

## SUAT – BNBU 合作项目

**It's essential that you have contacted the potential SUAT and BNBU supervisors before submitting an application.**

Formal applications should follow the instructions in '[Application Procedure](#)' section.

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### Research Programs

- Doctor of Philosophy Programme in Biology
- Doctor of Philosophy Programme in Computer Science and Technology
- Doctor of Philosophy Programme in Applied Mathematics

### Available PhD topics in Biology

PhD topic	Synthetic Biology and Duckweed Biomanufacturing Chassis Development
SUAT Supervisor	<a href="#">Dr. Hongwei Hou</a>
BNBU Supervisor(s)	<a href="#">Dr. Alisa Wenmeng HE</a>
Short introduction & description of the PhD project	<p>The PhD project focuses on developing duckweed (Lemnaceae family) as an efficient biomanufacturing chassis for high-value products and promoting its efficient development and utilization. Duckweed, an tiny aquatic floating plant, boasts remarkable traits: rapid growth (doubling biomass in 1–2 days), high protein content (30–40% of dry weight), strong synthetic and reproductive capacities and a simplified structure. The core research involves modifying duckweed via synthetic biology and metabolic engineering to optimize its metabolic pathways. A key focus is the biosynthesis of glabridin—a bioactive isoflavanoid with anti-inflammatory, antioxidant, and anti-cancer properties, traditionally extracted from licorice with low yield and high cost—by reconstructing and optimizing its biosynthetic pathway in duckweed, including introducing and expressing key functional enzymes. Additionally, the project optimizes controlled cultivation conditions (e.g., light, nutrient supply, density) to maximize biomass and product yield, solves industrial application bottlenecks, and promotes the efficient utilization of duckweed resources in food, pharmaceuticals, and green biomanufacturing fields.</p>

<b>Contact points</b>	Informal inquiries may be addressed to Dr. Hongwei Hou (houhongwei@suat-sz.edu.cn ) and Dr. Alisa Wenmeng HE (wenmenghe@bnbu.edu.cn ).
<b>PhD topic</b>	<b>The impact of adverse environmental exposures (e.g., cadmium, tobacco smoke) on female fertility and intergenerational health</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Jian Zhang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Bo LEI</a>
<b>Short introduction &amp; description of the PhD project</b>	The project aims to investigate the impact of adverse environmental exposures (e.g., cadmium, tobacco smoke) on female fertility and intergenerational health. Using mouse or zebrafish models, the project will examine follicular development defects, oocyte quality decline, and premature reproductive aging, complemented by epigenetic analyses to uncover mechanisms of intergenerational damage. Building on our preliminary findings, the project will also evaluate peptide-based interventions to protect F0 reproductive capacity and mitigate offspring impairment. This direction is goal-oriented and feasible, and it will foster the student's interdisciplinary competence in both environmental toxicology, reproduction and metabolic regulation.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Bo LEI(e-mail address: bolei@bnbu.edu.cn) and Researcher Jian Zhang (e-mail address: jian.zhang@siat.ac.cn ).
<b>PhD topic</b>	<b>Deciphering Brain-Bone Interorgan Communication via Circulating Exosomes and Its Impact on Aging-Related Diseases</b>
<b>SUAT Supervisor</b>	<a href="#">Prof Xiaoli ZHAO</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof Bo LEI</a>
<b>Short introduction &amp; description of the PhD project</b>	Emerging evidence highlights a clinical correlation between neurodegenerative disorders, such as Alzheimer's disease, and osteoporosis, suggesting profound interorgan crosstalk. Exosomes, as key carriers of bioactive molecules, have been identified as crucial mediators of systemic communication. This project hypothesizes that aging alters the cargo of circulating exosomes, thereby dysregulating brain-bone signaling and promoting co-pathogenesis. We will isolate exosomes from models and human cohorts, employing multi-omics to characterize their content. Functional studies will validate their role in disrupting neural and skeletal homeostasis, aiming to uncover novel mechanisms and therapeutic targets for age-related

