UNNC – SUAT Doctoral Training Partnership

It's essential that you have contacted the potential 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	**Research on Synergistical Assessment and Interaction Mechanisms of Neuro-Muscular and Cardiopulmonary-Circulatory Functions After Stroke Based on Multimodal Information Fusion**
SUAT Supervisor	Prof. Peng Fang
UNNC Supervisor(s)	Prof. Ying Weng
Short introduction & description of the PhD project	Motor impairment (paralysis) is one of the common functional deficits in stroke survivors. Patients with paralysis not only experience motor dysfunction due to impaired neuromuscular function, but also suffer from cardiopulmonary decline caused by prolonged bed rest and related complications. Human motor function relies on the dynamic coupling among nervous, muscular, and cardiopulmonary systems, and brain-cardiopulmonary synergistical interventions represent an important approach to improving motor rehabilitation outcomes in patients. Conducting a synergistical assessment of neuromuscular and cardiopulmonary function after stroke and elucidating their interaction mechanisms are fundamental for establishing brain-cardiopulmonary synergistical interventions. This project addresses the motor rehabilitation needs of stroke patients, focusing on two major dimensions on: (i) integrating brain-computer interface technologies to acquire multimodal physiological information, including electrophysiological (EEG, EMG, ECG), hemodynamic (blood flow, oxygenation, etc.), and cardiopulmonary (respiratory metabolism, cardiac output, etc.) information, and developing an AI-based assessment model to achieve synergistical assessment of neuromuscular and cardiopulmonary functions; (ii) constructing a multidimensional function coupling model based on multimodal physiological data and synergistical assessment outputs, to explore the patterns of neuromuscular and cardiopulmonary functional changes and their interaction mechanisms after stroke.

Contact points	Informal inquiries may be addressed to Prof. Ying Weng (ying.weng@nottingham.edu.cn) and Prof. Peng Fang (peng.fang@siat.ac.cn).
PhD topic	**Flexible interfacial device for human-machine interactions**
SUAT Supervisor	Tai Yanlong
UNNC Supervisor(s)	Xu Zhuang
Short introduction & description of the PhD project	As human-machine interaction technology advances towards intelligence and naturalness, traditional rigid interface materials (such as metals and silicon-based devices) are difficult to meet the long-term stable interaction requirements due to issues like mechanical property mismatch and insufficient biocompatibility. Flexible materials (such as hydrogels and conductive polymers), with their tissue-like softness, stretchability and biocompatibility, have become the key to breaking through this bottleneck. We aim to focus on the innovative design of flexible human-machine interface materials and interaction devices, aiming to address core challenges such as energy autonomy, long-term stability and adaptive response, and promote their application in fields such as medical rehabilitation, intelligent robots and brain-computer interfaces. Welcome to join us to forward this direction together.
Contact points	Informal inquiries may be addressed to Xu Zhuang (zhuang.xu@nottingham.edu.cn) and Tai Yanlong (yl.tai@siat.ac.cn).
PhD topic	**Scene Understanding for Service Robotics: from Segmentation to Affordance Learning**
SUAT Supervisor	Zhengkun Yi
UNNC Supervisor(s)	Chin Poo Lee
Short introduction & description of the PhD project	The project focuses on advancing robot scene understanding and affordance learning through vision foundation models (VFMs) and multimodal perception. While recent VFMs such as SAM show strong generalization in segmentation, they remain limited in handling fine-grained 3D scenes and robotic interaction tasks. This research aims to (i) adapt and enhance VFMs for robust 2D–3D segmentation in complex environments, (ii) integrate affordance learning to enable robots to recognize actionable object regions, and (iii) explore sequential affordance reasoning for multi-step, goal-directed manipulation. By connecting perception, reasoning, and interaction, the project seeks to develop a unified framework for intelligent robots capable of understanding and acting effectively in unstructured real-world environments.
Contact points	Informal inquiries may be addressed to Prof Zhengkun Yi(zk.yi@siat.ac.cn) and Dr Chin Poo Lee (Chin-Poo.Lee@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)	Asst. Prof. Fazl Ullah (Khan)
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 Prof Fazl Ullah (Khan) (Fazl.Ullah@nottingham.edu.cn)
PhD topic	**AI-based Medical Imaging and Analysis**
SUAT Supervisor	Prof. Yanjie Zhu
UNNC Supervisor(s)	Prof. Ying Weng
Short introduction & description of the PhD project	Artificial intelligence has become a transformative force in medical imaging and medical image analysis, where data acquisition complexity, long scan times, and high-dimensional image characteristics pose persistent challenges. This PhD project aims to develop AI-based MR imaging and analysis methods to enable faster, more accurate, and more informative imaging for both clinical and research applications. Building on this background, the project will focus on integrating advanced machine learning and deep learning techniques with MR physics, image reconstruction, and image analysis. Key research topics include intelligent MR image reconstruction from highly undersampled k-space data, AI-driven MR image processing, and automated interpretation of MR images for disease diagnosis and prognosis. By jointly leveraging large-scale clinical MR data and cutting-edge imaging hardware, the project seeks to explore new MR imaging paradigms and to improve imaging efficiency, robustness, and diagnostic reliability.
Contact points	Informal inquiries may be addressed to Prof. Ying Weng (Ying.Weng@nottingham.edu.cn) and Prof. Yanjie Zhu (yj.zhu@siat.ac.cn).
PhD topic	**Intelligent Diagnosis Foundation Model Based on Distributed Low-Field Magnetic Resonance Imaging**
SUAT Supervisor	Prof. Yihang ZHOU
UNNC Supervisor(s)	Prof. Ying WENG
Short introduction & description of the PhD project	This doctoral research confronts the pressing challenge of limited MRI accessibility in China's primary healthcare, where high costs and technical complexity restrict the deployment of high-field systems. It investigates a novel, clustered application paradigm anchored by low-field MRI devices enhanced with trustworthy artificial intelligence. The core objectives are to develop methods for significant image quality improvement at low field strengths and to architect a scalable system for distributed deployment and intelligent interpretation via regional medical data platforms. By decoupling advanced diagnostic performance from prohibitive hardware costs, this work aims to establish a feasible model for the widespread and equitable adoption of MRI technology.

Contact points	Informal inquiries may be addressed to Prof. Zhou (yh.zhou2@siat.ac.cn) and Prof. Weng (Ying.Weng@nottingham.edu.cn).
PhD topic	**Autonomous cellular surgery system**
SUAT Supervisor	Prof. Haifeng Xu
UNNC Supervisor(s)	Prof. Weihua Meng
Short introduction & description of the PhD project	Autonomous cellular surgery systems have gained increasing attention in recent years as microrobotics and intelligent automation open new possibilities for operating at the single-cell scale. This concept provides an opportunity to move beyond manual micromanipulation toward precise cellular interventions, where tiny robots can act as "surgical tools" inside microscale environments. In fact, cell-scale robotic surgery requires the integration of external-field actuation and AI-driven perception to cope with uncertain microfluidic dynamics, limited visibility, and strict safety constraints for living cells. This PhD project will focus on two major dimensions: (1) micro robotic actuation and control (e.g., designing cell-sized robots and achieving accurate motion using magnetic fields), and (2) vision-AI-enabled autonomy for single-cell operations (e.g., real-time cell tracking, task planning, and autonomous execution of surgery procedures).
Contact points	Informal inquiries may be addressed to Haifeng (hf.xu@siat.ac.cn) and Weihua Meng (Weihua.Meng@nottingham.edu.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	**An Intelligent Computational Model for Early Detection of Alzheimer's Diseases**
SUAT Supervisor	Prof Zhanli Hu
UNNC Supervisor(s)	Assoc. Prof. Kian Ming Lim
Short introduction & description of the PhD project	This project aims to use Artificial intelligence (AI) in developing efficient and reliable computational models for Alzheimer's disease (AD) prediction. AD is a neurodegenerative chronic disease that is one of the leading causes of dementia, an expensive disease all over the World reported in alz.org. Around 50 million people

	are affected by AD around the globe and the number is increasing as reported by WHO. In this regard, researchers have made lots of efforts to establish a system that can identify the disease's mechanism and causes, as well as prevent the disease from spreading. However, the high dimension with a small number of samples in analyzing brain images poses a significant barrier in research. In addition, due to the limited accuracy and explainability of existing techniques, Alzheimer's detection and progression prediction are still openly challenging problems. To overcome these issues, AI-based computation models are needed to be designed for the detection of AD in the early stage. In this project, the proposed system will use MRI and CT Scan images as well as sequential information of DNA, RNA, and some other proteins as information or patterns. The proposed systems will use AI algorithms for classification and detection.
Contact points	Informal inquiries may be addressed to Prof Zhanli Hu (zl.hu@siat.ac.cn) and Dr. Kian Ming Lim (Kian-Ming.Lim@nottingham.edu.cn).
PhD topic	**Deep Learning for Medical Image Analysis**
SUAT Supervisor	Prof. Dr. Wenjian Qin
UNNC Supervisor(s)	Assoc. Prof. Dr. Kian Ming Lim
Short introduction & description of the PhD project	Medical imaging plays an important role in modern healthcare, enabling the visualization and diagnosis of a wide range of medical conditions. The increasing volume and complexity of medical images, such as X-rays, MRI, CT scans, and pathological images, have presented both challenges and opportunities for automated analysis. Deep learning, a branch of artificial intelligence, has demonstrated remarkable success in addressing these challenges, offering the potential to significantly improve diagnostic accuracy, efficiency, and patient care. This PhD project focuses on proposing state-of-the-art deep learning techniques to medical image analysis. The research will explore the use of large-scale models to extract intricate patterns and features from complex medical images. It will also investigate a range of strategies, such as optimization techniques, domain-specific model adaptations, and multimodal approaches that integrate imaging data with other relevant sources, to address various tasks including segmentation, classification, and anomaly detection. By addressing key challenges, such as limited annotated data, variability in imaging quality, and the interpretability of deep learning models, this project aims to deliver robust, scalable, and generalizable solutions for medical image analysis. The outcomes will contribute to advancing AI-driven diagnostics and improving workflows in clinical and research settings, ultimately paving the way for improved precision medicine and enhanced clinical workflows.
Contact points	Informal inquiries may be addressed to Dr. Wenjian Qin (wj.qin@siat.ac.cn) and Dr. Kian Ming Lim (Kian-Ming.Lim@nottingham.edu.cn).
PhD topic	**Manipulation of Vascular Interventional Robot**
SUAT Supervisor	Prof. Lei WANG
UNNC Supervisor(s)	Dr Boon Giin Lee
Short introduction & description of the PhD project	This project focuses on the manipulation and force-sensing control of vascular interventional robots used in minimally invasive procedures. The study aims to enable safe, precise, and intuitive robot-assisted navigation of catheters and guidewires within complex vascular environments. By integrating multi-modal force sensing, real-time signal processing, and advanced control algorithms, the research seeks to accurately perceive tool–vessel interaction forces and provide effective

