**Adaptive ultrasonic scanning for elasticity characterization and 3D ultrasonic imaging of soft human bodies with complex shape and acoustic property**
SUAT Supervisor	Prof. Shifeng Guo
UNNC Supervisor(s)	Prof. Jian Yang
Short introduction & description of the PhD project	Human organs generally have complex surfaces, medium heterogeneity, and multi-interface, resulting in complex ultrasound propagation behavior. Consequently, medical ultrasound diagnosis of such huma organs have problems of poor image quality based on a simplified homogeneous model, difficulties in scan trajectory planning and posture control of ultrasonic transducer when scanning along a complex surface contour, and low efficiency in manual interpretation of two-dimensional images. The objective of this project aims at adaptive scan and three-dimensional ultrasound imaging of complex human structures. The critical scientific questions of this project include: (a) quantitative description of the spatial elasticity distribution of soft human organs and their impact on ultrasound propagation, (2) adaptive scan path planning and control for complex surfaces, (3) mapping and decoupling mechanisms between organ features and multi-dimensional ultrasound parameters. The following research activities will be implemented: (1) establishing an acoustic model that accurately reflects the interaction mechanism between ultrasound and organ through partitioned description of acoustic property distribution; (2) proposing an innovative scan strategy which uses a two-dimensional array probe to excite omnidirectional synthetic ultrasound beams, achieving full coverage scan with a fixed probe posture and a simple linear raster scan path. The unknown surface contour can also be reconstructed using surface reflection ultrasonic signals; (3) developing an ultrasonic ray tracing assisted imaging algorithm to achieve high-resolution three-dimensional imaging of human organs in full view; (4) combing the multi-dimensional acoustic parameters and machine learning algorithm for intelligent interpretation of human organ features to improve lesion detection sensitivity, quantitative sizing accuracy, and diagnosis automation level. Implementation of this project will provide theoretical guidance and new technical support for automated medical ultrasound scanning and imaging of human organs.
Contact points	Informal inquiries may be addressed to Prof. Shifeng Guo (sf.guo@siat.ac.cn) and Prof. Jian Yang (Jian.yang@nottingham.edu.cn).
PhD topic	**Advance electric machine controller design with artificial intelligence**
SUAT Supervisor	Prof. Weinong Fu
UNNC Supervisor(s)	Dr. John Xu
Short introduction & description of the PhD project	This PhD project will focus on the optimal control of electric motors for electric vehicles at the system level. Innovative predictive control models with machine learning, deep learning, and reinforcement learning should be investigated to enhance the performance of a given controller and make it more resilient, efficient, and robust for different machines with various operation scenarios. Hardware experiments will be applied to validate the proposed models and methodologies. The applicants should have a basic knowledge of electric motors and control theory.

Contact points	Informal inquiries may be addressed to Weinong Fu (fuweinong@suat-sz.edu.cn) and John Z. Xu (John.XU@nottingham.edu.cn).
PhD topic	**AI-driven IC design**
SUAT Supervisor	Huiyun Li
UNNC Supervisor(s)	Heng Yu
Short introduction & description of the PhD project	Modern AI and autonomous systems demand unprecedented computing power, challenging traditional monolithic chip design. We aim to develop reconfigurable design and evaluation methodologies for heterogeneous integrated chiplets. By integrating AI-driven IC design automation, processor architecture optimization, and reliable chiplet integration strategies.
Contact points	Informal inquiries may be addressed to Heng YU (heng.yu@nottingham.edu.cn) and Huiyun Li (huiyun.li@suat-sz.edu.cn, hy.li@siat.ac.cn).