	comorbidities.
<b>Contact points</b>	Informal inquiries may be addressed to Prof Xiaoli ZHAO (zhao.xl@siat.ac.cn) and Prof Bo LEI (bolei@uic.edu.cn).
<b>PhD topic</b>	<b>The neural signal synchronization function of myelin</b>
<b>SUAT Supervisor</b>	<a href="#">Dr.Hao Wang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr Yu Li</a>
<b>Short introduction &amp; description of the PhD project</b>	Myelin is a critical component of the nervous system, yet its precise functional role in neural signal transmission remains elusive. Traditional theory posits that myelin primarily serves as an insulator for the axon; however, an increasing body of experimental observations in recent years has challenged this conventional wisdom. Despite these findings, a systematic theoretical framework to explain these phenomena is currently lacking. This project is based on the hypothesis proposed by Prof. Hao Wang that myelin may possess a coil inductive function. We propose a series of investigations to validate theoretical predictions, including: Anatomical observation of the cross-axon alignment at the Nodes of Ranvier. Theoretical simulation of neural signal synchronization between axons mediated by myelin. Screening for specific proteins within the myelin inner tongue capable of sensing electric fields and regulating myelin development. This is a comprehensive interdisciplinary study integrating histological sectioning, immunofluorescence staining, mathematical modeling, gene editing, and multi-omics analysis.
<b>Contact points</b>	Informal inquiries may be addressed to Dr Wang (wanghao@suat-sz.edu.cn) and Dr.Li (yuli@bnbu.edu.cn).
<b>PhD topic</b>	<b>Neuroinflammation, Functional Brain Imaging, and Cognitive Assessment in Neurodegenerative Disorders</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Zhen Xu</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Yu LI</a>
<b>Short introduction &amp; description of the PhD project</b>	This PhD project aims to investigate neuroinflammation and its functional consequences in neurodegenerative diseases through an interdisciplinary framework combining neurobiology, cognitive science, and functional brain imaging. Chronic neuroinflammatory processes, particularly microglia-associated immune responses, are increasingly recognized as important contributors to cognitive decline, yet the links between inflammatory mechanisms, brain network dysfunction, and cognitive impairment remain insufficiently understood. The project will examine how neuroinflammation-related biological

	<p>changes are associated with alterations in learning, memory, and large-scale brain function. A particular emphasis will be placed on exploring the feasibility of functional neuroimaging approaches, such as fMRI and possibly MEG, as readouts of neuroinflammation-related brain dysfunction. Rather than serving as direct markers of inflammation, these methods will be evaluated for their ability to reflect functional consequences of underlying inflammatory processes. By integrating mechanistic studies, functional imaging, and cognitive assessment, the project seeks to establish connections between biological mechanisms and functional outcomes. This work is expected to contribute to the development of interdisciplinary approaches for understanding and evaluating neurodegenerative disorders.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Dr Zhen Xu (xuzhen@suat-sz.edu.cn) and Dr. Yu LI (yuli@bnbu.edu.cn).</p>
<b>PhD topic</b>	<b>New Neural Electronics for Neuroscience</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Zhiyuan Liu</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Yu LI</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>Neural electrodes are essential tools for studying brain activity, yet current technologies are limited in stability, resolution, and adaptability for cognitive neuroscience research. This project aims to develop advanced neural electrodes tailored for high-quality neural recording in cognitive and behavioral studies.</p> <p>The research will focus on: (i) design of flexible and biocompatible electrode materials for stable long-term recordings; (ii) development of high-density electrode arrays for high-resolution monitoring of brain activity; and (iii) application of these neural interfaces to investigate neural mechanisms of cognition, such as perception, attention, and decision-making.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Zhiyuan Liu (liuzhiyuan@suat-sz.edu.cn) and Dr. Yu LI (yuli@bnbu.edu.cn).</p>
<b>PhD topic</b>	<b>Porphyrinoids for Anti-Cancer Research</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Qiucheng Chen</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Esther Yan Qin TAN</a>
<b>Short introduction &amp; description of the PhD</b>	<p>Porphyrinoids represent highly promising platforms for the development of agents for simultaneous cancer-targeted imaging</p>