	force feedback to the operator or autonomous controller. This work addresses key challenges such as weak force detection, nonlinear friction, and time-varying vascular constraints, with the ultimate goal of improving surgical accuracy, reducing tissue damage, and enhancing the safety and efficiency of vascular interventional procedures.
Contact points	Informal inquiries may be addressed to Lei WANG (wang.lei@siat.ac.cn) and Boon Giin Lee (BOON-GIIN.LEE@nottingham.edu.cn).
PhD topic	**Medical Imaging and Medical Image Analysis with Artificial Intelligence**
SUAT Supervisor	Prof. Haifeng Wang
UNNC Supervisor(s)	Prof. Ying Weng
Short introduction & description of the PhD project	In order to detect neurological disorders at an early stage, a wide variety of imaging techniques have been developed. However, these techniques also bring the huge amount of medical data. So, it is necessary to study high-performance and automatic algorithms to reconstruct the images and processing the large amount of medical data. Based on this background, the PhD project will focus on develop medical image processing technologies based on artificial intelligence and discover new medical imaging methods for the neurological doctors can develop individualized treatment plans with a high chance of cure. Moreover, these schemes in clinical neurological applications should balance the trade-offs between the accuracy and the efficiency. And the candidate can choose from the following Intelligent directions: 1) image reconstruction for MRI devices; 2) diagnosis and analysis for clinical neurological medical images; 3) prediction of disease.
Contact points	Informal inquiries may be addressed to Prof. Ying Weng (Ying.Weng@nottingham.edu.cn) and Prof. Haifeng Wang (hf.wang1@siat.ac.cn).
PhD topic	**Construction of a Systematic Biological Research Framework for Multi-omics Integration, Cross-scale Modelling, 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 pro.Yang Min (min.yang@siat.ac.cn).
PhD topic	**Study on High-precision Thermal Control at the Micro and Nanoscale with High-performance Computing**
SUAT Supervisor	Prof. Rongliang Chen

UNNC Supervisor(s)	Dr. Yong Shi
Short introduction & description of the PhD project	Temperature nonuniform is a critical issue in many micro and nanoengineering applications, e.g., chip manufacture, and requires a high-precision thermal control. Under these circumstances, gas is often used as an available cooling medium; however, its thermal characteristics at such small scales manifests strong noncontinuum effects, and cannot be accurately described the conventional theory at the Navier-Stokes order. This brings formidable challenges to the corresponding thermal design and cooling setup, in particular when high control-accuracy is required. In this project, we study gas flow and heat transfer confined in such micro/nanostructures. We aim at proposing robust and effective kinetic-based models to describe gas cooling behaviours in a wide range of Knudsen numbers. In combination with different micro and nanoscale geometries, the corresponding parallel algorithms will also be developed, and validated and tested on supercomputers. The numerical results in this project will deepen our understanding on gas flow and heat transfer at the micro and nanoscale, and provide valuable insights into the design and optimization of high-sensitivity thermal control means for today's micro and nano manufacturing processes.
Contact points	Informal inquiries may be addressed to Dr. Yong Shi (yong.shi@nottingham.edu.cn) and Prof. Rongliang Chen (rl.chen@siat.ac.cn).
PhD topic	**Collaborative Computing and Resource Optimization for AI Inference Networks**
SUAT Supervisor	Prof. Yong Zhang
UNNC Supervisor(s)	Prof. Ruibin Bai
Short introduction & description of the PhD project	With the rapid deployment of large-scale artificial intelligence applications, next-generation Internet infrastructures are increasingly required to support collaborative AI inference under heterogeneous, resource-constrained, and highly dynamic network environments. In particular, the tight coupling between AI model execution, network resource allocation, and system-level coordination poses significant challenges to efficient, reliable, and secure inference services. This PhD project aims to investigate collaborative computing and optimization techniques for AI inference networks, focusing on task decomposition, lightweight model deployment, and resource-aware scheduling across cloud–edge–device environments. The research will explore mechanisms for decomposing complex AI inference tasks and enabling their efficient execution over edge nodes with limited computational capabilities, while maintaining high performance, low latency, and reliable data synchronization. A key research direction is the development of multi-dimensional resource perception and optimization models for inference networks. By jointly considering channel quality, network congestion, system uncertainty, and security constraints, the project will design intelligent resource allocation and scheduling algorithms to achieve integrated deployment and coordinated management of computing and networking resources. The project will further study adaptive optimization strategies to support collaborative inference under varying workloads and network conditions. By combining theoretical modeling, algorithm design, and system-level evaluation, this research is expected to provide fundamental methods and practical solutions for collaborative AI inference in next-generation Internet architectures, contributing to scalable, efficient, and trustworthy intelligent networked systems.
Contact points	Informal inquiries may be addressed to Prof. Yong Zhang (zhangyong@siat.ac.cn) and Prof. Ruibin Bai (Ruibin.BAI@nottingham.edu.cn).
PhD topic	**AI-aided control for complex spatiotemporal networks**

SUAT Supervisor	Dr. Ling Yin
UNNC Supervisor(s)	Dr. Huan Jin
Short introduction & description of the PhD project	Complex spatiotemporal network control is of significance for many areas such as epidemic control and transportation control. AI appoaches such as Reinforcement learning (RL) are suggested as useful tools to address these issues. However, there are some challenges to deal with a complex spatiotemporal network such as the representation learning of complex spatiotemporal environment, uncertainty of environment in real-world situation, the large discrete action space problem, the game and coordination between multiple agents, the complex spatiotemporal dynamics embedded within the networks and so on. This project aims to develop approaches to address the above challenges and apply these AI-aided control methods to real-world problems such as epidemic control and transportation control. 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. Huan Jin (Huan.Jin@nottingham.edu.cn).
PhD topic	**Artificial Intelligence for Explainable Medical Imaging and Multimodal Clinical Prediction**
SUAT Supervisor	Dr. Dan WU
UNNC Supervisor(s)	Dr. Chin Poo Lee
Short introduction & description of the PhD project	Artificial intelligence (AI) has rapidly reshaped modern healthcare by enabling more accurate medical image interpretation and data-driven clinical decision-making. In particular, advances in deep learning and foundation models have demonstrated strong potential in extracting high-level representations from complex imaging modalities such as CT, MRI, ultrasound, and X-ray. However, despite impressive predictive performance, many AI systems remain limited by their “black-box” nature, which hinders clinical trust, regulatory deployment, and real-world adoption in high-stakes medical environments. At the same time, clinical outcomes are rarely determined by imaging information alone. Patient prognosis and risk stratification often depend on the joint evidence across heterogeneous sources, including imaging, physiological signals, laboratory tests, electronic health records (EHR), and demographic information. This creates a critical opportunity for developing explainable multimodal prediction models that can integrate medical imaging with clinical variables, provide transparent reasoning, and support personalized clinical decision-making. This PhD project will focus on two major dimensions: (i) explainable medical imaging intelligence, aiming to build interpretable models that highlight clinically meaningful patterns and generate faithful explanations aligned with radiological knowledge; and (ii) multimodal clinical prediction, aiming to fuse imaging-derived representations with structured and unstructured clinical data to improve outcome forecasting, risk stratification, and decision support. By bridging representation learning, multimodal fusion, and explainable reasoning, this research ultimately seeks to advance trustworthy AI methodologies that are both clinically actionable and deployable in real-world healthcare systems.
Contact points	Dr. Dan WU (dan.wu@siat.ac.cn) and Dr. Chin Poo Lee (Chin-Poo.Lee@nottingham.edu.cn).
PhD topic	**Turbulence-robust mechanic design and high-precision motion control for autonomous underwater vehicles**