PhD topic	**AI-Enabled Robotic Platform for Autonomous Materials Discovery**
SUAT Supervisor	Dr. Jing Jiang
UNNC Supervisor(s)	Dr. Xinan Chen
Short introduction & description of the PhD project	Advancing beyond conventional automation, this project pioneers a new generation of intelligent robotic systems that integrate cutting-edge AI with experimental robotics to revolutionize materials research. We aim to develop self-driven platforms capable of closed-loop experimentation-systems that autonomously design hypotheses, optimize experimental workflows, and interpret results through embedded scientific reasoning. The core innovation lies in equipping robots with context-aware AI agents trained to: 1. Synthesize domain knowledge by parsing literature and experimental databases 2. Generate hypothesis-driven experiments using physics-informed machine learning 3. Execute adaptive optimization through real-time spectral/structural feedback PhD candidates will work at the nexus of robotic automation, large-language model, and materials informatics to create robotic systems demonstrating PhD-level experimental intuition. The research challenges span causal reasoning in experimental design, and human-AI collaboration frameworks for laboratory environments.
Contact points	Informal inquiries may be addressed to Prof Xinan Chen (xinan.chen@nottingham.edu.cn) and Prof. Jing Jiang (j.jiang@suat-sz.edu.cn).
PhD topic	**Care Quality Assessment and Health Economic Analysis based on Electronic Health Record Data to Improve Quality and Efficiency of Care in Hospital Settings**
SUAT Supervisor	Professor Jinling Tang
UNNC Supervisor(s)	Professor Zhuo Chen

Short introduction & description of the PhD project	It is important to continue to improve the quality and cost-effectiveness of health care in hospitals in China, the predominant care provider, to tackle the consistent increasing disease burden and healthcare costs in China due to population aging and people's demand for high quality medical care. Care quality can be revealed by service variations and further assessed by comparing particular selected care items with guidelines or internal standards. Health economic analysis can be conducted by comparing the effectiveness of selected actual care items with costs required. The student will work with a collaborative team of SIAT and UNNC senior researchers to conduct studies based on data from electronic health records of some 5 million old hospital patients. The project is important for improving the quality and efficiency of hospital services. All analyses will be conducted with strict adherence to ethical and regulatory guidelines. Deliverables from the project will provide important evidence on quality and cost- effectiveness of selected care items with a long term goal of improving healthcare services and aiding future policymaking. The student will have opportunity to work with an international team including leading experts in evidence-based medicine and health economics.
Contact points	Informal inquiries may be addressed to Professor Zhuo Chen (Zhuo.Chen@nottingham.edu.cn) and Professor Jinling Tang (tangjinling@suat-sz.edu.cn).
PhD topic	**Cell-level aggregation and dimensional reduction of high-resolution spatial transcriptomic data, integrating ontologies and knowledge graphs along with qualitative spatial logics, to enable the exploration of complex cellular heterogeneity and spatial organization in tissue microenvironments.**
SUAT Supervisor	Prof. Jijun Tang
UNNC Supervisor(s)	Dr. Heshan Du
Short introduction & description of the PhD project	Although current spatial transcriptomics data can achieve subcellular-level resolution, they still suffer from blurred boundaries between cells. This project proposes leveraging contrastive learning to incorporate the spatial information from spatial transcriptomics data, in conjunction with qualitative spatial logics, ontologies, and knowledge graphs. By fully utilizing the transcriptomic expression characteristics at cell boundaries, we aim to reconstruct clearer boundaries between cells. With improved cell boundaries, it becomes possible to explore the complex cellular heterogeneity and spatial organization within tissue microenvironments more effectively.
Contact points	Informal inquiries may be addressed to Prof. Jijun Tang (tangjijun@suat-sz.edu.cn) and Dr. Heshan Du (Heshan.Du@nottingham.edu.cn).