<b>project</b>	and therapy. This program will focus on newly synthesized porphyrinoids and their corresponding metal complexes in cancer research, including: 1) design and preparation of drug candidates through bottom-up macrocycle synthesis and/or late-stage functionalization; 2) photophysical, electrochemical, and sonophysical characterization of porphyrinoids, with emphasis on applications in photodynamic therapy (PDT), electrochemiluminescence (ECL), and sonodynamic therapy (SDT), respectively; 3) in vitro evaluation for cell imaging and cytotoxicity, along with in vivo assessment for cancer treatment and imaging; and 4) mechanistic investigations underlying the biological effects. This integrated approach will facilitate the discovery of anticancer drugs using bioinspired molecules.
<b>Contact points</b>	Informal inquiries may be addressed to Dr. Qiucheng Chen (chenqiucheng@suat-sz.edu.cn) and Dr. Esther Yan Qin TAN (estherqtan@bnbu.edu.cn).
<b>PhD topic</b>	Research and Application of Anti-Osteoporotic Probiotic Functional Food Technologies
<b>SUAT Supervisor</b>	<a href="#">Prof. Jiake Xu</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Esther Yan Qin TAN</a>
<b>Short introduction &amp; description of the PhD project</b>	Osteoporosis is a highly prevalent chronic bone metabolic disease amid global population aging, and has emerged as a major public health challenge threatening the health of middle-aged and elderly populations. Conventional intervention strategies for osteoporosis are plagued by notable adverse effects and poor long-term patient compliance, while existing anti-osteoporosis-related probiotic products generally suffer from insufficient functional targeting, unclear mechanism of action, underdeveloped industrialization technologies, and a lack of systematic evidence-based validation and large-scale application, which fail to meet the urgent demand for precise prevention and control of osteoporosis. This project aims to conduct research on key technologies, product development and application demonstration of anti-osteoporosis probiotic functional foods, and establish a full-chain innovation system spanning from strain screening to industrial promotion. The research will focus on three core aspects: (i) high-throughput screening of targeted anti-osteoporosis functional probiotics and elucidation of their bone metabolism regulatory mechanism; (ii) breakthroughs in key industrialization technologies, including stable preservation of probiotics, and development of serial functional food products; (iii) evidence-based population evaluation of the products and large-scale application demonstration in multiple scenarios.

	Through multidisciplinary integration, this project will overcome the key technical barriers in the research and development of anti-osteoporosis probiotic functional foods, yielding innovative achievements with independent intellectual property rights. The project is expected to provide a safe and efficient solution for non-pharmacological intervention of osteoporosis, and promote the high-quality development of the functional food industry.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Jiake Xu (jiake.xu@siat.ac.cn) and Prof. Esther Yan Qin TAN (estherytan@bnu.edu.cn).
<b>PhD topic</b>	Cancer Theranostic Technologies Based on Biomimetic Biomaterials
<b>SUAT Supervisor</b>	<a href="#">Dr. Pengfei Zhang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Esther Yan Qin TAN</a>
<b>Short introduction &amp; description of the PhD project</b>	This PhD project focuses on developing advanced cancer theranostic technologies using biomimetic biomaterials—nature-inspired materials mimicking biological systems (e.g., cell membranes, biominerals). Its core goal is to solve key limitations of current theranostics, such as poor biocompatibility, low tumor targeting, and disconnected diagnosis-therapy, promoting precision oncology and clinical translation. Adopting a multidisciplinary approach, the project involves designing tailored biomimetic materials, fabricating integrated theranostic platforms (combining imaging agents and therapies), and conducting preclinical evaluations. It explores innovative strategies like homologous cell membrane coating and stimulus-responsive release to enhance efficacy and reduce off-target effects. Expected outcomes include 2-3 novel platforms, high-impact publications, and foundational insights, contributing to improved cancer diagnosis and treatment.
<b>Contact points</b>	Informal inquiries may be addressed to Dr Pengfei Zhang (pf.zhang@siat.ac.cn) and Dr. Esther Yan Qin TAN (estherytan@bnu.edu.cn).
<b>PhD topic</b>	AI-Enabled High-Throughput Development of Colorimetric Sensing Reagents for Environmental Monitoring
<b>SUAT Supervisor</b>	<a href="#">Dr. Jing JIANG</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. SiuTai TSIM</a>
<b>Short introduction &amp; description of the PhD project</b>	This project aims to develop an AI-enabled high-throughput platform for the rapid discovery and optimization of colorimetric sensing reagents for environmental monitoring. Motivated by practical needs in ecological governance, such as buoy-based