SUAT Supervisor	Sanming Song
UNNC Supervisor(s)	Adam Rushworth
Short introduction & description of the PhD project	Underwater robots are essential for safety monitoring, inspection, and hydrographic surveying in highly dynamic waters. Near nuclear power plants, currents can be extreme and strongly time-varying due to cooling-water intake/outfall jets, thermal discharge plumes, and tidal forcing in adjacent coastal zones. Flow velocities may fluctuate from roughly 1 to 10 knots, posing major challenges to stable navigation, precise hovering, and reliable perception under strong disturbances and complex optical/acoustic conditions. Comparable difficulties also occur in inland rivers, where flow speed varies significantly across sections depending on upstream inflow, terrain gradients, and channel width, leading to spatially non-uniform currents and turbulence. To ensure robust operation across this wide range of flow regimes, this project proposes an integrated technical framework that combines anti-current mechanical design, high-precision navigation and control, and intelligent optical–acoustic environmental perception. The goal is to enable underwater robotic platforms to maintain stability, accuracy, and situational awareness in strong currents, turbulent flow fields, and multi-path optical/acoustic interference. Key research directions include (but are not limited to): (1) turbulence-robust control for AUVs to handle unsteady flow disturbances, model uncertainty, and fluctuating external forces/moments in jet- and tide-dominated environments; (2) high-precision control over a wide speed range, spanning low-speed maneuvering to high-current transit via gain scheduling and adaptive/robust control architectures; (3) high-precision hovering and station-keeping through disturbance estimation, thruster allocation optimization, and closed-loop velocity/position regulation; (4) fusion of multi-beam and side-scan sonar for improved seabed reconstruction, obstacle awareness, and mapping consistency in turbid or low-visibility waters; and (5) echo feature analysis for plankton detection, leveraging acoustic backscatter signatures and robust signal processing pipelines for ecological monitoring. Overall, the project aims to deliver a practical and scalable solution for underwater robotic operations in nuclear-facility-adjacent coastal zones and high-variability inland rivers, enabling safer inspection, higher-quality survey outputs, and enhanced ecological sensing.
Contact points	Informal inquiries may be addressed to Prof. Sanming Song (sm.song@siat.ac.cn) and Prof. Adam Rushworth (Adam.Rushworth@nottingham.edu.cn).
PhD topic	**AI and IoT-Enabled Health Management**
SUAT Supervisor	Prof. Nie Zedong
UNNC Supervisor(s)	Dr. Pushpendu Kar
Short introduction & description of the PhD project	The global prevalence of chronic diseases and the growing demand for personalized, real-time healthcare services have made AI and IoT-enabled health management an urgently needed and promising research field. With the aging population and the limitations of traditional healthcare models in continuous monitoring and proactive intervention, integrating artificial intelligence (AI) with the Internet of Things (IoT) has become a transformative solution to address unmet healthcare needs. This PhD project focuses on developing innovative IoT-based sensor technologies, reliable communication protocols, and advanced AI algorithms to tackle key challenges in chronic disease monitoring and management. The research aims to design intelligent, interconnected healthcare systems that enable real-time collection, transmission, and analysis of physiological data, facilitating early disease

	detection, personalized treatment adjustment, and long-term health tracking for chronic conditions. We are seeking highly motivated candidates with backgrounds in electronic engineering, communication engineering, computer science, or related disciplines. Ideal applicants will contribute to advancing cross-disciplinary research at the intersection of AI and IoT, driving the development of next-generation health management solutions that improve patient outcomes, reduce healthcare costs, and reshape the future of preventive healthcare.
Contact points	Prof. Nie Zedong (zd.nie@siat.ac.cn) and Dr. Pushpendu Kar (Pushpendu.Kar@nottingham.edu.cn).
PhD topic	**Adoption of AI Agents within a fine-grained cloud-native framework to transform traditional reactive macromarketing into a proactive and autonomous Resilience-as-a-Service model**
SUAT Supervisor	Prof. Minxian XU
UNNC Supervisor(s)	Dr. Russa Yuan
Short introduction & description of the PhD project	Applicants can develop a set of Research Questions that specifically bridge with technical "Cloud/Microservices/AI" and "Macromarketing" aspects, as follows: **Service-Oriented Smart Tourism**: Explore how AI Agents for safeguarding the City Brand and its Tourism Ecosystem. Rather than focusing solely on technical uptime, this framework treats urban resilience as a Service-Dominant Logic asset, modularizing critical infrastructure protection into scalable market offerings such as Real-time Destination Integrity, Predictive Visitor Safety, and Seamless Experience Restoration. By autonomously managing the interdependencies between water management, transport, and healthcare, these AI agents ensure Systemic Value Cocreation—minimizing cascading service failures during crises to maintain the city's competitive position as a safe, sustainable, and "smart" tourism destination. **AI Agents in the Critical Infrastructure**: An autonomous layer of critical infrastructure designed to protect clinical services by treating security and resilience as a dynamic, cloud-native capability. These agents function as proactive "teammates" that continuously monitor the vast network of medical IoT devices and Electronic Health Records (EHR) to sense anomalies—such as early signs of patient sepsis or unauthorized data exfiltration—and autonomously initiate mitigation protocols without waiting for human intervention. By utilizing microservices to deliver these specialized defense functions, the system can coordinate across platforms to isolate threats and predict equipment failures, transforming the traditional reactive model into a high-speed, "Resilience-as-a-Service" framework that significantly reduces response times and ensures the continuity of life-critical services. **AI Adoption in Service Settings**: Research explores the "Resilience-as-a-Service" model as an advisor rather than a controller, ensuring human operators maintain manual skills to manage systems during AI outages or hallucinations. For example, implementing machine learning (ML) to forecast infrastructure failures before they occur, thereby reducing service downtime and costs.
Contact points	Informal inquiries may be addressed to Dr. Russa Yuan (Russa.yuan@nottingham.edu.cn) and Prof. Minxian XU (mx.xu@siat.ac.cn).
PhD topic	**Advanced Nanozyme-Hydrogel Composites for Sustained, On-Demand Therapy in Osteoarthritis**
SUAT Supervisor	Prof. Guocheng Wang
UNNC Supervisor(s)	Prof. Enrico Marsili

Short introduction & description of the PhD project	Osteoarthritis (OA) is a debilitating degenerative joint disease characterized by a vicious cycle of chronic inflammation and oxidative stress. This pathological feedback loop drives progressive cartilage degradation and persistent pain, significantly reducing patients' quality of life. Current treatments offer only short-term symptomatic relief due to rapid clearance from the joint cavity, necessitating frequent and invasive procedures. Nanomaterials, particularly nanozymes with intrinsic therapeutic activity, present a promising avenue for developing long-acting therapies. Their sustained catalytic function offers a unique advantage over stoichiometric drugs, enabling prolonged modulation of the disease microenvironment. This PhD project focuses on developing a novel, multifunctional nanozyme-hydrogel composite specifically designed to overcome the challenge of rapid clearance and provide sustained, on-demand therapy for OA. The project will involve the rational design and synthesis of a stimuli-responsive hydrogel depot capable of integrating advanced catalytic nanozymes. This "smart" hydrogel will be engineered to release the therapeutic nanozyme in response to specific inflammatory biomarkers that are overexpressed in the OA joint. The efficacy of this composite system in providing extended therapeutic effects while reducing administration frequency will be rigorously investigated using relevant in vitro release models and an in vivo rat model of OA. Ultimately, this project aims to create a targeted, self-regulating therapeutic platform that offers superior efficacy and patient compliance compared to current treatments for chronic joint diseases, thereby driving innovation in the field of smart biomaterials and 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	**Development of Deep Learning-Based Models for Automated Microbial Image Recognition and Species Identification**
SUAT Supervisor	Prof. Lei Dai
UNNC Supervisor(s)	Prof. Ying Weng
Short introduction & description of the PhD project	Precise identification of microbial species is a cornerstone of clinical infection diagnosis and life sciences research. Currently, the "gold standard" remains dependent on culture-based methods and high-throughput sequencing (e.g., mNGS). While highly accurate, these approaches are constrained by long turnaround times (24–72 hours), high costs, and complex operational procedures, making it difficult to meet the urgent needs of rapid diagnosis for critically ill patients. This project aims to develop a high-speed microbial identification platform based on artificial intelligence algorithms. By collecting large-scale, multi-dimensional microscopic and colony images, we will construct a high-throughput image database and utilize Deep Convolutional Neural Networks (CNNs) combined with transfer learning to extract micro-morphological features. Compared to traditional methods, the proposed model enables non-invasive, automated, and second-level species identification, significantly reducing the clinical Turnaround Time (TAT). This research not only provides an immediate basis for precise clinical decision-making regarding antibiotics but also offers a high-efficiency assessment tool for fundamental microbiological research.
Contact points	Informal inquiries may be addressed to Lei Dai (lei.dai@siat.ac.cn) and Ying Weng (ying.weng@nottingham.edu.cn).
PhD topic	**Roles and regulations of cell mass density in rewiring genetic circuitry**
SUAT Supervisor	Yuping Chen
UNNC Supervisor(s)	Dr. Jodi Woan Fei Law

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. Jodi Woan Fei Law (Jodi-Woan-Fei.Law@nottingham.edu.cn).
PhD topic	**Engineering Evolutionarily Stable Synthetic Gene Circuits in E. coli for Robust Therapeutic Function within the Tumor Microenvironment**
SUAT Supervisor	Prof. Xiongfei Fu
UNNC Supervisor(s)	Prof. Yong Shi
Short introduction & description of the PhD project	Synthetic gene circuits enable precise programming of cellular behaviors and have emerged as a promising platform for living therapeutics in metabolic disease and cancer. Typical circuit motifs—such as mutually inhibitory switches, oscillators, kill-switches, and logic gates—can be used to enable engineered *E. coli* to sense tumor-associated cues and conditionally express or release therapeutic effectors. A major barrier to clinical translation is evolutionary instability: therapeutic circuits impose metabolic burden on the host, creating strong selective pressure for escape mutants that abrogate circuit function and thereby rapidly compromise therapeutic efficacy. In addition, host physiological state and the tumor microenvironment (e.g., nutrient limitation, hypoxia, immune pressures) introduce spatiotemporal variability that perturbs circuit dynamics and control. This project aims to address the tension between complex circuit functionality and long-term maintenance of therapeutic activity in the tumor microenvironment. This project will focus on two major aspects: (i) optimization of gene circuit architecture and metabolic load regulation (e.g., tuning expression strength and incorporating safety kill-switch modules to minimize the competitive advantage of escape mutants); and (ii) construction of controllable therapeutic Escherichia coli strains, with an emphasis on engineering strains that can stably grow and precisely release therapeutic molecules within the tumor microenvironment.
Contact points	Informal inquiries may be addressed to Yong Shi (Yong.Shi@nottingham.edu.cn) and Xiongfei Fu (xiongfei.fu@siat.ac.cn).
PhD topic	**Construction materials engineered by programmed bacteria**
SUAT Supervisor	Prof. Zhunjun Dai
UNNC Supervisor(s)	Dr Bo Li
Short introduction & description of the PhD project	Imagine a future where buildings grow, roads self-repair, and concrete absorbs carbon instead of emitting it. This vision is being unlocked by a new paradigm in material science: construction materials engineered by programmed bacteria. By harnessing the natural biological processes of microorganisms, such as calcium carbonate precipitation, cellulose production, or silica deposition, and directing them through genetic and synthetic biology tools, we intend to create living materials that are dynamic, sustainable, and responsive. These bioengineered materials can be designed to sense environmental cues, self-heal cracks, sequester pollutants, or even change properties on demand. Moving beyond traditional,

