UNNC – SIAT/SUAT Doctoral Training Partnership

It's essential that you have contacted the UNNC and SIAT/SUAT supervisors before applying.

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

- 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

	Yuanmiao Sun
	Dr. AKM Asif Iqbal Dr. Yi Nie
	Biomaterial-based artificial bone implants are becoming popular for treating human bone problems. Developing artificial bone implants for bone repair is a significant topic in advanced bio-manufacturing. Traditional metallic biomaterials are permanent and non-degradable in physiological environments. These materials used in bone-fixing implants require re-surgery to retract following tissue healing. In addition, metallic materials have a higher elastic modulus and strength than real bone. This elastic modulus mismatch causes stress shielding, which limits bone development and remodeling to meet mineral content requirements. Eventually, the surrounding bone becomes weak and porous, causing implant failure. One prospective solution to the above problem is to develop a suitable material that shows similar mechanical properties to human bone, accelerates the healing process, and can be completely resorbed in the human body after the healing of the fractured bone. Therefore, we propose to develop a novel hybrid metal matrix composite that can possess all the properties necessary for the bone implant. The metallic composite will be fabricated by hydroxyapatite (HA) and graphene (GNP) reinforcement by using 3D printing. Their mechanical corrosion and degradation properties will be evaluated by experimental investigation and numerical modelling.
	Informal inquiries may be addressed to Dr. Yi Nie (yi-nie@nottingham.edu.cn) and Dr. Yuanmiao Sun (sunym@siat.ac.cn).

	Prof. Shifeng Guo
	Prof. Jian Yang
	Human organs generally have complex surfaces, medium heterogeneity, and multi-interface, resulting in complex ultrasound propagation behavior. Consequently, medical ultrasound diagnosis of such human organs has 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. 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.
	Informal inquiries may be addressed to Prof. Shifeng Guo (sf.guo@siat.ac.cn) and Prof. Jian Yang (jian.yang@nottingham.edu.cn).
	Yang Bai
	Prof. Christos Spitas, Dr. Yi Nie
	By ionising and accelerating fullerene molecules in vacuum to a precisely controlled narrow energy window, or by manipulating fullerene molecules with tightly focusd femtosecond laser, and directing them at a suitable substrate (e.g. graphene), we propose to cause controlled fusion of the fullerenes and the substrate, and subsequently of fullerenes to fullerenes in subsequent layers. We shall thereby develop an additive manufacturing process, capable of producing net shape fullerite to any scale, depending on application times, obtaining structures of unprecedented strength-to-weight ratio as well as several other beneficial multiphysical properties. The research will make use of both computational (MD, DFT) and physical models (new experimental apparatus) to prove the concept and produce a first demonstration of the process, the material, and their capabilities.

	Informal inquiries may be addressed to Dr. Yi Nie (yi-nie@nottingham.edu.cn) and Dr Yang Bai (y.bai@siat.ac.cn).
	Prof. Yongbing Tang
	Prof. Di Hu

Wide-temperature batteries are an essential advancement in electrochemical storage technology, catering to a broad spectrum of applications from electri .4(a1(m)1.12 0.599 re2)-1.plTEMCco fue tno ao actn te.3(o)-4.2(a)-3.c

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	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.
	Informal inquiries may be addressed to Prof. Zhanli Hu (zl.hu@siat.ac.cn) and Prof. Fazlullah (Khan) (fazl.ullah@nottingham.edu.cn)
	Yimin Zhou
	Dave Towey
	The underwater environment is complex and changeable, and the adaptability and measurement accuracy of varied sensors in different spatial-temporal regions are quite diversified, hence the study on the underwater behavior understanding and behavioural trajectory prediction based on multimodal data is important for the underwater small target behavior understanding. It is of great significance for the underwater security system development towards intelligence and autonomy.
	Informal inquiries may be addressed to Yimin Zhou (ym.zhou@siat.ac.cn) and Dave Towy (dave.towey@ nottingham.edu.cn).
	Prof. Rong Sun
	Dr Kok-Hoong Wong
	With the popularity and rapid upgrading of mobile phones and computers and other electronic appliances, a large number of electronic waste needs to be disposed of. According to the United Nations, an average of 7.6 kg of e-waste was generated per person in 2021, meaning that more than 57.4 million tons of e-waste has been generated globally in 2021. If these e-waste is not properly dealt with, it will seriously endanger human survival, so it is an inevitable trend to develop environmentally friendly materials with degradable characteristics in the field of electronic packaging. This project will focus on biodegradable polymer materials through molecular design. After being utilized, the polymer materials can be decomposed in a mild acid environment such as acetic acid and soil, without causing environmental pollution, and alleviate the ecological pollution caused by e-waste from the source.
	Informal inquiries may be addressed to Prof. Rong Sun (rong.sun@siat.ac.cn) and Dr Kok-Hoong Wong (kok-hoong.wong@nottingham.edu.cn)
	Prof. Lin XIA
	Dr Wai Siong CHAI
	Ammonia is one of the most popular energy vectors with its zero carbon properties. The Haber-Bosch process producing ammonia has existed for more than a century and still requires high pressure high temperature condition for operation. The bioelectrochemical wastewater treatment system is anticipated to produce ammonia from the wastewater via