PhD topic	**De Novo Molecular Design Against Given Targets Using Large Language Models**
SUAT Supervisor	Dr Yi Pan
UNNC Supervisor(s)	Dr Bencan Tang
Short introduction & description of the PhD project	De novo molecular design is a computational technique aimed at generating novel compounds with desirable property profiles from the ground up. It serves as a complement to virtual screening, where extensive virtual compound libraries are pregenerated, stored, and subsequently ranked as needed. The chemical space in virtual screening, encompassing all possible molecules, is vast. Although enumerated virtual screening libraries have become enormous by drug discovery standards, with many

	containing over a billion molecules, they represent only a minuscule portion of the entire chemical space. Furthermore, in evaluating libraries of such magnitude, methods may inevitably sacrifice predictive validity. By adopting a directed approach to generate compounds through de novo design, computational practitioners aim to navigate chemical space more effectively. This project aims to investigate the design and generation of de novo molecules using large language models. We will conduct a systematic review of machine learning and deep learning-based de novo molecular design studies to consolidate relevant evidence and identify critical gaps for future research. Additionally, we will explore the application of large language models in de novo molecular design. The student involved in this project will gain expertise in machine learning-based molecular design research and the analysis of biomedical data. They will develop skills in conducting systematic literature reviews, study design, statistical programming, and data analysis. Support will be provided for the student to publish peer-reviewed papers as the lead author during their Ph.D. The training will cover artificial intelligence-based drug design methods, advanced statistics, programming, and academic writing. The idea candidate should hold a Master's degree in Pharmaceutical Sciences, Computer Science, Mathematics, or Biomedical Engineering. Proficiency in Python programming, PyTorch, AutoDock, and Maestro is essential.
Contact points	Informal inquiries may be addressed toDr Yi Pan (panyi@suat-sz.edu.cn). and Dr Bencan Tang (Bencan.Tang@nottingham.edu.cn).
PhD topic	**Design of High Entropy Metal Catalysts for Efficient Electrochemical CO_2 Reduction**
SUAT Supervisor	Dr. Xiaolong Zhang
UNNC Supervisor(s)	Dr. Mengxia Xu
Short introduction & description of the PhD project	The escalating levels of carbon dioxide (CO_2) in the atmosphere have become a critical global concern, driving the urgent need for sustainable strategies to mitigate its impact. Among the various strategies, the electrochemical CO_2 reduction reaction (CO_2RR) stands out as a promising approach, capable of converting CO_2 into valuable chemicals and fuels. This process not only helps close the carbon cycle but also reduces reliance on fossil fuels. However, the widespread adoption of CO_2RR technology is hindered by the lack of highly efficient and selective catalysts. High entropy alloys (HEAs) have recently emerged as a groundbreaking class of materials with unique properties, making them attractive candidates for CO_2RR catalysts. Composed of five or more principal elements in near-equimolar ratios, HEAs forms a single-phase solid solution with high configurational entropy. This unique structure imparts HEAs with a range of desirable properties, including superior catalytic activity, selectivity, and stability, which are critical for advancing CO_2RR technology. This PhD project aims to design and develop high entropy metal catalysts tailored for efficient electrochemical CO_2 reduction. The research will focus on four key aspects: Catalyst Design and Synthesis, Catalyst Characterizations, Electrochemical Performance Evaluation and Mechanistic Studies. Through these efforts, the project seeks to address the current limitations in catalysts performance and unlock the full potential of HEAS for CO_2RR. The successful completion of this PhD project is expected to make significant contributions to the field of electrochemical CO_2 reduction. By developing high performance, selective HEA catalysts, this research will pave the way for the efficient conversion of CO_2 into

	valuable products, thereby supporting the transition towards a sustainable and carbon-neutral energy future.
Contact points	Informal inquiries may be addressed to Dr. Xiaolong Zhang (xl.zhang@siat.ac.cn) (zhangxiaolong@suat-sz.edu.cn) and Dr. Mengxia Xu (mengxia.xu@nottingham.edu.cn).