	energy-intensive manufacturing, this approach merges biology with construction, offering a pathway toward truly adaptive and regenerative infrastructure.
Contact points	Informal inquiries may be addressed to Dr Bo Li(bo.li@nottingham.edu.cn) and Prof. Zhunjun Dai(zj.dai@siat.ac.cn).
PhD topic	**Developing stable and programmable microbial division-of-labor systems using horizontal gene transfer**
SUAT Supervisor	Professor Dr Teng Wang
UNNC Supervisor(s)	Assistant Professor Dr Loh Teng-Hern Tan Assistant Professor Dr Jodi Woan-Fei Law Professor Dr Learn-Han Lee
Short introduction & description of the PhD project	This PhD project aims to establish horizontal gene transfer (HGT) as a robust engineering strategy for constructing stable and efficient microbial division-of-labor systems. The project will develop minimal conjugative plasmids enabling reliable gene transfer, and will define quantitative criteria governing stable plasmid coexistence by integrating mathematical modeling with experimental validation. It will further investigate the long-term evolutionary dynamics of transferable plasmids to understand how mutation, selection, and host–plasmid coevolution affect system stability and functionality. Building on these principles, the project will exploit HGT-assisted division of labor to program spatial and temporal patterns in bacterial colonies. Finally, it will elucidate the molecular mechanisms of plasmid–plasmid and plasmid–host interactions and evaluate their impact on metabolic coordination and bioproduction yields, providing design rules for evolutionarily stable and high-performance microbial systems.
Contact points	Informal inquiries may be addressed to Assist. Prof. Dr Loh Teng-Hern Tan (Loh-Teng-Hern.Tan@nottingham.edu.cn), Assist. Prof. Dr Jodi Woan-Fei Law (Jodi-Woan-Fei.Law@nottingham.edu.cn), Prof. Dr Learn-Han Lee (Learn-Han.Lee@nottingham.edu.cn) and Prof. Dr Teng Wang (t.wang1@siat.ac.cn).
PhD topic	**Electrocatalytic CO2 capture**
SUAT Supervisor	Prof. Huanyu Jin
UNNC Supervisor(s)	Dr Mengxia Xu
Short introduction & description of the PhD project	This project focuses on the development of a high-efficiency electrochemical CO2 capture platform that enables selective, reversible, and energy-efficient CO2 separation driven by electricity rather than thermal input. The system is designed to capture CO2 from dilute gas streams through electrochemically controlled interfacial reactions, allowing precise regulation of CO2 uptake and release under mild operating conditions. Advanced electrode materials and redox-active interfaces will be engineered to promote selective CO2 binding, stabilize key carbonate and bicarbonate species, and achieve low-energy regeneration through potential-modulated operation. By optimizing catalyst composition, electrode architecture, and interfacial microenvironments, the project aims to enhance CO2 capture capacity, selectivity, cycling stability, and energy efficiency. Overall, this research seeks to establish an electricity-driven CO2 capture strategy that is compatible with renewable power sources and scalable for practical deployment, providing a sustainable alternative to conventional thermally driven carbon capture technologies.
Contact points	Informal inquiries may be addressed to Dr Mengxia Xu (Mengxia.Xu@nottingham.edu.cn) and Prof Huanyu Jin (hy.jin2@siat.ac.cn)..

PhD topic	**Laser-Synthesized High-Entropy Alloy Nanoclusters for Seawater Electrolysis**
SUAT Supervisor	Prof. YANG Xinchun https://www.yangxcgroup.com/
UNNC Supervisor(s)	Dr. Reza Shoja Razavi
Short introduction & description of the PhD project	This project pioneers a novel route for catalyst development by applying Ultrafast Laser Ablation in Liquid (LAL) to synthesize high-entropy alloy (HEA) nanoclusters tailored for the harsh conditions of direct seawater splitting. LAL provides a unique, chemical-free method to produce oxide-free, compositionally precise multi-metallic nanoparticles with non-equilibrium structures ideal for catalysis. The research will systematically explore the relationship between laser parameters, HEA nanocluster composition (e.g., PtFeCoNiX), and their catalytic activity and stability for both the oxygen and hydrogen evolution reactions (OER/HER) in simulated and real seawater. Advanced in-situ spectroscopy and electrochemical methods will be employed to understand the degradation mechanisms and the role of each element in resisting chloride corrosion and fouling. The goal is to establish a laser-based manufacturing platform for next-generation, highly durable electrocatalysts that bypass the limitations of traditional wet-chemistry synthesis.
Contact points	Informal inquiries may be addressed to Prof. Reza Shoja Razavi (Sayed-Reza.Shoja-Razavi@nottingham.edu.cn) and Prof. YANG Xinchun (xc.yang@siat.ac.cn).
PhD topic	**Using AI to aggregate and control building energy consumption and participate power grid demand response**
SUAT Supervisor	Wei FENG
UNNC Supervisor(s)	Wu DENG
Short introduction & description of the PhD project	The building sector contributes to 21% of China's carbon emissions. The phd program emphasize to decarbonize building sector through technology innovation and building-to-grid (B2G) integration using cutting-edge AI and optimization approaches. The phd students will focus on simulating of building technologies' impact on building energy use, using both analytical and AI based approaches to aggregate and control large scale building loads to achieve demand response. The phd program will also use techno-economic analysis and optimization methods to understand building energy technologies economic contribution to the regional or national level energy systems decarbonization. Phd students are expected to have good understanding of building technologies and building energy systems. Experience of using building energy simulation tools are desired. Students are also expected to have good computer programming skills to solve AI and/or optimization problems including using Matlab and/or Python.
Contact points	Informal inquiries may be addressed to Wei FENG (w.feng@siat.ac.cn) and Wu DENG (Wu.Deng@nottingham.edu.cn).
PhD topic	**Assessing the Spatial Synergy and Carbon Mitigation Potential of Urban Photovoltaic Systems**
SUAT Supervisor	Dr.Liqun Sun
UNNC Supervisor(s)	Dr.Wu Deng
Short introduction & description of the PhD project	With the trend of global urbanization and energy transition, urban photovoltaic (PV) systems, as a critical carrier of distributed clean energy, play a vital role in building a low-carbon and resilient urban energy system. Confronted with the dual pressures of limited urban space and continuously growing energy demand, the traditional centralized energy supply model can hardly meet the development needs of high-density cities. Urban PV not only directly utilizes building surfaces to generate electricity, thereby replacing fossil fuels and reducing greenhouse gas emissions, but

	also contributes to mitigating the local urban heat island effect. This is of key significance for enhancing urban energy self-sufficiency, addressing climate change, and promoting sustainable urban development. This PhD project aims to develop a comprehensive assessment framework for urban PV systems, analyzing their potential for energy generation, carbon emission reduction, and spatial synergy under different scenarios. By integrating geospatial artificial intelligence (GeoAI), remote sensing observations, and mathematical-statistical models, the project will systematically evaluate the technical potential of PV and examine the spatial coupling mechanisms between urban PV facilities and factors such as the built environment and socioeconomic attributes, the project seeks to provide a scientific basis and optimization strategies for energy-space synergistic planning under urban carbon neutrality goals, thereby advancing the transition toward smart, green, and low-carbon urban futures.
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	**Multi-timescale Co-Optimization and Stability-Aware Control of Grid-Forming Battery Energy Storage Systems in Low-Inertia Grids**
SUAT Supervisor	Dr. Cheng Gong
UNNC Supervisor(s)	Dr. John Xu
Short introduction & description of the PhD project	This PhD project focuses on the control and optimization of grid-forming battery energy storage systems (BESS) that can establish stable voltage and frequency in low-inertia, inverter-dominated power grids. Unlike grid-following converters, grid-forming storage must remain stable under weak-grid conditions, fast disturbances, and strict converter constraints such as current limits, DC-link dynamics, and fault ride-through requirements. The project will develop robust, constraint-aware grid-forming control strategies that ensure reliable synchronization and power-sharing while delivering high-quality voltage and frequency support across a wide range of operating scenarios. In parallel, the project will design multi-timescale optimization methods that coordinate fast inverter dynamics (milliseconds) with slower energy management objectives (seconds to hours), including state-of-charge regulation, efficiency, thermal limits, and battery aging. By embedding stability margins and operational constraints directly into the optimization layer, the proposed framework aims to enable safe and optimal provision of ancillary services such as fast frequency response, synthetic inertia, and voltage support. The research will be validated through simulation and hardware-in-the-loop or laboratory experiments, producing practical algorithms that improve grid resilience and accelerate real-world deployment of grid-forming energy storage.
Contact points	Informal inquiries may be addressed to Cheng Gong(fz.kung@outlook.com) and John Z. Xu (John.XU@nottingham.edu.cn).
PhD topic	**Medical image processing for AI assisted intervention and surgical navigation**
SUAT Supervisor	Research Prof. Shoujun Zhou
UNNC Supervisor(s)	Prof. Sean He
Short introduction & description of the PhD project	This project focuses on the development of interventional surgery robots and their multi-agent systems, aiming to promote the innovation of precise and safe minimally invasive interventional treatment technologies. The research will center around core aspects such as high-precision master-slave operation, real-time force feedback, and multi-dimensional navigation, and will develop new generations of master hands, slave hands, and intelligent control algorithms. The key breakthroughs will be in the collaborative control among multiple robot agents,

	distributed perception and decision-making, to achieve autonomous collaborative operations such as intravascular navigation, intracavitary imaging, and treatment instruments. Ultimately, an intelligent and modular multi-agent surgical platform will be constructed, providing disruptive solutions for cardiac, neurological, and tumor interventional fields, and striving to enhance the standardization level of surgeries and remote diagnosis capabilities.
Contact points	Informal inquiries may be addressed to (Sean.He@nottingham.edu.cn) and Prof Shoujun Zhou (sj.zhou@siat.ac.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@suatsz.edu.cn) and John Z. Xu (John.XU@nottingham.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	**AI-assisted Precision Cancer Intervention: A Multimodal Learning Approach using Real-World Clinical Big Data**
SUAT Supervisor	Prof. Fuxiao Li
UNNC Supervisor(s)	Prof. Alejandro Guerra Manzanares