	environmentally-friendly process. The lifecycle analysis and environmental impact of such system also has to be evaluated. Based on this background, this project will focus on three dimensions (i) set up the bioelectrochemical wastewater treatment systems; (ii) test the efficiency for wastewater to fuel conversion; and (iii) perform the lifecycle analysis. The project would contribute to carbon neutrality and point the way for a sustainable future.
	Informal inquiries may be addressed to Dr Wai Siong CHAI (wai-siong.chai@nottingham.edu.cn) and Prof. Lin XIA (lin.xia@siat.ac.cn).
	Prof. Ping Gong
	Dr. Yong Ren
	Using the designability characteristics of artificial components such as supramolecules, fluorescent probes, micro-nano particles, nucleic acid aptamers, peptides, etc., combined with the advantages of biological components such as antibodies, enzymes, cell membranes, vesicles, etc., to construct bionic non-cell hybrid systems, giving non-cell hybrid systems perception and autonomous movement functions, and applying them to the diagnosis and treatment of gastrointestinal tumors.
	Informal inquiries may be addressed to Yong Ren (email yong.ren@nottingham.edu.cn) and Ping Gong (ping.gong@siat.ac.cn).
	Professor Jinling Tang
	Professor Zhuo Chen
	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.

	Prof Shuqiang Wang
	Dr Heshan Du
	Generative artificial intelligence refers to new technologies that employ existing data including images, text, and audio files to create new content. This new content has a similar underlying pattern of real-world data and has great potential applications in many areas. Synthetic data from generative AI can train machine learning models to be less biased and help robots to learn more abstract concepts both in the real and virtual world. An ontology refers to an explicit specification of a shared conceptualization and plays an important role in establishing a common vocabulary for people who need to share information. It defines the meanings of concepts and relations explicitly, and these definitions can be read and interpreted by machines automatically. Consider the image segmentation problem as an example. To improve the interpretability and reliability of deep learning-based image semantic segmentation methods, it is promising to represent domain knowledge and inference rules defined by human beings as ontologies and incorporate ontology reasoning into the deep learning framework. This research will explore (1) the advances, challenges, and prospects of brain image computing and brain network computing techniques using generative artificial intelligence; (2) the effectiveness of combining deep learning and ontology reasoning for medical image segmentation, object detection and classification, etc.
	Informal inquiries may be addressed to Prof Shuqiang Wang (sq.wang@siat.ac.cn) and Dr Heshan Du (heshan.du@nottingham.edu.cn).
	Dr. Ling Yin
	Dr. Huan Jin
	Complex spatiotemporal network control is of significance for many areas such as epidemic control and transportation control. Reinforcement learning (RL) is suggested as a useful tool to address these issues. However, there are some challenges to deal with a complex spatiotemporal network such as the 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 RL-based control methods to real-world problems in 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.
	Informal inquiries may be addressed to Dr. Ling Yin (yinling@siat.ac.cn) and Dr. Huan Jin (Huan.Jin@nottingham.edu.cn).

	Dr Jijun Tang
	Dr Weihua Meng
	Traditional drug research and development is a time-consuming and laborious process. From target discovery to lead compound generation to candidate drugs, it requires a lot of human and financial resources. Computer-aided drug molecular design can accelerate the process of drug molecular research and development. The molecular design aims to generate molecular compounds with high affinity for certain receptor targets, and also have good biological function characteristics. According to the different representations of molecular compounds, the existing drug research and development directions can be roughly divided into three categories: molecular generation based on one-dimensional molecular description, molecular generation based on two-dimensional molecular description, and molecular generation based on three-dimensional molecular description. In addition, molecular generation tasks can be divided into two types according to the molecular generation tasks. The first type is molecular generation based on a single target, and the second type is molecular generation based on multiple targets, indicating that the generated molecules need to target more than two targets at the same time. The student will gain relevant research experience in the design of drug-like molecules. The student would cultivate the skills of study design, analysis of molecular data (one-dimensional representation, two-dimensional representation of drug-like molecules, etc.), constructing deep learning model architectures, and drug-related experimental processing methods. Molecule analysis, programming, and academic writing will be provided. The student will be supported to publish papers as the lead author during the Ph.D. The ideal candidate should have a Master's degree in Bioinformatics or computer science. Proficiency with Python is essential.
	Informal inquiries may be addressed to Dr Jijun Tang (jj.tang@siat.ac.cn) and Dr Weihua Meng (Weihua.Meng@nottingham.edu.cn).
	Prof. Yaoqin Xie
	Prof. Sean He
	Image Guidance is critical during radiation therapy, Medical imaging plays an essential role in cancer diagnosis, treating plan and radiotherapy. But during the treating course, tumors position would change caused by breathing and filling of hollow organs, and irregular movement caused by emotional stress. This my laed to target region inaccuracy and trouble on tumor track and the plan to continue treatment. Image processing techniques based on machine learning can improve these problems, by learning natural mark supervised learning the matching relation, or by learning multimodal fusion problem. These problems will be the main focus during the project.
	Informal inquiries may be addressed to Prof Sean He (sean.he@nottingham.edu.cn) and Prof Yaoqin XIE (yq.xie@siat.ac.cn).
	Dr Yi Pan
	Dr Bencan Tang

the great challenges we are confronted with is the heterogeneity gap in multimodal data.