PhD topic	**Efficient purification of engineered exosomes based on microfluidic technology and the treatment of metabolic and reproductive diseases**
SUAT Supervisor	Jian Zhang
UNNC Supervisor(s)	Yong REN
Short introduction & description of the PhD project	Engineered exosomes are the sort of exosome whose surface or internal molecules are modified with various methods to enhance their ability as the drug delivery system and reduce the drug-load loss rate and treatment-related adverse effects. The most common techniques include chemical modification, genetic manipulation, physical methodology, and microfluidic technology, which has its own benefits and disadvantages. The studies of engineered exosomes have been widely investigated worldwide, while many obstacles remain to overcome. By targeting specific modification on engineered exosomes, this project will focus on the engineered exosomes with three primary purposes, (i) improve the production of the modified engineered exosomes with microfluidic platform, (ii) enhance the targeting accuracy of engineered exosomes, (iii) expand the application of engineered exosomes in various diseases with minor adverse effects.
Contact points	Informal inquiries may be addressed to Prof Jian Zhang (jian.zhang@siat.ac.cn) and Prof Yong REN (yong.ren@nottingham.edu.cn).
PhD topic	**Hydrogel sustained-release cerium dioxide nanodrugs designed for the treatment of inflammatory diseases**
SUAT Supervisor	Dr. Yang LI
UNNC Supervisor(s)	Dr. Yong Ren
Short introduction & description of the PhD project	Inflammatory diseases, especially chronic inflammation, normally requires sustained treatment for ideal therapeutics. The sustained-release drugs can reduce the number of repeated treatment and could be designed as the best tool for treating chronic inflammatory disease, for instance rheumatoid arthritis. Hydrogel, a kind of sustained-release drug carrier with high biological safety, has been used in clinical practice. Cerium oxide nanomaterials are reported as potential nanodrug for anti-ROS and anti-inflammation. In this direction, this project is about to apply hydrogel and cerium dioxide chronic inflammatory diseases treatment. The following topics will be developed: 1) the preparation and synthesis of environment responsive hydrogels; 2) cerium dioxide nanomaterials synthesis and their surface modification for best anti-inflammation property. 3) combinational treatment strategy for chronic inflammation therapeutics. This project aims to training an interdisciplinary expert in material science and biology science.
Contact points	Informal inquiries may be addressed to Prof. Yang Li (yang.li@siat.ac.cn) and Prof. Yong Ren (Yong.Ren@nottingham.edu.cn).
PhD topic	**Leveraging Large Models for Video Analysis and Understanding**

SUAT Supervisor	Prof. Dr. Song Wang
UNNC Supervisor(s)	Assoc. Prof. Dr. Kian Ming Lim
Short introduction & description of the PhD project	Recent advancements in large-scale models, including video generation models and visual-language models, have created significant opportunities to enhance video analysis and understanding. These models excel at capturing intricate spatiotemporal patterns and generating rich representations of visual and contextual information, making them invaluable tools for addressing challenges in video-based domains such as human activity recognition and related tasks. This PhD project aims to investigate how large models can contribute to developing more effective approaches for video analysis. By leveraging these models, the research will focus on extracting meaningful features, learning robust representations, and optimizing applications for specific tasks. Additionally, the project will explore strategies to adapt these models to diverse real-world scenarios, addressing challenges such as variability in human activities, environmental contexts, and video quality. A key aspect of this research involves integrating model-generated insights into existing workflows to enhance the training of deep neural networks for downstream tasks. Comprehensive evaluation frameworks will be designed to rigorously assess the impact of these large models on tasks such as human activity recognition, behavior prediction, and anomaly detection. This research has the potential to drive significant advancements in video analysis techniques, paving the way for robust, scalable, and adaptable solutions across domains like surveillance, healthcare, and autonomous systems. By harnessing the capabilities of large-scale models, the project aims to address both theoretical and practical challenges, offering innovative approaches to understanding complex video data.
Contact points	Informal inquiries may be addressed to Prof. Dr. Song Wang (wangsong@suat-sz.edu.cn) and Dr. Kian Ming Lim (Kian-Ming.Lim@nottingham.edu.cn).