	<p>water quality monitoring and field detection of environmental pollutants, the research will focus on three key aspects: (i) design of robotic high-throughput workflows for automated preparation and screening of gas- and liquid-phase sensing reagents; (ii) development of AI-driven optimization models to improve sensitivity, selectivity, stability, and resistance to environmental interference; and (iii) integration of optimized sensing reagents with deployable sensing systems for real-world environmental analysis. This project is expected to establish a new paradigm for intelligent environmental sensor development, enabling rapid, low-cost, and application-oriented reagent discovery for ecological monitoring and environmental management.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Dr Jing JIANG (j.jiang@suat-sz.edu.cn) and Dr. SiuTai TSIM (siutaitsim@bnu.edu.cn).</p>
<b>PhD topic</b>	<p>Research on the Electrochemical Behaviors at Interfaces of Key Materials in Energy Storage Batteries</p>
<b>SUAT Supervisor</b>	<p><a href="#">Prof. Guojin Liang</a></p>
<b>BNBU Supervisor(s)</b>	<p><a href="#">Dr. Siutai Tsim</a></p>
<b>Short introduction &amp; description of the PhD project</b>	<p>This PhD project focuses on the application of bio-materials (e.g., natural polysaccharides, lignin, chitosan, biomass-derived carbons, and functional biomolecules) at the key interfaces of lithium-ion batteries (LIBs) and all-vanadium redox flow batteries (VFBs). Bio-materials offer abundant surface functional groups, biodegradability, and unique interfacial affinity, making them promising for suppressing side reactions, regulating SEI nucleation and growth, improving electrode wettability, and mitigating active species crossover. However, their dynamic interfacial electrochemical behaviors under operating conditions remain largely unexplored. This project will combine in situ/operando spectroscopy (Raman, FTIR, XPS), electrochemical quartz crystal microbalance (EQCM), atomic force microscopy (AFM), and theoretical calculations (DFT, molecular dynamics). Key research topics include: For LIBs: the influence of bio-material derived interfacial layers on SEI structure, gas evolution, and mechanical-electrochemical stability at Ni-rich cathodes and Si-C anodes. For VFBs: the role of bio-material modified carbon-based electrodes in regulating vanadium redox kinetics, hydrogen/oxygen evolution side reactions, and membrane permeability. The goal is to establish structure–property relationships of bio-material interfaces in both battery systems, and to develop green, low-cost interfacial engineering strategies. The outcomes will provide bio-inspired</p>

	solutions for highly stable, long-life energy storage batteries.
<b>Contact points</b>	Informal inquiries may be addressed to Dr Guojin Liang (liangguojin@suat-sz.edu.cn) and Dr. Siutai Tsim (siutaitsim@bnbu.edu.cn).
<b>PhD topic</b>	Duckweed as a Plant for Life Support Systems and a Model for Microgravity Adaptation
<b>SUAT Supervisor</b>	<a href="#">Dr. Hongwei Hou</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr.Siu-tai TSIM</a>
<b>Short introduction &amp; description of the PhD project</b>	This PhD project focuses on duckweed, an ideal model for studying microgravity adaptation and plant evolution. Duckweed is widely used in space station life support systems as it efficiently absorbs CO <sub>2</sub> , produces oxygen, and provides edible biomass. It evolved from land plants to aquatic environments, with a unique evolutionary history of adapting from terrestrial to aquatic habitats. The research mainly explores two core aspects: first, analyzing the evolutionary rules of duckweed's root degradation and adaptive traits; second, studying how gravity environments affect its growth and metabolic regulation. Specifically, it investigates how duckweed adapts to microgravity, optimizes its growth and photosynthetic efficiency, and uses genomics and metabolic analysis to clarify the regulatory mechanisms of its growth and development. This research not only deepens the understanding of plant adaptation to extreme environments but also provides theoretical support for the application of duckweed in space life support systems.
<b>Contact points</b>	Informal inquiries may be addressed to Dr. Hongwei Hou (houhongwei@suat-sz.edu.cn) and Dr. Siu-tai TSIM (siutaitsim@bnbu.edu.cn).
<b>PhD topic</b>	Gut-Microbiome Modulation of the Muscle-Adipose Axis in Metabolic Syndromes
<b>SUAT Supervisor</b>	<a href="#">Prof. Liwei XIE</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Baojun XU</a>
<b>Short introduction &amp; description of the PhD project</b>	Research targeting the gut-muscle and gut-adipose axes via probiotics (live beneficial microbes) and postbiotics (non-viable microbial cells, cell components, or metabolites) represents a frontier in treating metabolic syndromes such as obesity and insulin resistance. Future investigations should focus on the precise molecular mechanisms by which gut-derived signals remodel peripheral tissues to restore energy homeostasis. Key potential research directions include: 1. Postbiotic Regulation of Skeletal Muscle Mitochondrial Function and Insulin