	Informal inquiries may be addressed to Prof. Zeyang Xia (zy.xia@siat.ac.cn) and Assoc. Prof Dunant Halim (dunant.halim@nottingham.edu.cn).
	Dr Xiao Yi
	Dr Jing Wang
	Surface Plasmon Resonance (SPR) technology uses a surface-sensitive optical instrument to detect heavy metals, viruses or pathogenic bacteria by specific binding of these targets with probing molecules such as proteins. While a robust and versatile probe, naturally occurring proteins are usually insufficient in their binding affinity to the targets, thereby limiting the sensitivity of SPR based diagnostics. Directed evolution mimics the cycle of mutagenesis and natural selection in nature to evolve novel or improved protein functions, and have been serving a workhorse for engineering proteins for industrial and medical applications. Recent advances of this technology such as Targeted Artificial DNA Replisome (TADR) further boosts the capacity of optimizing protein functions. TADR is able to (i) target a region no less than a gene and show low off-target mutagenesis, (ii) carry out a high mutation rate that can be turned on and off, and (iii) work with any trait that can be screened. This project will focus on (i) constructing TADR in and (ii) evolving probe proteins to be used in SPR sensor chips.
	Informal inquiries may be addressed to Dr Jing Wang (Jing.Wang@nottingham.edu.cn) and Dr Xiao Yi (xiao.yi@siat.ac.cn).
	Dr. Jiandong Wu
	Dr. Yong Shi
	The high specificity of the tumor microenvironment (TME) and the species differences between animal models and humans lead to significant disparities between traditional in vitro and in vivo models and the actual TME. Leveraging techniques from engineering, biology, and physics, microfluidic device holds the promise to provide a more authentic, precise, and controllable physiological environment, presenting a substantial advantage in the creation of in vitro cancer models. This project will focus on development of microfluidic tumor-immune interaction models characterized by high throughput, high vascularity, and the ability to replicate the role of immune system in cancer development. Potential applications of these sophisticated models will include understanding of role of the immune system in cancer progression, as well as evaluating different immunotherapy methods such as the immune cell therapy and immune checkpoint therapy.
	Informal inquiries may be addressed to Dr. Yong Shi (Yong.Shi@nottingham.edu.cn) and Dr. Jiandong Wu (jd.wu@siat.ac.cn).
	Prof. Zhiyuan Liu
	Dr. Yong Ren

	Stretchable electronics has evolved with the synthesis of new soft materials and new device architectures that require significant deformability; therefore, it has high application potentials in wide range of biomedical areas such as biosensors. This project will focus on study of the solid-liquid phase transition and plastic deformation of liquid metal alloy and fabrication of liquid metal alloy based flexible electronic devices which are composed of 3D circuits. Our work will lead to the development of 3D structured wearable sensor and a multilayer flexible circuit board. It will provide a facile strategy for constructing highly integrated electronics of hierarchical structure involving complicated 3D circuits.
	Informal inquiries may be addressed Prof. Zhiyuan Liu (zy.liu1@siat.ac.cn) and Dr Yong Ren (yong.ren@nottingham.edu.cn).
	Prof. William Weijia Lu
	Dr Enrico Marsili
	1. 3D-bioprinted osteoblast-laden hydrogel constructs with induced microenvironments promote cell viability, differentiation, and osteogenesis both in vitro and in vivo 2. Drug& device modulates osteogenic activity of bone biomaterials for bone formations
	Informal inquiries may be addressed to Prof. William Lv (wwlu@siat.ac.cn) and Prof. Enrico Marsili (enrico.marsili@nottingham.edu.cn).
	Prof. Guocheng Wang
	A/Prof. Enrico Marsili
	Titanium and its alloys, collectively referred to as titanium alloys, possess high mechanical strength, excellent biocompatibility, strong corrosion resistance, and wear resistance. As a result, they have become widely used materials for the repair of hard tissues such as bones and teeth. However, there are two significant issues with clinical titanium alloy implants: inadequate bone-inducing capacity and a lack of antimicrobial and antibiofilm activity. Therefore, the current focus and challenge in research lie in how to endow implants with antimicrobial and antibiofilm capabilities and achieve bone integration through surface modification strategies. In recent years, the promotion of cellular functions and the inhibition of bacterial adhesion by nanostructures have received considerable attention. Based on this, the aim of this project is to develop a novel strategy for constructing nanostructured surfaces on implants, systematically investigate the differential regulatory mechanisms of nanostructures on cells and bacteria, and develop an implant surface that not only possesses antimicrobial functionality but also inhibits biofilm formation and bacterial activity to prevent bacterial infections.
	Informal inquiries may be addressed to A/Prof. Enrico Marsili (enrico.marsili@nottingham.edu.cn) and Prof. Guocheng Wang (gc.wang@siat.ac.cn).