PhD topic	**Light-driven carbon fixation**
SUAT Supervisor	Prof. Chao Zhong
UNNC Supervisor(s)	Dr Wai Siong CHAI
Short introduction & description of the PhD project	Material-microorganism hybrid based artificial photosynthesis combines the broad absorption of semiconductors and the catalytic specificity of biosystems. They could achieve high-efficiency light-driven fixation of carbon dioxide to long-chain molecules. The impact to environment was still not fully understood, which hindered the practical usage and government decisions. So we need to calculate their LCA (life cycle analysis) and asses their environmental impact. Based on this background, this project will focus on three dimensions (i) set up the material-microorganism hybrid systems; (ii) test the efficiency for light to chemical conversion; and (iii) perform the LCA. The project would contribute to carbon neutral and point the way for a sustainable future.
Contact points	Informal inquiries may be addressed to Dr Xinyu Wang (xy.wang3@siat.ac.cn).

PhD topic	**Medical Image Processing and Artificial Intelligence**
SUAT Supervisor	Prof Zhanli Hu
UNNC Supervisor(s)	Prof Guoping Qiu
Short introduction & description of the PhD project	Artificial intelligence technology has gained widespread popularity in various fields. We expect to carry out medical image processing based on artificial intelligence technology, discover new imaging methods and means, and conduct research in combination with clinical data and imaging equipment. The team focuses on upstream and downstream ecological collaboration in medical imaging, and has carried out in-depth scientific research cooperation with leading high-end medical device companies and dozens of tertiary hospitals across the country, geared towards solving practical problems in the medical industry and medical clinics. Relevant technologies have been translated to leading high-end medical device companies and landed in domestic PET/MR, PET/CT and CT products. During his PhD, he expects to develop novel artificial intelligence imaging technologies, and he can choose from the following directions: 1) Intelligent image reconstruction technologies for PET/MR, PET/CT, and CT devices; 2) Intelligent diagnosis and analysis technologies for clinical medical images; 3) Intelligent prediction of disease.
Contact points	Informal inquiries may be addressed to Prof Zhanli Hu (zl.hu@siat.ac.cn) and Prof Guoping Qiu (guoping.qiu@nottingham.ac.uk).
PhD topic	**Medication reduction and its cost-effectiveness in patients with type 2 diabetes**
SUAT Supervisor	Dr Zhirong Yang
UNNC Supervisor(s)	Prof Zhuo Chen
Short introduction & description of the PhD project	Polypharmacy is common in older adults, especially in those with multiple chronic diseases. Previous studies showed that the prevalence of polypharmacy was more than 60% in older people with type 2 diabetes and it has been associated with adverse health outcomes, including hospitalization and death. However, it is unclear whether medication reduction in these patients could help address the health problems raised from polypharmacy, and if so, whether this could be cost-effective. In this project, we will examine these questions. We will systematically review randomized controlled trials and observational studies to summarize available relevant evidence and identify the important gaps for future research. We will use real-world clinical data from Shenzhen and the UK to assess the potential effectiveness and safety of medication reduction in patients with type 2 diabetes. We may also conduct cost-effectiveness analysis. The student will gain experience in pharmacoepidemiology and pharmacoeconomics research using large-scale real-world data. The student will develop skills in conducting systematic literature reviews, study design, statistical programming, data analysis and academic writing. Relevant training will be provided. The student will be supported to publish peer-reviewed papers as the lead author during the PhD. The ideal candidate should have a Master degree in epidemiology, data science, public health, or clinical medicine. Proficiency with STATA, R or SAS is essential.