Short introduction & description of the PhD project	This PhD project focuses on developing and validating advanced multimodal artificial intelligence (AI) frameworks in clinical settings. The research will utilize high-dimensional, real-world clinical data, such as electronic health records (EHR), multi-sequence medical imaging (CT, MRI, PET-CT), histopathology images, laboratory results, and longitudinal follow-up data. The primary objective is to integrate these heterogeneous data streams through innovative multimodal representation learning and deep learning techniques to address critical clinical bottlenecks throughout the cancer care continuum—from early screening and precise diagnosis to treatment response prediction and personalized monitoring. Specifically, the project will investigate how to effectively fuse imaging and non-imaging modalities to provide robust, interpretable clinical decision support for oncology.The student will work within a multidisciplinary and international team from SUAT and UNNC. The project is vital for advancing the frontiers of precision medicine and improving the efficiency of oncological services in China. All research will be conducted with strict adherence to ethical and regulatory guidelines regarding patient data privacy. Deliverables from the project will include high-impact peer-reviewed publications and validated AI models with significant potential for clinical translation. The successful candidate will gain comprehensive expertise in medical AI, clinical data science, and evidence-based medicine, preparing them for a leading career in the rapidly evolving field of digital healthcare.
Contact points	Informal inquiries may be addressed to Prof Fuxiao Li (lifuxiao@suat-sz.edu.cn) and Prof Alejandro Guerra Manzanares (alejandro.guerra@nottingham.edu.cn).
PhD topic	**Distributed Machine Learning and Applications**
SUAT Supervisor	Bo Liu
UNNC Supervisor(s)	Yanwen Mao
Short introduction & description of the PhD project	Distributed Machine Learning and Applications: This project develops distributed learning technologies for intelligent IoT systems, addressing challenges such as data heterogeneity, label scarcity, model isolation, adversarial attacks, and dynamic system evolution. It explores semi-supervised learning methods, knowledge distillation frameworks, defense and recovery mechanisms against adversarial attacks, and strategies for forgetting and continuous learning in dynamic environments. The goal is to create a trusted collaborative learning paradigm for IoT systems under weak supervision and evolving conditions. Theoretical contributions extend the intersection of distributed learning and IoT, while the methodologies provide adaptive, secure, and scalable solutions. This research aims to enhance the intelligence and security of critical infrastructures like smart cities, industrial IoT, and smart grids, contributing to national infrastructure and AI safety advancements.
Contact points	Informal inquiries may be addressed to Dr. Yanwen.Mao (Yanwen.Mao@nottingham.edu.cn) and Prof. Bo Liu (liubo@suat-sz.edu.cn).
PhD topic	**Digital Twin in Cardio- and Cerebrovascular Diseases diagnosis and treatment**
SUAT Supervisor	Weixin Si
UNNC Supervisor(s)	Ying Weng
Short introduction & description of the PhD project	With the rapid advancement of artificial intelligence and digital twin technology, its application in the diagnosis and treatment of cardiovascular and cerebrovascular diseases has garnered increasing attention. By integrating multi-dimensional patient physiological data, medical imaging, and real-time monitoring information, digital twin technology enables the creation of dynamic, high-fidelity individualized models of the cardiovascular and cerebrovascular system. This approach not only provides novel pathways for in-depth exploration of disease mechanisms but also enhances

	early warning, precise diagnosis, and personalized treatment strategies for key conditions such as coronary heart disease and stroke. The project will focus on three main aspects: (i) AI-guided disease diagnosis, primarily involving medical image analysis for tasks such as AI-driven lesion detection and segmentation; (ii) AI-driven modeling and simulation, with an emphasis on hemodynamic simulations and stent-vessel coupling systems; and (iii) AI-assisted surgical planning and decision-making, mainly focusing on surgical strategy optimization, outcome evaluation, and AI-enhanced surgical navigation.
Contact points	Informal inquiries may be addressed to Weixin Si (siweixin@suat-sz.edu.cn) and Ying Weng (Ying.Weng@nottingham.edu).
PhD topic	**Generalizable AI-Empowered Multitask Learning on Longitudinal Multi-modal Data for Perioperative Patient Safety and Health Equity**
SUAT Supervisor	Prof. Weixin SI
UNNC Supervisor(s)	Prof. Xiangjian HE
Short introduction & description of the PhD project	Postoperative complications after hepatectomy are key determinants of perioperative safety and long-term prognosis, featuring a broad spectrum of events and a dispersed time window of onset. Current clinical assessment largely relies on postoperative monitoring and experience-based judgement, which often fails to achieve stable early stratification across different complications or to guide individualized interventions in time. Therefore, there is an urgent need for strategies that enable reliable early risk stratification and timely intervention during the perioperative period. Meanwhile, perioperative data are multimodally heterogeneous and temporally dependent, and in real-world multicentre settings they are further challenged by distribution shift and missingness. As a result, a single-model paradigm often struggles to provide accurate early risk characterization, cannot reliably identify actionable risk determinants, and is difficult to translate into feasible clinical interventions. This project aims to develop a multimodal, multi-agent framework for early warning and decision support. First, it will 1) construct a dynamic evolution model of postoperative complications along a unified perioperative timeline, improving robustness to cross-modal heterogeneity, cross-centre shifts, and missing data; 2) then learn the temporal association structure across evidence sources to identify the most contributive core signals for early warning, reducing redundancy and yielding a parsimonious yet accurate representation of early risk. Second, 3) this project will advance semantic reasoning and integration over these core multimodal evidences to build an intelligent analysis system that can automatically update multi-complication risk levels over time, localize key driving factors, and provide stratified management recommendations, thereby offering earlier, more stable, and actionable decision support for clinicians; 4) by incorporating uncertainty estimation, the system will organize key evidence into traceable evidence chains, which is expected not only to improve the efficiency of early identification and timely intervention for postoperative complications, but also to provide a reusable and evaluable paradigm for perioperative intelligent collaboration in multicentre settings. Ultimately, this study aims to shift hepatectomy complication management from "passive monitoring and delayed response" to "proactive early warning and earlier intervention", delivering a deployable intelligent collaborative tool for timely clinical intervention and perioperative management.
Contact points	Informal inquiries may be addressed to Prof. Weixin SI (siweixin@suat-sz.edu.cn) and Prof. Xiangjian HE (Sean.He@nottingham.edu.cn).

PhD topic	**Model-driven Ophthalmic OCT Data Generation for Controllable Intraoperative Scenario Simulation**
SUAT Supervisor	Prof. Heng Li
UNNC Supervisor(s)	Prof. Ying Weng Prof. Ruibin Bai
Short introduction & description of the PhD project	Over the past decade, optical coherence tomography (OCT) has become increasingly relevant for intraoperative guidance, where surgeons rely on real-time cross-sectional cues to track tissue interfaces, verify surgical endpoints, and monitor rapid procedure-related changes. Unlike routine clinical imaging, intraoperative OCT is acquired under tight time constraints and challenging conditions—tissue deformation, transient fluid interfaces, and frequent instrument-induced artefacts (shadows, reflections, occlusions). Meanwhile, safety-critical events are rare and unpredictable (e.g., sudden interface disruptions or abrupt motion bursts), yet they are precisely the cases that determine whether intraoperative vision models are dependable. As a result, large-scale, well-annotated intraoperative OCT datasets that systematically cover both typical workflow states and unexpected events remain scarce, limiting robust model development and evaluation. This project aims to build a model-based synthesis pipeline where OCT images are generated from explicit, interpretable parameters describing anatomy, acquisition settings, and pathology, and where a differentiable learning component enables reversing deduction with real images so that the synthetic distribution remains clinically plausible while retaining full controllability. In particular, this project will be organised around three steps: (i) An OCT data rendering tool will be developed and validate its correctness against established physical priors, such as simplified OCT formation mechanisms, attenuation behaviour, speckle/noise characteristics. (ii) Use paired samples of model states and rendered images to formulate a differentiable inverse pipeline to infer and iteratively refine the underlying physical model. (iii) Parameterise the refined model into a compact set of clinically meaningful control variables (covering anatomy, procedure stage, device settings, and rare adverse events), enabling controllable intraoperative scenario simulation at scale. These steps are expected to yield a dataset-oriented outcome: a reproducible simulator plus a structured intraoperative OCT dataset with scenario parameters and ground-truth annotations, supporting robust training and stress-testing of models' performance in surgery.
Contact points	Informal inquiries may be addressed to Prof. Heng Li (liheng@suat-sz.edu.cn) and Prof. Ying Weng (Ying.Weng@nottingham.edu.cn).
PhD topic	**Magnetic/electric stimulation and Brain Computer Interface assisted neural regeneration and repair in brain degenerative diseases.**
SUAT Supervisor	Professor Bing Song
UNNC Supervisor(s)	Dr Weihua Meng
Short introduction & description of the PhD project	Magnetic/electric stimulation has been widely used clinically to treat neurological disorders, including neuropathic pain, depression, epilepsy, Alzheimer's disease, etc. Although Magnetic/electric stimulation may substantially enhance the plasticity between different brain regions and networks, it might also lead to a subsequent impairment of the treated brain tissues depending on the magnitude of the stimulation. Therefore, it is critical to systematically model the magnetic/electric parameters at various brain regions under magnetic/electric stimulation to link up the associated cellular response in vitro with the functional recovery *in vivo*, and guide the clinical treatments in the future therapeutic application. The project is a multidisciplinary team effort combining two sets of expertise from UNNC and SUAT supervisors. Our goal is to identify potential biological mechanisms or impacts under