	Huiyun Li
	Jian Yang
	Nowadays, the industrialization and wide ranges of applications of autonomous driving technologies still face challenges. Test the safety of Autonomous Driving Systems (ADS) with realistic traffic conditions is important to the insurance industry, legislators, and third-party technical services. However, the scarcity of risky driving events distributed in real-world driving often makes sampling inefficient. A unified and hierarchical testing framework for efficient and unbiased tests of ADS is targeted.
	Informal inquiries may be addressed to Prof Huiyun Li (hy.li@siat.ac.cn) and Prof Jian Yang (jian.yang@nottingham.edu.cn).
	Dr Zhuojun Dai
	Dr Bo Li
	Living building materials utilize microorganisms to produce construction materials that exhibit mechanical and biological properties. The resultant materials could have the capacity to self-repair and self-replicate, sense local and distant disturbances in their environment, and respond with functionalities for reporting, actuation or remediation. However, few engineered living materials are capable of both responsivity and use in macroscopic structures. Therefore, we proposed to engineer microbial consortia that can form mouldable, foldable and regenerative living structures. This living building material could be further strengthened and optimized by integrating with the nano-materials. By this strategy, we can facilitate the development of living biomaterials with new properties and functionalities.
	Informal inquiries may be addressed to Dr. Bo Li (bo.li@nottingham.edu.cn) and Prof Zhuojun Dai (zj.dai@siat.ac.cn).
	Prof. Na Zhang
	Prof Xiangjian (Sean) He
	The Internet of Things (IoT), especially in healthcare, generates a vast amount of complex data. This requires significant attention in managing the data influx to perform timely and accurate diagnoses. As a result, numerous AI and data fusion models have been proposed but these are prone to issues, such as privacy, complex structure, and variance in healthcare data. In this project, we aim to propose a two-stage multi-classification model in IoT-enabled federated fusion for Breast Cancer (BC). The proposed model integrates an enhanced VGG-16 (eVGG-16) Convolutional Neural Network with L1 regularization and a dropout layer to identify BC and its associated stages. First, we identify cancer cells via binary classification, and then we identify cancer stages using multi-classification. However, in multi-classification, standard models struggle to capture patterns from data due to their complex structure. Therefore, federated learning (FL) is used to train eVGG-16 on a fused dataset of BC, which is then deployed on client devices (hospital). The proposed arrangements ensure the preservation of privacy, while the data

	fusion adds depth and context to the complex BC data, enabling us to circumvent complexities and achieve higher precision.
	Informal inquiries may be addressed to Prof. Na Zhang (na.zhang@siat.ac.cn) and Xiangjian (Sean) He (sean.he@nottingham.edu.cn).
	Prof. Zhengkun Yi
	Dr. Jing Wang
	Soft robots are capable of mimicking complex motions of human beings and animals. Embedded soft sensors are important for soft robots to sense and response to its surroundings. Unfortunately, most sensors are made out of conventional electronics, which is rigid and is not suitable for soft robotic applications. Alternatively, fiber-optic sensor has a number of unique advantages compared with its electronics counterpart. Fiber-optic sensors have been a powerful tool for sensing a wealth of physical quantities such as strain, pressure, vibration, temperature and so on. This project will aim to develop fiber-optic sensor for soft robots and stretchable electronics., including 1) the development of novel fiber-optic sensor with large strains that can be used for soft robotics and stretchable electronics, 2) the development of advanced machine learning methods for interpreting optical signals, and 3) integration of the developed sensors and algorithms for various applications such as soft robot hand, tactile glove, exoskeleton robots.
	Informal inquiries may be addressed to Prof. Zhengkun Yi (zk.yi@siat.ac.cn) and Dr. Jing Wang (Jing.Wang@nottingham.edu.cn).
	Shuqiang Wang
	Ruibin Bai
	This topic mainly focus on the application of advanced algorithms and machine learning techniques in the field of healthcare to generate, analyze, and make sense of large amounts of data. This interdisciplinary approach combines the power of artificial intelligence and computational methods to develop innovative solutions for improving patient care, disease diagnosis, treatment planning, and medical research. By leveraging generative AI and computational intelligence, healthcare professionals can gain valuable insights, predict outcomes, and optimize medical processes, ultimately leading to more personalized and effective healthcare interventions.
	Informal inquiries may be addressed to Shuqiang Wang (sq.wang@siat.ac.cn) and Ruibin Bai (ruibin.bai@nottingham.edu.cn).
	Xiangxin Li
	Pushpendu Kar
	Monitoring and analysis the human physiological information to assess the functions of human movement and cognition based on wireless sensor networks and machine learning.

	It mainly includes the researches of wireless sensor networks for the real-time acquisition of multimodal physiological information such as EEG, EMG, blood bleeding oxygen and ultrasonic image, biomedical signal processing, high-performance information mining and characterization, internet of things, and the development and application of machine learning algorithms.
	Informal inquiries may be addressed to Dr Pushpendu Kar (Pushpendu.Kar@nottingham.edu.cn) and Dr Xiangxin Li (lixx@siat.ac.cn).
	Ye Li
	Ruibin Bai