	<p><b>Sensitivity</b>This direction focuses on how specific gut-derived metabolites (postbiotics)—such as short-chain fatty acids (SCFAs), secondary bile acids, and urolithin A—systemically circulate to skeletal muscle. Research should investigate how these molecules activate pathways (e.g., AMPK/SIRT1) to enhance mitochondrial biogenesis, promote GLUT4 membrane translocation, and enhance lipid oxidation. A critical sub-direction is determining if specific postbiotics can prevent "sarcopenic obesity" by mitigating lipid-induced lipotoxicity and intramuscular adipose tissue (IMAT) infiltration, thereby preserving muscle mass and metabolic sink capacity.</p> <p><b>2. Probiotic-Driven Adipose Tissue Remodeling and Thermogenesis</b>This direction explores the capacity of specific probiotic strains (e.g., <i>Lactobacillus</i>) or their structural components (e.g., surface proteins, extracellular vesicles) to induce the "browning" or "beigeing" of white adipose tissue (WAT). Studies should aim to elucidate the molecular signalling cascades that upregulate Uncoupling Protein 1 (UCP1) and drive thermogenesis. Additionally, research should focus on how these interventions modulate the adipose immune microenvironment—specifically, shifting macrophage polarization from a pro-inflammatory (M1) to an anti-inflammatory (M2) state to resolve local tissue inflammation and adipocyte dysfunction.</p> <p><b>3. Multi-Tissue Crosstalk: The Gut-Muscle-Adipose Triad</b>Rather than viewing tissues in isolation, this direction investigates how microbiome-targeted interventions synergistically alter the endocrine function of both tissues. Research should determine how probiotic or postbiotic supplementation reshapes the systemic "secretome"—specifically, observing whether gut modulation simultaneously normalizes adipokine secretion (e.g., increasing adiponectin) from fat and stimulates myokine release (e.g., irisin, Thbs4) from muscle. Understanding this multi-organ crosstalk will help identify therapeutic targets that simultaneously curb fat accumulation and enhance muscle metabolic efficiency.</p>
<p><b>Contact points</b></p>	<p>Informal inquiries may be addressed to Prof. Liwei XIE (xieliwei@suat-sz.edu.cn) and Prof. Junbao Xu(baojunxu@uic.edu.cn/ baojunxu@bnbu.edu.cn)</p>
<p><b>PhD topic</b></p>	<p>Evaluation of medicinal and edible value of complex natural products</p>
<p><b>SUAT Supervisor</b></p>	<p><a href="#">Prof. Xin LIU</a></p>
<p><b>BNBU Supervisor(s)</b></p>	<p><a href="#">Prof. Bruce Baojun XU</a></p>
<p><b>Short introduction &amp; description of the PhD project</b></p>	<p>This project aims to systematically explore the medicinal and edible value of alkaloids, terpenoids, and glycosides through</p>