Contact points	Informal inquiries may be addressed to Dr Zhirong Yang (yangzhirong@suat-sz.edu.cn) and Prof Zhuo Chen (Zhuo.Chen@nottingham.edu.cn)
PhD topic	**Multimodal Medical Image Analysis and Intelligent Diagnosis Based on Deep Learning**
SUAT Supervisor	Assoc. Prof. Na Zhang
UNNC Supervisor(s)	Assoc. Prof. Dr. Kian Ming Lim
Short introduction & description of the PhD project	Multimodal medical image processing is a critical component in the field of contemporary medical diagnostics. It involves the integration of image data from different imaging technologies such as PET, MR, and CT, providing more comprehensive information on biological tissues. This integration enhances the accuracy of image analysis, leading to more refined disease diagnosis and monitoring. Artificial intelligence technologies, especially deep learning techniques that have emerged in recent years, offer efficient and accurate methods for the processing and analysis of multimodal medical images. We are interest in developing new technologies and methods for multimodal medical image diagnosis and treatment based on artificial intelligence. The team maintains deep collaborative relationships with leading medical imaging equipment manufacturers and various medical institutions. They are dedicated to bridging the gap between AI research outcomes in medical image processing and practical clinical applications, with the goal of addressing real-world problems in the healthcare industry. Several patents have been transferred to medical imaging equipment manufacturers and have been implemented in domestic MR and PET/MR products. During the PhD period, students can choose from the following research directions: 1) Multimodal intelligent image reconstruction techniques for multi-sequence MR and PET/MR; 2) Medical intelligence diagnostic and analysis combining natural language with medical images; 3) Disease intelligence prediction methods utilizing multimodal technologies.
Contact points	Informal inquiries may be addressed to Prof. Na Zhang (na.zhang@siat.ac.cn) and Dr. Kian Ming Lim (Kian-Ming.Lim@nottingham.edu.cn).
PhD topic	**Nanomaterial-Based Strategies for Combating Chronic Infections** **Nanomaterials to combat chronic infections**
SUAT Supervisor	Prof. Guocheng Wang
UNNC Supervisor(s)	Prof. Enrico Marsili
Short introduction & description of the PhD project	Chronic infections, such as diabetic foot ulcers and osteomyelitis, represent a significant and growing global health challenge. The rise of antibiotic resistance, coupled with the formation of resilient biofilms and impaired healing, contributes to the persistence and severity of these infections. This results in prolonged patient suffering, reduced quality of life, and a substantial increase in healthcare costs, as conventional antibiotic treatments often prove ineffective. Nanomaterials, with their unique physicochemical properties, offer a promising avenue for developing innovative and more effective therapies for chronic infections. These properties include enhanced drug delivery and targeting, controlled release of therapeutic agents, and the potential to modulate the inflammatory microenvironment.

	This PhD project focuses on developing novel multifunctional nanomaterials specifically designed to address the complex challenges posed by chronic infections. Utilizing either nanozyme or antibiotic nanoformulation approaches, the project will explore the rational design and synthesis of nanomaterials that combine enhanced antibacterial activity, targeted anti-inflammatory action, and robust pro-regenerative capabilities, while simultaneously mitigating the development of antibiotic resistance. The efficacy of these multifunctional nanomaterials in eradicating biofilms, modulating the inflammatory response, and promoting tissue regeneration will be rigorously investigated using a range of relevant in vitro and in vivo models of chronic infection. Ultimately, this project aims to create targeted, nanomaterial-based therapies that offer superior efficacy and reduced side effects compared to current treatments for chronic infections, thereby significantly improving patient outcomes and driving innovation in the field of nanomedicine.
Contact points	Informal inquiries may be addressed to Prof. Guocheng Wang (gc.wang@siat.ac.cn) and Prof. Enrico Marsili (enrico.marsili@nottingham.edu.cn).
PhD topic	**Spatiotemporal Reasoning over Knowledge Graphs**
SUAT Supervisor	Dr. Ling Yin
UNNC Supervisor(s)	Dr. Heshan Du
Short introduction & description of the PhD project	A knowledge graph is often used to represent real-world objects and their relationships. Spatiotemporal reasoning over knowledge graphs has various applications in different domains, including urban management, transportation, epidemic control, tourism and so on, which involves complex spatiotemporal relationships. The reasoning over knowledge graphs includes deductive reasoning and inductive reasoning. Deductive reasoning is based on first-order logic or description logic. To reason with spatial and temporal knowledge in knowledge graphs, qualitative spatial and temporal reasoning are required. This project aims to develop spatiotemporal reasoning methods and apply them to real-world knowledge graphs to obtain new knowledge and track how new knowledge is derived from existing knowledge. This project is funded by National Natural Science Foundation of China and the Key R&D Program of the Ministry of Science and Technology of China.