Internet of Medical Things (IoMT) has been promoted in widespread digital health applications, with the technical development on wearable devices, Internet of Things, and artificial intelligence, etc.. Currently, the most common application scenarios are, for instance, daily healthcare and smart

	composites are one of the most critical materials to solve the EMI problems. This project will focus on the high performance electrically conductive composites through novel chemical and microstructure design, and dedicate to improving their versatility including flame retardant, thermal conductive and recyclability, etc. Moreover, the application of the high performance electrically conductive composites will also be demonstrated.
	Informal inquiries may be addressed to Prof Xiaoling Liu (Xiaoling.liu@nottingham.edu.cn) and Prof Yougen Hu (yg.hu@siat.ac.cn).
	Tianfu Sun
	Jing Li
	Motor is the prime mover for both industry and domestic applications. With the increasing performance of power electronics and micro-processor (MCU), higher speed becomes the trend of the motor technique. Increase of the motor rated speed can significantly enhance the motor power density and make the whole system lighter and more compact. Therefore, high speed motor could be widely applied in automobile industry, robotics, aerospace industry, etc. However, higher speed will also bring more changelings. This project will focus on two major dimensions: (i) high speed motor design, including multi-physical field simulation analysis, electromagnetic optimization, thermal and stress analysis of high-speed motor; (ii) high speed motor control, including design and prototype of wide-bandgap power module-based motor drive, development of advanced sensor-less control strategy and etc.
	Informal inquiries may be addressed to Prof Tianfu Sun(tf.sun@siat.ac.cn) and Prof Jing Li (Jing.Li@nottingham.edu.cn).
	Chunbo Lou
	Xiangjian (Sean) He
	By combining high-throughput experiment and natural language processing algorithm to mining and optimizing potent biological regulatory parts. Specially, we are interested in the design of regulatory elements for next generation RNA technology and gene therapy, e.g. efficient RNA Capping enzymes for RNA vaccine.
	Informal inquiries may be addressed to Xiangjian He (Sean.He@nottingham.edu.cn) and Chunbo Lou (cb.lou@siat.ac.cn).

	treating neuropsychiatric isorders such as retinal degenerative diseases.
	Informal inquiries may be addressed to Prof Guang Zhu (Guang.Zhu@nottingham.edu.cn) and Prof Xuemin DU (xm.du@siat.ac.cn).
	Zhile Yang
	Prof Ruibin Bai
	The generation, transmission, storage and application of energy is an important topic for human survival and development. Under the multiple pressures of environmental protection, energy structure transformation, energy conservation and emission reduction, the world is vigorously promoting the development of the electric vehicle industry. In the face of the characteristics of electric vehicle user behaviour and energy perception, such as strong spatiotemporal randomness, a large proportion of user willingness, and deep integration of multiple factors, the realization of high generalization and robust optimization and control of electric vehicle cluster energy interconnection, modelling and intelligent collaboration is a necessary research to improve vehicle owner economy, power grid stability, system operating costs, and operator benefits. To achieve the above goals, the project will focus on the following three directions: (i) Integration of multi-objective group intelligent optimization algorithms to achieve individual energy interconnection modelling and collaborative regulation. (ii) Establish a variety of energy interconnection regulation models within and across clusters, and introduce a large-scale swarm intelligence optimization algorithm to solve the difficulties of cluster energy interconnection collaborative optimization regulation. (iii) Integration of large language models to achieve model self-training and self-selection for group perceptual scheduling optimization of electric vehicles.
	Informal inquiries may be addressed to Prof. Zhile Yang (zl.yang@siat.ac.cn) and Prof Ruibin Bai (ruibin.bai@nottingham.edu.cn).
	Prof. Baofu Ding
	Dr Wai Siong CHAI
	The freshwater resources available for direct human use constitute only a tiny fraction (0.007%) of the global water resources. Membrane for water treatment, through selective separation and removal of ions from water, holds great potential in addressing water purity and scarcity issues. Conventional membrane-based water treatment technologies include electrodialysis, reverse osmosis, and forward osmosis. Forward osmosis, operating based on the natural osmotic pressure gradient across the membrane, stands out due to its extremely low energy consumption. However, the trade-off between selectivity and throughput in forward osmosis remains a challenging issue. Based on this background, this project will focus on (i) the uniform construction of anisotropic two-dimensional nanochannels, (ii) precise control of nanochannel dimensions, (iii) functionalization strategies of nanochannels. These efforts aim to enhance the ion rejection rate and water

	transport performance of water treatment membranes, as well as paving for carbon-neutral future.
	Informal inquiries may be addressed to Prof. Baofu Ding (bf.ding@siat.ac.cn) and Dr Wai Siong CHAI (wai-siong.chai@nottingham.edu.cn).
	Prof. Nie Zedong
	Dr. Pushpendu Kar
	According to report, 30% of all deaths are related to circulatory systems problems, like arrhythmias, myocardial ischemia, or prolonged QT intervals. Thus the importance of the monitoring of our vital signals by an electrocardiogram (ECG) - the electrical activity of the heart recorded by electrocardiography, includes the measurement of the heart rate and the determination of the rhythm as well as the diagnosis of arrhythmias, myocardial ischemia, and prolonged QT intervals. Indeed, IoT-based detection of heart diseases have the potential to give maximum information and deliver information to medical staff. Our aim in this project is to identify and provide technological solution of heart diseases through IoT-based systems. The developed system will help to better monitor cardiovascular patients and elderly people as well as reach a better medical treatment to them.
	Prof. Nie Zedong (zd.nie@siat.ac.cn) and Dr. Pushpendu Kar (Pushpendu.Kar@nottingham.edu.cn).
	Prof. Chao Zhong
	Dr Wai Siong CHAI
	Material-microorganism hybrid based artificial photosynthesis combines the broad absorption of semiconductors and the catalytic specificity of biosystems. They could achieve high-efficiency light-driven fixation of carbon dioxide to long-chain molecules. The impact to environment was still not fully understood, which hindered the practical usage and government decisions. So we need to calculate their LCA (life cycle analysis) and asses their environmental impact. Based on this background, this project will focus on three dimensions (i) set up the material-microorganism hybrid systems; (ii) test the efficiency for light to chemical conversion; and (iii) perform the LCA. The project would contribute to carbon neutral and point the way for a sustainable future.
	Informal inquiries may be addressed to Dr Wai Siong CHAI (wai-siong.chai@nottingham.edu.cn), Prof. Chao ZHONG (chao.zhong@siat.ac.cn) and Dr Xinyu Wang (xy.wang3@siat.ac.cn).
	Shanshan Wang
	Prof.Sean He
	Artificial intelligence technology has garnered widespread attention across various domains. We anticipate leveraging AI-powered medical image processing and analysis to assist physicians and medical equipment, enhancing medical efficiency and accuracy, aiding individuals in obtaining