	the supervision of Professor Weihua Meng (UNNC),to systematically reveal the spatial parameters of magnetic/electric exposure at different brain areas, and conduct the subsequent mechanistic analysis. Subsequently, this shall be further tested in the laboratory of Professor Bing Song (SUAT) using tissue/organoids in vitro and animal models in vivo. Meng lab at UNNC shall offer systematic training in biology, bioinformatics and genetics at the biomedical interface for the PhD candidate. Song lab at SIAT will train the PhD candidate to conduct the electric-magnetic stimulation on neural stem cells in vitro and neurologically dysfunctional animal models in vivo using Brain Computer Interface system, including Alzheimer's disease, epilepsy, stroke, neuropathic pain etc. Our explicit aims of this project would be to train the PhD candidate to master systems biology modelling skills and be experienced in the mechanistic analysis of Brain Computer Interface and electromagnetic stimulation in treating neurological disorders. Prof Weihua Meng and Prof Bing Song have years of collaboration with joint publications, and co-supervised joint PhD projects under the UNNC-SUAT programme. This PhD project is a part of and financially supported by a National Key R&D Program, Ministry of Science and Technology China.
Contact points	Informal inquiries may be addressed to Prof Bing Song (songbing@suat-sz.edu.cn) or Prof Weihua Meng (weihua.meng@nottingham.edu.cn)
PhD topic	**Multimodal Computational Detection and Closed-Loop Intervention for Adolescent Mood Disorders**
SUAT Supervisor	Prof. Jinglong Wu
UNNC Supervisor(s)	Dr. Alejandro Guerra Manzanares
Short introduction & description of the PhD project	Adolescent mood disorders are characterized not only by emotional dysregulation but also by a significant impairment in "top-down" cognitive control. Persistent negative affect and rumination excessively deplete the brain's limited cognitive resources, resulting in inefficient resource allocation during external tasks. This internal competition makes it difficult for the impaired brain to effectively integrate multisensory information, particularly under high cognitive load. Consequently, multisensory integration capability under cognitive load serves as a highly sensitive, objective probe for revealing underlying neural circuit dysfunctions associated with mood disorders. Building on this scientific hypothesis, this PhD project aims to construct a framework for the precision detection and intervention of adolescent mood disorders. The project will systematically investigate how cognitive load modulates multisensory integration to capture latent cognitive deficits. By collecting clinical assessment scales, cognitive psychophysical metrics, and multimodal neuroimaging data, and utilizing machine learning techniques for heterogeneous data fusion, this study seeks to achieve a deep integration of subjective measures and objective neuro-behavioral data. The resulting quantifiable computational model is designed to precisely parse disease heterogeneity and identify specific neurocognitive subtypes. On this basis, the project will develop a mechanism-guided, closed-loop neuromodulation strategy. This approach utilizes phase synchronization with real-time neural oscillations to achieve state-dependent precision stimulation. It aims to target and repair impaired cognitive control circuits, thereby establishing a complete loop from "multidimensional detection" to "targeted intervention," providing scientific evidence and innovative methods to enhance cognitive control and emotion regulation in adolescents.
Contact points	Informal inquiries may be addressed toJinglong Wu (wujinglong@suat-sz.edu.cn) and Alejandro Guerra Manzanares(alejandro.guerra@nottingham.edu.cn).

PhD topic	**Smart Responsive Biomaterials Integrated with Physicochemical Stimuli for Comprehensive Neural Repair**
SUAT Supervisor	Zhifeng You
UNNC Supervisor(s)	Xiaoling Liu
Short introduction & description of the PhD project	Neural injuries such as spinal cord injury and long-gap peripheral nerve defects remain a major unmet clinical need. Traditional biomaterial scaffolds that only provide structural bridging fall short of enabling ideal functional recovery. Effective repair demands an integrated strategy that recapitulates the native neural microenvironment and combines synergistic physical and chemical cues. This PhD project will develop next-generation, smart responsive biomaterials that mimic key features of natural neural tissue including tunable stiffness, aligned architecture, and electrical conductivity, so as to actively promote regeneration. The research will focus on: 1. designing and fabricating intelligent biomaterial systems with tailored mechanical, topographical, and conductive properties;2. evaluating their therapeutic efficacy when combined with physical stimuli (e.g., electrical stimulation) and bioactive molecules in neural injury models. This project aims to training an interdisciplinary expert in material science and biology science.
Contact points	Informal inquiries may be addressed to Prof. Zhifeng You (youzhifeng@suat-sz.edu.cn) and Prof. Liu (Xiaoling.Liu@nottingham.edu.cn).
PhD topic	**Neuro-cardio-pulmonary interaction, evaluation and rehabilitation for healthy and post-stroke movement dysfunction**
SUAT Supervisor	Prof. Bao Shichun
UNNC Supervisor(s)	Prof. He Xiangjian
Short introduction & description of the PhD project	Post-stroke movement dysfunction is major public health requirement, conventional techniques only focused on neuromuscular functions after stroke. However, those patients not only experience motor impairments due to neuromuscular dysfunction but also suffer from decreased cardiopulmonary functions, which may be an important factor limiting the effectiveness of motor function rehabilitation. Research on the impact of cardiopulmonary function on the recovery of motor ability is lacking. Human motor function depends on the dynamic coupling of the neuromuscular, and cardiopulmonary systems, and coordinated neuro-cardio-pulmonary intervention may be an important approach to improve the effectiveness of motor rehabilitation in patients with movement dysfunction. By integrating multimodal heterogeneous data and artificial intelligence technology, a comprehensive analysis and evaluation of neuro-cardio-pulmonary systems might provide new insights on human motor functions and clinical applications.
Contact points	Informal inquiries may be addressed to Prof. Bao Shichun (sc.bao@suat-sz.edu.cn) and Prof. He Xiangjian (Sean.He@nottingham.edu.cn).
PhD topic	**Steering the Carbon Oxides Reduction Selectivity toward Multi-Carbon Product**
SUAT Supervisor	Qiucheng Chen
UNNC Supervisor(s)	Jun He
Short introduction & description of the PhD project	The electrochemical CO_2 reduction reaction (CO_2RR) offers a sustainable pathway to produce multicarbon chemicals and fuels. Catalyst design is pivotal in determining the selectivity and efficiency of this process. Among various catalysts, copper-based materials are unique in facilitating C–C coupling, enabling the formation of multicarbon products (C_{2+}) such as ethylene, ethanol, and propanol. However, the complexity of the reaction mechanism leads to a diverse range of products, making it challenging to achieve high selectivity for a single desired compound.

	Furthermore, the structure-property-performance relationships of Cu catalysts under high-current-density electrolysis remain poorly understood. This research program aims to bridge the gap between fundamental catalyst design and practical application by investigating the role of electrode material and electrolyte in species transport and coupling. The ultimate goal is to achieve a Faradaic efficiency exceeding 90% for C_{2+} products.
Contact points	Informal inquiries may be addressed to Prof. Qiucheng Chen (chenqiucheng@suat-sz.edu.cn) and Prof. Jun He (Jun.He@nottingham.edu.cn)
PhD topic	**Design, Additive Manufacturing, and Functional Integration of Multicomponent Alloy Catalysts with Diffusion–Catalysis Synergy for Efficient Water Electrolysis**
SUAT Supervisor	Dr Fucong LYU
UNNC Supervisor(s)	Dr Di HU
Short introduction & description of the PhD project	This PhD project focuses on the rational design, additive manufacturing, and functional integration of multicomponent alloy catalysts with coupled diffusion and catalytic functionalities for high-efficiency water electrolysis hydrogen production. The research aims to develop advanced, low-cost, and durable catalyst architectures by integrating alloy composition optimisation with three-dimensional porous structural engineering. High-throughput computational methods and machine learning will be employed to screen and optimise multicomponent alloy systems, including high-entropy and medium-entropy alloys, with superior catalytic activity, corrosion resistance, and long-term stability. The influence of elemental composition and atomic configuration on electronic structure, surface reactivity, and reaction pathways will be systematically investigated to establish clear structure–property–performance relationships. Advanced 3D printing techniques, such as Selective Laser Melting (SLM) and Near-net-shape Electrochemical Metallisation (NEM), will be used to fabricate catalysts with precisely controlled porous architectures, including pore size gradients, porosity, and geometric topology. The effects of printing and processing parameters on microstructure, mechanical integrity, mass transport, and electrochemical performance will be elucidated. By combining in situ and ex situ characterisation techniques with electrochemical testing, the project will reveal the synergistic mechanisms between porous structure and alloy composition that enhance hydrogen evolution and oxygen evolution reactions. Finally, the catalysts will be evaluated in alkaline, acidic, and neutral electrolytes and integrated into membrane-based electrolyser assemblies to assess their practical applicability and scalability for clean hydrogen production.
Contact points	Informal inquiries may be addressed to Dr Di Hu (di.hu@nottingham.edu.cn) and Dr Fucong Lyu (lyufucong@suat-sz.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 CO2RR 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 CO2RR 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 CO2RR. 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 Xiaolong Zhang (xl.zhang@siat.ac.cn) and Mengxia Xu (mengxia.xu@nottingham.edu.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	**Chemical Modification-Driven Enhancement of Gene Therapy and Stem Cell Therapy Efficacy**
SUAT Supervisor	Prof. Qizhou Lian
UNNC Supervisor(s)	Prof.Binjie Hu
Short introduction & description of the PhD project	Stem cell and gene therapy hold enormous potential for the treatment of various refractory diseases, including degenerative disorders, tissue injuries, and genetic defects. However, the clinical translation of stem cell therapy is hindered by key challenges such as low in vivo survival rate of transplanted stem cells, limited targeted homing to lesion sites, and insufficient therapeutic efficacy due to inadequate regulation of stem cell differentiation.