	<p>integrated chemical and biosynthetic strategies. By combining microbial fermentation, enzymatic catalysis, and modern chemical synthesis, we will establish efficient production systems for target compounds and further optimize their bioactivity, safety, and pharmacokinetic properties through rational structural modification. For medicinal applications, the focus will be on evaluating therapeutic effects against aging, cancer, obesity, and diabetes, with in-depth investigation into the underlying mechanisms. For edible applications, functional properties including immunomodulation, antioxidant capacity, and gut microbiota regulation will be investigated alongside comprehensive toxicological safety assessments. Structure-activity relationship studies will guide molecular design, ultimately enabling the establishment of a multidisciplinary platform integrating biological/chemical production, functional evaluation, and safety analysis. This project will provide sustainable solutions for developing novel drugs and functional food ingredients.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Xin LIU (liuxin@suat-sz.edu.cn) and Prof. Bruce Baojun XU (baojunxu@uic.edu.cn).</p>
<b>PhD topic</b>	<p>Mechanisms of active acetone and natural products in promoting enzyme activity and functional evaluation</p>
<b>SUAT Supervisor</b>	<p><a href="#">Prof. Jian Zhang</a></p>
<b>BNBU Supervisor(s)</b>	<p><a href="#">Prof. Bruce Baojun XU</a></p>
<b>Short introduction &amp; description of the PhD project</b>	<p>The project aims to investigate the mechanisms by which bioactive peptides and natural products regulate metabolic and reproductive aging through the gut microbiota-host axis, as well as evaluate their potential in cancer prevention. I am confident that by combining your team's expertise in natural product chemistry, microbiome research, and functional food development with our experience in bioactive peptide functional studies, this collaboration could yield innovative scientific outcomes and provide new strategies for addressing health challenges related to aging.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Bruce Baojun XU (e-mail address: baojunxu@bnbu.edu.cn) and Researcher Jian Zhang (e-mail address; jian.zhang@siat.ac.cn ).</p>
<b>PhD topic</b>	<p>Deciphering the Microbial-Epigenetic Axis: A Multi-Omics Investigation into How Functional Food Components Modulate Host Health via Microbiota</p>

<b>SUAT Supervisor</b>	<a href="#">Prof. Qing Ma</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Bruce Baojun XU</a>
<b>Short introduction &amp; description of the PhD project</b>	This interdisciplinary PhD project aims to establish a novel research pipeline integrating food science/nutrition, microbiome ecology, and epigenetics. The core objective is to investigate the precise mechanisms by which specific bioactive food components (e.g., polyphenols, dietary fibers) influence host physiology, with a focus on the microbiome as a key mediator and host tissue epigenetics as a critical regulatory output.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Qing Ma (qing.ma@siat.ac.cn) and Prof. Bruce Baojun XU (baojunxu@bnu.edu.cn).

## Available PhD topics in Computer Science and Technology

<b>PhD topic</b>	<b>GeoAI-aided Human Mobility Modelling and Control</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Ling Yin</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Xiaowen Bi</a>
<b>Short introduction &amp; description of the PhD project</b>	Human mobility modeling and intervention driven by multi-source spatiotemporal data, such as mobile phone tracking data and vehicle tracking data, is a critical research topic in urban computing and social computing. It can fundamentally support various fields, including urban governance, sustainable transportation development, environmental protection, and public physical and mental health. In response to the current research challenges in this field, this project, based on GeoAI technology, will focus on the following areas: 1) Leveraging AIGC technology to develop generative models for human mobility patterns with various generalizability across space, time, populations, and public events; 2) Utilizing reinforcement learning technology to develop robust policies for human mobility intervention under specific scenarios (e.g., epidemic control), capable of addressing uncertainties in a complex spatiotemporal system.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Yin (yinling@siat.ac.cn) and Dr. Bi (xiaowenbi@uic.edu.cn).
<b>PhD topic</b>	<b>Security and Information Leakage Protection for High-Performance Heterogeneous Computing Systems under AI Workloads</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Huimin Li</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Donald Donglong CHEN</a>
<b>Short introduction &amp; description of the PhD project</b>	The rapid growth of AI training, inference, and edge intelligence is making high-performance computing systems a critical part of future digital infrastructure. Modern AI applications increasingly rely on heterogeneous platforms composed of CPUs, GPUs, XPU, FPGAs, and other accelerators to deliver high throughput, low latency, and energy efficiency. At the same time, the design and deployment of AI-oriented computing chips and systems are facing growing challenges in security, trustworthiness, and information leakage protection. Therefore, it is increasingly important to study how secure and efficient operation can be achieved through joint considerations of chip design, computer architecture, and system-level optimization. In high-performance heterogeneous computing systems, intensive resource sharing, concurrent execution, and dynamic scheduling may introduce