	superior healthcare services, elevating the standard of medical care, and reducing healthcare costs.
	Informal inquiries may be addressed to Shanshan Wang (ss.wang@siat.ac.cn) and Prof.Sean He (Sean.He@nottingham.edu.cn).
	Prof Zhanli Hu
	Prof Xiangjian (Sean) He
	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
	Informal inquiries may be addressed to Prof Zhanli Hu (zl.hu@siat.ac.cn) and Prof Xiangjian (Sean) He (sean.he@nottingham.edu.cn)
	Prof. Shoujun Zhou
	Prof. Sean He
	Artificial intelligence assisted intervention therapy is the trend of clinical development, but accurate navigation is still one of the clinical difficulties. In order to break through the technical bottleneck of interventional surgery, the key is to solve the core scientific problems such as accurate path planning, real-time navigation and safe operation. Therefore, the research of artificial intelligence methods for medical image big data and related conditions is of great significance.
	Informal inquiries may be addressed to Prof Sean He (Sean.He@nottingham.edu.cn) and Prof Shoujun Zhou (sj.zhou@siat.ac.cn)

	reduction in these patients could help address the health problems raised from polypharmacy, and if so, whether this could be cost-effective. In this project, we will examine these questions. We will systematically review randomized controlled trials and observational studies to summarize available relevant evidence and identify the important gaps for future research. We will use real-world clinical data from Shenzhen and the UK to assess the potential effectiveness and safety of medication reduction in patients with type 2 diabetes. We may also conduct cost-effectiveness analysis. The student will gain experience in pharmacoepidemiology and pharmacoeconomics research using large-scale real-world data. The student will develop skills in conducting systematic literature reviews, study design, statistical programming, data analysis and academic writing. Relevant training will be provided. The student will be supported to publish peer-reviewed papers as the lead author during the PhD. The ideal candidate should have a Master degree in epidemiology, data science, public health, or clinical medicine. Proficiency with STATA, R or SAS is essential.
	Informal inquiries may be addressed to Dr Zhirong Yang (zr.yang@siat.ac.cn) and Prof Zhuo Chen (Zhuo.Chen@nottingham.edu.cn)
	Assoc. Prof. Baofu Ding
	Assoc. Prof. Nicholas Musyoka
	High-purity hydrogen is crucial for fuel cells, and H_2/CO_2 separation is a key technology in hydrogen production and purification. The H_2/CO_2 separation methods encompass absorption, adsorption, cryogenic separation, and membrane separation technologies. Among these, membrane separation technology stands out due to its lower energy input requirements and high selective separation of H_2/CO_2. However, the high selectivity often implies low throughput, thereby affecting the efficiency of gas separation. The trade-off between selectivity and throughput in gas separation remains a challenging issue. Based on this background, this project will focus on (i) the uniform construction of anisotropic two-dimensional nanochannels, (ii) precise control of nanochannel dimensions, (iii) functionalization strategies of nanochannels. These efforts aim to develop a gas separation membrane that combines precise H_2 sieving with efficient transport, thereby enabling effective capture of CO_2 molecules and efficient transport of H_2 molecules.
	Informal inquiries may be addressed to Prof. Baofu Ding (bf.ding@siat.ac.cn) and Assoc. Prof. Nicholas Musyoka (Nicholas.Musyoka@nottingham.edu.cn).
	Prof Zhi-Quan LIU
	Dr Kok Hoong WONG
	Integrated circuit (IC) technology plays a role of cornerstone in advanced electronic manufacturing and provides the hardware infrastructure in modern electronic information industry. The surging of 5G, interconnect of things (IoT) and artificial intelligence (AI) technology waves drives chips of customer electronics to higher levels of miniaturization, integration, and

multi-function. Since semiconductor processing is approaching the physical limits of Moore's Law, advanced packaging technologies gain considerable