	This PhD project integrates the expertise of stem cell biology, gene therapy, and chemical engineering to develop advanced targeted delivery systems for enhancing stem cell therapy. The project focus on three core research directions: (1) Rational design and synthesis of functionalized nanomaterials (e.g., lipid nanoparticles, polymer-based nanocarriers, or inorganic nanocomposites) with good biocompatibility, biodegradability, and high gene loading capacity, tailored for stem cell transfection. (2) Surface modification of nanocarriers with targeting ligands (e.g. cell-specific antibodies, peptides, or small molecules) to achieve precise delivery of therapeutic genes to stem cells in vitro and in vivo, improving transfection efficiency while reducing off-target effects. (3) Evaluation of the enhanced therapeutic efficacy of gene-modified stem cells in preclinical models: The therapeutic genes will be selected to promote stem cell survival, homing, and directed differentiation; the combined effect of functionalized nanocarrier-mediated gene delivery and stem cell therapy will be systematically assessed through in vitro cell experiments and in vivo animal models, with a focus on optimizing the safety and efficacy of the integrated therapy.
Contact points	Informal inquiries may be addressed toProf. Qizhou Lian(lianqizhou@suat-sz.edu.cn) and Prof.Binjie Hu (Binjie.HU@nottingham.edu.cn).
PhD topic	**Machine learning meets constant-potential AIMD at electrified interfaces for CO_2 electroreduction**
SUAT Supervisor	Prof. Jinggang Lan
UNNC Supervisor(s)	Dr. Mengxia Xu
Short introduction & description of the PhD project	Electrocatalytic CO2 reduction reaction (CO2RR) offers a promising route to convert intermittent renewable electricity into value-added chemicals. In aqueous electrocatalysis, electrolytes, interfacial water, and the applied potential jointly shape the electrified interfacial microenvironment and product selectivity. However, experimentally resolving potential-dependent interfacial structures and reaction processes remains challenging. This PhD project will combine ab initio molecular dynamics (AIMD) with advanced machine-learning interatomic potentials (MLIPs) technology to capture the subtle interplay between applied potential and electrolyte jointly regulate interfacial structures and dynamics during CO2RR, enabling electronically accurate and extensively sampled simulations under a constant-potential framework developed by our group for electrified solid-liquid interfaces. Building on this framework, this project will focus on CO_2RR to simulate how **applied constant-potential** and **electrolyte** regulate catalyst–electrolyte interfacial interactions, thereby modulating competing C1 vs C2+ product pathways and underlying mechanisms. The outcomes aim to deliver molecular-level mechanisms to guide electrolyte and operating-condition design for selective CO2 conversion.
Contact points	Informal inquiries may be addressed to Dr. Mengxia Xu (mengxia.xu@nottingham.edu.cn) and Prof. Jinggang Lan (jinggang.lan@suat-sz.edu.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	Professor Shifeng GUO
UNNC Supervisor(s)	Professor 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 Jian YANG (Jian.Yang@nottingham.edu.cn) and Prof Shifeng GUO (sf.guo@siat.ac.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	**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	**Evaluation of Safety and Immunogenicity of PROTAC Vaccines Based on Airway-on-a-Chip**

SUAT Supervisor	Prof. Longlong SI Dr Huafang ZHAO
UNNC Supervisor(s)	Prof Yong Ren
Short introduction & description of the PhD project	PROTAC (Proteolysis-Targeting Chimera) technology, as a novel drug development strategy, provides an innovative direction for disease prevention and control in the field of vaccines. However, the evaluation of the safety and immunogenicity of PROTAC vaccines after airway mucosal administration still lacks the support of efficient in vitro models. The airway chip, as a cutting-edge platform combining microfluidic technology and tissue engineering, can accurately simulate the physiological microenvironment, cell interactions, and barrier function of the human airway, thus making up for the limitations of traditional in vitro cell culture and animal models. This project focuses on the airway mucosal delivery system of PROTAC vaccines and centers around two major research dimensions: (i) Safety evaluation: Detect the effects of the vaccine on the integrity of the airway epithelial barrier, cytotoxicity, inflammatory factor release, and tissue stress response through the airway chip. (ii) Immunogenicity analysis: Explore the efficacy of the vaccine in inducing the activation of airway mucosal immune cells, antibody production, and the formation of immune memory in the chip model. The research will construct a highly biomimetic airway chip model, optimize the delivery parameters of PROTAC vaccines, and establish an accurate in vitro evaluation system, providing key data support for the clinical translation of PROTAC vaccines and expanding the application scenarios of microfluidic chips in the evaluation of novel vaccines.
Contact points	Informal inquiries may be addressed to Dr Huafang ZHAO (hf.zhao1@siat.ac.cn), Prof. Longlong SI (ll.si@siat.ac.cn) and Prof Yong Ren (Yong.Ren@nottingham.edu.cn).
PhD topic	**Multimodal Wearable Bioelectronics for Cardiovascular Diseases Monitoring**
SUAT Supervisor	Dr Caizhi Liao
UNNC Supervisor(s)	Dr Sen Yang
Short introduction & description of the PhD project	The concept of multimodal wearable bioelectronics has gained increasing attention in recent years, driven by the urgent need for continuous, noninvasive, and personalized monitoring of cardiovascular diseases (CVDs). These technologies provide a transformative opportunity to move beyond conventional episodic clinical assessments toward continuous healthcare paradigms that integrate sensing, data analytics, and clinical decision-making. By combining advances in flexible electronics, biointerfaces, and intelligent algorithms, wearable bioelectronic systems enable real-time acquisition of physiological signals relevant to cardiovascular health, such as electrophysiology, hemodynamics, and biochemical markers. In essence, multimodal wearable bioelectronics holistically address the complex and multifactorial nature of cardiovascular diseases by capturing complementary information across electrical, mechanical, and biochemical dimensions. This integrated approach allows for improved detection of early pathological changes, risk stratification, and dynamic disease management. This project will focus on two major dimensions: (i) the development of advanced wearable bioelectronic devices for multimodal cardiovascular signal acquisition (e.g. ECG, mechano-acoustic signals, hemodynamic parameters, and biomarkers), and (ii) data fusion and intelligent analysis frameworks aimed at enabling accurate disease monitoring, prognosis, and personalized intervention in real-world settings.

Contact points	Informal inquiries may be addressed to Dr Caizhi Liao (liaocaizhi@suat-sz.edu.cn) and Dr Sen Yang (Sen.Yang@nottingham.edu.cn).
PhD topic	**Rational design of carbon-based architectures for advanced lithium metal batteries**
SUAT Supervisor	Dr. Ruopian Fang
UNNC Supervisor(s)	Dr. Di Hu
Short introduction & description of the PhD project	Increasing energy density has been the primary driving force for the innovation of advanced battery systems. The currently dominating lithium-ion batteries are approaching their theoretical limit for energy density, but still far from satisfying the demands of future electric vehicles and smart grids. Lithium metal batteries (LMBs) using lithium (Li) metal anodes are believed the future of high-energy battery technology, as Li metal has extraordinary theoretical specific capacity (3860 mAh g^{-1}) and the most negative standard electrode potential (−3.04 V versus standard hydrogen electrode). Yet the uncontrolled electrochemical behaviours of the Li metal anode induce irreversible consumption of active Li and Li dendrite formation, greatly hindering their practical implementation. Carbon-based materials, featuring high conductivity, tunable micro/nanostructures and surface chemistry, and light weight, provide an ideal platform for fundamental studies of their role in regulating Li redox reactions. Moreover, nanocarbons can be assembled into various macroscopic architectures, providing new opportunities for construct stable Li metal anodes for advanced LMB technology. This PhD project aims to overcome the performance bottlenecks of Li metal anode through rational design of carbon-based architectures for advanced lithium metal batteries. The research will establish design rationale for nanocarbons towards constructing high-capacity, safe and durable Li anode, acquire in-depth understanding of the Li redox behaviours, and demonstrate high-energy LMBs with practical reliability. The following research tasks will be included: 1. Modulate the microstructure and macro-assembly of nanocarbons, to study the Li redox reaction mechanisms in nanocarbons and to fabricate high-energy LMBs. 2. Acquire in-depth understanding of the Li redox mechanisms in correlation with carbon carbon-based architectures by applying in-situ/ex-situ analytical techniques. 3. Construct high-energy LMBs using the innovated carbon-based Li composite anode demonstrate a design prototype of practically viable LMBs with optimized cell engineering parameters.
Contact points	Informal inquiries may be addressed to Dr. Di Hu (Di.Hu@nottingham.edu.cn) and Dr. Ruopian Fang (fangruopian@suat-sz.edu.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 Prof. Dr. Di Hu (Di.Hu@nottingham.edu.cn) and Prof. Dr. Wen Yang (yangwen@suat-sz.edu.cn).
PhD topic	**Design and Fabrication of Multifunctional Cellular Platforms for Wearable Biosensors and In-Body Energy Storage**
SUAT Supervisor	FANG Peng
UNNC Supervisor(s)	Amin Farrokhabadi
Short introduction & description of the PhD project	This interdisciplinary research project focuses on creating a fundamental transformation in health-oriented wearable technology. The primary objective is to develop an integrated cellular platform that simultaneously performs two vital functions: 1) precise and continuous sensing of physiological and biochemical biomarkers in the body, and 2) storage of electrical energy to power the system itself. This approach is achieved by drawing inspiration from efficient cellular structures found in nature (such as bone or wood) and utilizing advanced engineering principles. The first stage involves designing and optimizing the mechanical structure of this platform based on the study of fatigue and fracture behavior under dynamic loads caused by body movements, ensuring long-term durability and reliability. In the second stage, these engineered cellular scaffolds are transformed into active components through surface engineering and nanomaterial technologies (such as graphene or advanced conductive polymers). Thus, the controlled porosity of the structure will serve both as a site for attaching sensitive bioreceptors (functioning as electrochemical or pressure sensors) and as a substrate for active electrode nanomaterials (functioning as energy-storing supercapacitors). The final output of this research will be the presentation of prototypes for smart patches or implants capable of monitoring an individual's health in real-time and continuously, while supplying part or all of their required energy through internal storage or even via energy harvesting from the body's environment. This platform represents a key step toward realizing the next generation of personalized, minimally invasive, and self-sufficient medical systems.
Contact points	Informal inquiries may be addressed to Amin Farrokhabadi (amin-farrokh.abadi@nottingham.edu.cn) and FANG Peng (peng.fang@siat.ac.cn).
PhD topic	**Real-time Monitoring System for Organ-on-a-Chip**
SUAT Supervisor	Dr Feng Zheng
UNNC Supervisor(s)	Dr Gavin Lai
Short introduction & description of the PhD project	The Organ-on-a-Chip (OoC) technology has been widely promoted in biomedical research in recent years, and provides an opportunity for these microphysiological systems to adopt real-time monitoring solutions that merge with advanced electrochemical sensing strategies. These integrated approaches may transform the current drug screening and preclinical evaluation workflows regarding dynamic physiological assessment that includes metabolic kinetics, drug toxicity evaluation, transient cellular responses, and microenvironmental stability in in vitro models.