Contact points	Informal inquiries may be addressed to Dr. Ling Yin (yinling@siat.ac.cn) and Dr. Heshan Du (Heshan.Du@nottingham.edu.cn).
PhD topic	**Study on the carbon reduction and carbon sequestration potential of urban green infrastructure**
SUAT Supervisor	Dr.Liqun Sun
UNNC Supervisor(s)	Dr.Wu Deng
Short introduction & description of the PhD project	Urban green infrastructure, such as urban forests, parks, street trees, and green roofs, plays a crucial role in providing ecosystem services and is essential for the sustainable development of cities. In the context of global climate change, cities, as major hubs of carbon emissions, face immense pressure to reduce emissions. Urban green infrastructure not only directly absorbs carbon, effectively reducing the concentration of carbon dioxide in the atmosphere, but also contributes indirectly to carbon mitigation by regulating the surrounding environmental temperature, which in turn reduces energy consumption in buildings. This is significant for alleviating

	the urban heat island effect, lowering energy use, and improving the quality of life for urban residents. This PhD project will focus on comprehensively evaluating the ecosystem services of urban green infrastructure, exploring the carbon reduction and carbon sequestration potential under different scenarios. By analyzing the configuration patterns and spatial distribution of different types of buildings and their surrounding green spaces, the project seeks to provide scientific strategies for urban carbon neutrality planning and contribute to the construction of an ecological civilization."
Contact points	Informal inquiries may be addressed to Dr. SUN Liqun (lq.sun@siat.ac.cn) and Dr. Wu Deng (Wu.Deng@nottingham.edu.cn).
PhD topic	May choose from one of the two following: **1. The online graph coloring problem and its applications in scheduling, cloud computing, and wireless communication.** **2. The AI based dynamic transportation scheduling and its applications in trucking, drone logistics, and AGV operations.**
SUAT Supervisor	Prof. Yaqiao Li
UNNC Supervisor(s)	Prof. Xinan Chen
Short introduction & description of the PhD project	1. Graph coloring models many real-life scenarios from conflict-avoiding scheduling to spectrum design problems in wireless communications. While simple greedy algorithm can decide whether a graph can be colored by two colors, it is NP-complete to decide whether a graph is 3-colorable. In today's applications, many data are coming in real time and decisions need to be made real time and irrevocable, with the uncertainty of the future data. To design efficient algorithm for handling such computational problems involving incomplete-information, we have to study the online version of graph coloring. Currently, researchers have good understanding of online coloring 2-colorable graphs, but only partial understanding on 3-colorable graphs. This project aims to: (i) improve our theoretical understanding of online coloring 3-colorable graphs; (ii) study its applications such as in scheduling, cloud computing, wireless communication, etc. 2. In today's fast-paced world, transportation dynamic scheduling plays a vital role across various sectors, including truck delivery, drone logistics, AGVs, and more. The increasing complexity and uncertainty of real-time data in transportation systems have rendered traditional static mathematic based scheduling methods, inadequate for meeting the demands of a dynamic environment with uncertainty. To address this challenge, this project aims to: (i) enhance our theoretical understanding of dynamic transportation scheduling by combining Artificial Intelligence with mathematical methods; (ii) study its applications in trucking, drone logistics, warehouse AGV operations, etc., with a focus on improving current efficiency and performance.
Contact points	Informal inquiries may be addressed to Prof. Xinan Chen (xinan.chen@nottingham.edu.cn) and Prof. Yaqiao Li (liyaqiao@suat-sz.edu.cn).