	techniques to allow autonomous systems to act and cooperate safely and effectively in future "intelligent spaces". This overall aim will be broken down into three key objectives: 1) recognising the actions performed by other agents and humans via computer vision techniques; 2) predicting the intention of other agents and humans based on the recognised actions; and 3) deciding how to act given these predictions.
	Informal inquiries may be addressed to Dr. Yuan Yao (Yuan.Yao@nottingham.edu.cn) and Prof. Qieshi Zhang (qs.zhang@siat.ac.cn).
	Assoc. Prof. Na Zhang
	Asst. Prof. Fazl Ullah (Khan)
	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.
	Informal inquiries may be addressed to Prof Na Zhang (na.zhang@siat.ac.cn) and Prof Fazl Ullah (Khan) (Fazl.Ullah@nottingham.edu.cn)
	Prof. Pengfei Zhang
	Prof. Cheng Heng Pang
	With the booming development of nanomedicine, mild photothermal therapy (mPTT, 42– 45°C) has exhibited promising potential in tumor therapy. Compared with traditional PTT (> 50°C), mPTT has less side effects and better biological effects conducive to tumor treatment, such as loosening the dense structure in tumor tissues, enhancing blood perfusion, and improving the immunosuppressive microenvironment. However, such a relatively low temperature cannot allow mPTT to completely eradicate tumors, and therefore, substantial efforts have been conducted to

	optimize the application of mPTT in tumor therapy. This project will focus on two major dimensions on (i) development of novel nanoagent with multifunction for and (ii) understanding the mechanism of mild-temperature photothermal therapy.
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	Prof Jinyan Li
	Prof Vladimir Brusic
	In the battle against COVID-19, we are always acting behind the mutation and evolution pace of the SARS-CoV-2 virus. We are jabbing Pfizer and Modena mRNA vaccines for Delta strain-infected populations, which were actually designed using the spike gene template of the original strain and were trial-tested on the population infected by the original strain as well. As the mutations from the original strain to the Delta strain of the virus is significant, the efficacy of the mRNA vaccines is remarkably sacrificed (from 95% to 65%) for the Delta-strain infected patients to prevent death. If the mutations in the Delta strain have had been accurately predicted at the emerging time of COVID-19, the design of the mRNA vaccines would be considering both the original sequence and the predicted Delta-strain sequence to get early preparedness to fight against the pandemic. Computational Challenges: Although there are millions of sequences of different strains of the virus publically available at the NCBI and GISAID sars-cov-2 databases, the time stamps and series of these sequences are hardly known, causing difficulties in the training data construction for advanced machine learning and prediction models. Without the prediction model, it's challenging to answer questions such as what's the next strain, it's a mild mutation or virulent or deadly? Potential impacts: We will use bioinformatics methods to investigate the epitope sites and receptor-binding sites at the spike gene of the predicted strains. If the predicted strain is virulent, we will collaborate with pharmaceutical companies for the design of future mRNA vaccines to win a one-step-ahead time to effectively control next waves of viral infections. We also investigate the therapeutic target sites of miRNA or siRNA drugs at the predicted spike mRNA sequences in an aim for effective treatment of future patients. We will also collaborate and discuss with Health Departments to discuss government policy adjustments to prevent and control future infectious diseases.
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	Prof Weinong Fu
	Dr Nadia Mei Lin Tan Dr John Xu
	This research project will focus on the optimal design of electric motors for driving electric vehicles in system level. Numerical methods such as finite element method will be used to simulate the operation of the motors. Optimization methods will be employed to find the best designs, and

	artificial intelligence will accelerate the computing process. The machine learning methodologies will be investigated to achieve the global optimal control for the motor with control modules. Hardware experiments will be carried out to validate the proposed models and methodologies. The applicants may have the basic knowledge of electrical engineering.
	Informal inquiries may be addressed to Prof. Weinong Fu (wn.fu@siat.ac.cn) and Dr. Nadia Mei Lin Tan (nadia.tan@nottingham.edu.cn).
	Escherichia coli
	Dr. Bo Wang
	Prof. Xiaolei Fan
	Photosynthetic biohybrid systems integrating light-harvesting semiconductor nanomaterials with highly specific whole-cell biocatalysts, represent a new trend for artificial photosynthesis with remarkable capabilities in solar-to-chemical conversion. The development of such systems is still in the early stages, and their applications have been hindered by limited conversion efficiency and product value. As one of the widely used industrial workhorse microorganism, has mature genetic engineering tools to expand the product spectrum. Moreover, engineered have been successfully integrated with different nanomaterials to produce valuable products including glucose, l-malate, l-tert-leucine, farnesyl and threonine. MOFs are a new class of porous crystalline materials constructed from organic ligands and metal ions/clusters. They have attracted much attentions in recent years and numerous studies have revealed their great potential in various applications. Excellent cytoprotective function of MOFs has already been demonstrated, however, their roles as photosensitizer to microbial cells have not yet been deeply investigated in biohybrid system. Therefore, design and construction of a MOF- biohybrid system for efficient light-driven valuable chemical production is of great significance. This project will focus on (1) synthesis and screening MOFs with excellent photoelectrochemical property and cytoprotective function agaist reactive oxygen species, (2) constructing a MOF- biohybrid system with highly efficiency electron transfer interface, (3) genetic engineering to achieve light-driven biosynthesis of different valuable production (such as amino acids and alcohols), (4) studying the underlying mechanism of material-cell energy transfer and intracellular energy conversion.
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	Prof Zhitong Chen
	Prof Xiaolei Fan
	As the fourth state of matter, plasma's unique properties and interactions with other states of matter offer many promising opportunities for investigation and discovery. In particular, cold atmospheric plasma (CAP), operating at atmospheric pressure and room temperature, has remarkable potential applications for catalysis, biomedicine, environment, materials,