	In fact, these sensing and microfluidic concepts are holistically addressing multi-factors of solving organ-level data acquisition (e.g., non-invasive continuous recording, quantification of biochemical fluctuations, and overcoming endpoint analysis limitations). This project will focus on two major dimensions on (i) sensing technology and signal acquisition (e.g., anti-fouling interfaces, high sensitivity, and multi-analyte detection) and (ii) system integration and application (looking at biomimetic chip design and dynamic drug efficacy evaluation).
Contact points	Informal inquiries may be addressed to Dr Feng Zheng (zhengfeng@suat-sz.edu.cn) and Dr Gavin Lai (Gavin.Lai@nottingham.edu.cn).
PhD topic	**AI-driven medical microrobots**
SUAT Supervisor	Prof. Haifeng XU
UNNC Supervisor(s)	Prof. Giampaolo Buticchi Dr. Shuo Wang
Short introduction & description of the PhD project	Minimally invasive surgery is increasingly favored for its ability to minimize trauma and shorten recovery times for patients. Miniaturized catheters and guidewires offer significant potential for therapeutic and diagnostic interventions within small lumens. To optimize steerability and improve procedural outcomes in these confined spaces, multi-functional capabilities such as active steering, variable stiffness and unclogging motion are necessary for soft catheters and guidewires. This project focuses on the development of a magnetically actuated interventional surgical microrobots with autonomous navigation capability. By integrating environmental sensing functions at the tip of a miniature magnetic catheter and achieving AI-based control, the system will enable autonomous navigation during interventional procedures. This interventional microrobotic system has the potential to play an important role in reducing radiation exposure, improving navigation efficiency, and minimizing intraoperative injury.
Contact points	Informal inquiries may be addressed to Prof. Haifeng Xu (hf.xu@siat.ac.cn), Prof. Giampaolo Buticchi (Giampaolo.Buticchi@nottingham.edu.cn) and Dr. Shuo Wang (shuo.wang@nottingham.edu.cn).
PhD topic	**Development and Validation of Clinical Imaging–Based Artificial Intelligence Models for Osteoporosis Diagnosis and Fracture Risk Prediction**
SUAT Supervisor	Prof. Pengwei Xiao
UNNC Supervisor(s)	Prof. Ying Weng
Short introduction & description of the PhD project	Osteoporosis is characterized by progressive loss of bone mass and deterioration of bone microarchitecture, resulting in a substantially increased risk of fragility fractures. Current clinical assessment methods based on dual-energy X-ray absorptiometry (DXA) are inherently limited by their two-dimensional nature and their inability to capture bone geometry, spatial heterogeneity, and microstructural characteristics, leading to suboptimal identification of individuals at high fracture risk. Quantitative computed tomography (QCT) enables three-dimensional evaluation of volumetric bone mineral density and bone structure, offering improved biomechanical relevance; however, QCT generates high-dimensional and complex imaging data that are difficult to fully exploit using conventional analytical approaches. Integrating artificial intelligence with QCT imaging provides a powerful framework for extracting clinically meaningful, multiscale patterns from such data, thereby enabling more accurate and interpretable prediction of osteoporotic fracture risk. The overarching objective of this research is to develop advanced QCT-based artificial intelligence models for precise and individualized fracture risk assessment, with specific aims including the development of state-of-the-art imaging super-resolution techniques

	and explainable AI methodologies to enhance fracture risk prediction and clinical interpretability.
Contact points	Informal inquiries may be addressed to Prof. Ying Weng (ying.weng@nottingham.edu.cn) and Prof. Pengwei Xiao (xiaopengwei@suat-sz.edu.cn).
PhD topic	**Genome Mining of the Human Gut Microbiome for Bioactive Natural Products**
SUAT Supervisor	Prof. Shaonan Liu
UNNC Supervisor(s)	Prof. Learn-Han Lee Assist. Prof. Jodi Woan-Fei Law Assist. Prof. Loh Teng-Hern Tan
Short introduction & description of the PhD project	The human gut microbiome represents a rich yet largely untapped reservoir of biosynthetic diversity, encoding numerous natural products with potential roles in host physiology, microbial ecology, and disease modulation. Advances in genome sequencing and bioinformatics have revealed that gut microorganisms harbor abundant biosynthetic gene clusters (BGCs), many of which remain uncharacterized at the chemical and functional levels. This PhD project aims to employ genome mining–guided strategies to systematically discover and characterize bioactive natural products from the human gut microbiome. By integrating computational BGC prediction, heterologous expression, metabolomic analysis, structure elucidation, and biochemical characterization, the project will establish direct links between biosynthetic gene clusters, molecular structures, and biological functions.
Contact points	Informal inquiries may be addressed to Prof. Shaonan Liu (liushaonan@suat-sz.edu.cn) and Prof. Learn-Han Lee (Learn-Han.Lee@nottingham.edu.cn); Assist. Prof. Jodi Woan-Fei Law (jodi-woan-fei.law@nottingham.edu.cn); Assist. Prof. Loh Teng-Hern Tan (loh-teng-hern.tan@nottingham.edu.cn)
PhD topic	**Mechanistic Antimicrobial Development Targeting the D-Alanylation Pathway**
SUAT Supervisor	Prof. Pingfeng Zhang
UNNC Supervisor(s)	Assist. Prof. Loh Teng-Hern Tan Prof. Learn-Han Lee Assist. Prof. Jodi Woan-Fei Law
Short introduction & description of the PhD project	Bacterial multidrug resistance represents a critical and escalating threat to global public health, underscoring the urgent need for antibiotics with novel mechanisms of action. Targeting bacterial surface components and noncanonical pathways offers a promising strategy to overcome existing resistance. Our recent work has resolved high-resolution cryo-EM structures of DltB, a membrane protein that functions both as a transmembrane channel and as a catalytic enzyme in the D-alanylation of lipoteichoic acid (LTA). LTA, together with peptidoglycan, constitutes a major structural component of the Gram-positive bacterial cell envelope and plays a pivotal role in host–pathogen interactions. D-alanylation of LTA is essential for bacterial virulence, immune evasion, and resistance to cationic antimicrobial peptides, thereby establishing the D-alanylation pathway as a compelling and underexploited antimicrobial target. Building on our structural and mechanistic insights into DltB, this project aims to elucidate the molecular mechanisms governing LTA D-alanylation and to leverage AI-assisted structure-based drug design to develop potent and selective DltB inhibitors. The antibacterial efficacy of these inhibitors will be systematically evaluated through in vitro biochemical and microbiological assays, followed by in vivo validation in relevant infection models. Finally, the translational potential of this strategy will be explored through studies of

	microbiome-associated diseases, laying the foundation for future clinical applications.
Contact points	Informal inquiries may be addressed to Pingfeng Zhang (zhangpingfeng@suat-sz.edu.cn) and Loh Teng-Hern Tan (loh-teng-hern.tan@nottingham.edu.cn); Prof. Learn-Han Lee (Learn-Han.Lee@nottingham.edu.cn); Assist. Prof. Jodi Woan-Fei Law (jodi-woan-fei.law@nottingham.edu.cn).
PhD topic	**Thermal Management Mechanisms and Regulation Strategies for Electronic Skin Systems**
SUAT Supervisor	Prof. Zhiyuan Liu
UNNC Supervisor(s)	Prof. Yong Shi
Short introduction & description of the PhD project	Electronic skin systems integrate flexible electronic materials, high-density functional devices, and multimodal sensing units. Under complex operating environments and mechanical deformation, significant heat accumulation and non-uniform temperature distribution may occur. Thermal management has therefore become a critical scientific and engineering challenge affecting the performance stability, reliability, and wearing comfort of electronic skin systems. This PhD project focuses on thermal management in electronic skin systems through a collaborative research framework that integrates engineering thermophysics and flexible electronic materials. From the perspective of thermal management and heat transfer, the project aims to investigate heat generation, transport, and dissipation mechanisms in flexible and stretchable electronic systems, and to develop thermal analysis models suitable for electronic skin architectures. In parallel, the effects of material composition, structural design, and interfacial characteristics on thermal behavior will be systematically studied based on flexible electronic materials and device structures. Furthermore, the project will explore thermal management design and regulation strategies for electronic skin systems, establishing systematic relationships between materials, structures, and thermal performance. This research aims to provide fundamental understanding and methodological support for the development of high-performance and reliable electronic skin systems.
Contact points	Informal inquiries may be addressed to Prof. Zhiyuan Liu (liuzhiyuan@suat-sz.edu.cn) and Prof. Yong Shi (yong.shi@nottingham.edu.cn).
PhD topic	**Few-Shot Learning with Medical Foundation Models**
SUAT Supervisor	Prof.Chao Dong
UNNC Supervisor(s)	Prof.Ying Weng
Short introduction & description of the PhD project	Clinical AI development is often hindered by the "long-tail" distribution of medical data, where numerous rare conditions and specific clinical tasks lack sufficient annotated data, making model adaptation inefficient and non-scalable. Few-shot learning built upon multimodal foundation models offers a transformative solution to rapidly construct performant AI systems for these data-scarce scenarios. We will investigate parameter-efficient and prompt-based adaptation strategies that enable large multimodal medical foundation models to generalize to diverse downstream tasks, such as rare disease diagnosis, specialized imaging interpretation, and cross-modality clinical reasoning, using only a handful of labeled examples. Emphasis will be placed on robustness, data efficiency, and minimizing task-specific retraining costs.
Contact points	Informal inquiries may be addressed to Prof.Chao Dong (xulijian@suat-sz.edu.cn) and Prof. Ying Weng (Ying.Weng@nottingham.edu.cn).