	energy, and so on. In this project, we will co-supervise PhD students working on developing plasma technology for environmental remediation, waste valorisation, and biomedical applications. In addition, we also can supervise Ph.D. students developing plasma technology to assist in the rational design of new catalysts for CO2 conversions and biomedical applications.
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	Aldo Tagliabue
	Enrico Marsili
	Infectious diseases represent a major health threat for mankind, in particular for subjects with weak immune defenses, such as patients with chronic diseases and elderly people. In these subjects, infectious microorganisms trigger an inappropriate reaction that encompasses both an insufficient capacity to destroy the infectious agent and an unbalanced inflammatory reaction that can cause pathological conditions in the host. Treating bacterial infections such as pneumonia is increasingly challenging, due to the large spread of antibiotic-resistant microorganisms. The WHO estimates over 10 million death/year for antibiotic-resistant infections by 2030, mostly affecting individuals with inadequate immune defenses. This project aims at addressing the threat posed by antibiotic-resistant biofilms during interaction with healthy and aged models of immune system. This will be done as follows: 1. Examining the innate and adaptive inflammatory reactions to bacteria in normal vs. immunologically frail condition (aged model); 2. Identifying immune mechanisms involved in the anomalous response to bacteria and express the related molecules in cell lines or animal models. 3. Exploring biophysical stimuli of surrounding extracellular matrix (stiffness, topography and adhesion) as a way to express tissue aging in the model. 4. Developing novel adjuvants for immune rebalancing in therapeutic and preventive strategies against bacteria. Enrico Marsili has developed an easy-to-use biofilm testing platform based on bioelectrochemical analysis. The candidate will learn basic biofilm methods and how to monitor/map the interactions between immune cells and biofilms in vitro using biochemical and bioelectrochemical methods. Aldo Tagliabue has decades of experience in immunology and related drug development, recently he is exploring the mechano-immunology as a mean to control the interaction between macrophages and bacteria by changing physical stimuli of microenvironment; a fundamental aspect during aging. The candidate will learn analytical techniques in biophysics characterizing mechanical properties of macrophages in different conditions. In this project, the student will work with both supervisors to implement a model system for accurate monitoring of immune cells/biofilm interactions and identification of therapeutic immunological strategies for biofilm control. Pending positive results, the candidate will implement the most successful approach into animal models.

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	Prof. Wei FENG
	Prof. Nadia Tan
	Distributed energy resources (DERs) play important roles in decarbonizing energy systems and achieving a carbon natural target. The successful deployment of DERs (such as PV, storage etc.) requires a holistic optimization of local energy systems by considering, weather, energy demand, cost. In addition, local energy systems need to interact with the power grid to achieve grid-friendly energy use. The project will develop new energy systems optimization methods focusing on improving system cost, better power quality and/or lower carbon emissions. The project includes three dimension on DERs and local energy system controls: 1) optimization or DERs microgrid in multiple scenarios (including, but not limited to: island, city, remote locations); 2) multi-energy systems (heating/cooling/electricity/H2 etc.) optimization and controls, by using Model Predictive Control (MPC) and Machine Learning (ML) methods; 3) local energy systems demand response modelling focusing on end use technologies (e.g. air-conditioners, Electrical Vehicles -EV) demand response characteristics and optimal load aggregation strategies.
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	Dr. Ling Yin
	Dr. Heshan Du
	A knowledge graph is often used to represent real-world objects and their relationships. Spatiotemporal reasoning over knowledge graphs has various applications in different domains, including urban management, transportation, epidemic control, tourism and so on, which involves complex spatiotemporal relationships. The reasoning over knowledge graphs includes deductive reasoning and inductive reasoning. Deductive reasoning is based on first-order logic or description logic. To reason with spatial and temporal knowledge in knowledge graphs, qualitative spatial and temporal reasoning are required. This project aims to develop spatiotemporal reasoning methods and apply them to real-world knowledge graphs to obtain new knowledge and track how new knowledge is derived from existing knowledge. This project is funded by National Natural Science Foundation of China and the Key R&D Program of the Ministry of Science and Technology of China.
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	Prof. Rongliang Chen

	Dr.Yong Shi
	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.
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	Jian Zhang
	Jing Wang
	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, (ii) enhance the targeting accuracy of engineered exosomes, (iii) expand the application of engineered exosomes in various diseases with minor adverse effects.
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	Ruiheng Liu
	Yong Shi
	With the rapid development of new energy vehicles, thermal management of Lithium-ion battery pack has become one of the most important issues related to the security, endurance and energy efficiency. Thermoelectric can realize the bothway temperature control through electricity, and also features static, miniaturization and high response speed. This PhD project

	will focus on designing and developing intelligent battery thermal management systems, by taking advantage of advanced thermoelectric materials and devices, for low-carbon electric vehicles.
	Informal inquiries may be addressed to Dr/Prof Ruiheng Liu (Rh.liu@siat.ac.cn) and Dr Yong Shi (Yong.Shi@nottingham.edu.cn).