	<p>new risks related to information leakage, execution security, and system trustworthiness. These challenges may affect sensitive data, intermediate states, model parameters, and overall system reliability, especially under increasingly demanding AI workloads. Existing approaches often struggle to balance security, efficiency, and deploy ability, and they do not always provide an effective connection between chip implementation, architectural mechanisms, and upper-layer system requirements. This PhD project aims to investigate security and information leakage issues in high-performance heterogeneous computing systems under AI workloads. The research will focus on understanding key security challenges in shared computing environments, exploring protection strategies for secure and efficient execution, and studying chip–architecture–system co-design approaches for improving both security and performance. The project is expected to contribute to the trustworthy operation of future AI computing infrastructure and provide strong training opportunities in computer architecture, chip design, hardware security, system security, and AI system design.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Dr. Huimin Li (lihuimin@suat-sz.edu.cn) and Dr. Donald Donglong Chen (donglongchen@bmbu.edu.cn).</p>
<b>PhD topic</b>	<b>Quantum Algorithms and Complexity and PQC Hardware Co-Design</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Yaqiao LI</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Donald Donglong CHEN</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>This project explores how quantum algorithms and complexity theory can be used to analyze core components of post-quantum cryptography and inform efficient hardware implementation. Focusing on Keccak-based primitives and lattice-based sampling procedures, it combines theoretical analysis with implementation-oriented evaluation to study their quantum complexity and its relevance to FPGA and RISC-V accelerator design. The broader goal is to connect rigorous complexity-theoretic insight with practical cryptographic engineering for next-generation secure systems.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Dr Yaqiao LI (liyaqiao@suat-sz.edu.cn) and Dr. Donglong CHEN (donglongchen@bmbu.edu.cn).</p>
<b>PhD topic</b>	<b>Ultra-Low-Power AI Chips for Audio Intelligence: Algorithm-Hardware Co-Design from CNN to Emerging Sequence Models</b>

<b>SUAT Supervisor</b>	<a href="#">Prof. Lujie PENG</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Donald Donglong CHEN</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>This PhD project aims to develop ultra-low-power AI chips for audio intelligence, targeting long-term perception in resource-constrained embodied systems. While CNN-based models have been widely adopted in low-power audio sensing, they are limited in modeling long-range temporal dependencies, which are critical in real-world audio scenarios. Emerging sequence models offer improved capability but introduce new challenges for efficient hardware implementation. This project adopts an algorithm-hardware co-design approach that bridges CNN and emerging sequence models within a unified framework. It starts from optimized CNN-based solutions as a strong and hardware-efficient baseline, and extends toward hardware-friendly, low-power-aware implementations of emerging sequence models (e.g., Mamba). The goal is to achieve co-optimization of energy efficiency and classification accuracy, enabling enhanced temporal modeling capability under strict energy constraints. Key research topics include unified computing architectures for heterogeneous models, precision-adaptive computation, and low-complexity on-chip adaptation. The project will culminate in a prototype chip validated through tape-out.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Lujie PENG (<a href="mailto:penglujie@suat-sz.edu.cn">penglujie@suat-sz.edu.cn</a>) and Prof. Donglong CHEN (<a href="mailto:donglongchen@bnbu.edu.cn">donglongchen@bnbu.edu.cn</a>).</p>
<b>PhD topic</b>	<b>Building an end-to-end safety framework for autonomous LLM agents, spanning threat modeling, runtime defense, and alignment auditing against emerging agentic attack surface</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Zhiheng Ma</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Donald Donglong CHEN</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>LLM-based agents that combine reasoning with tool use, memory, browser automation, and inter-agent communication have dramatically expanded the attack surface beyond single-turn inference. Open-source frameworks such as OpenManus and OpenClaw have already accumulated hundreds of disclosed vulnerabilities spanning prompt injection, tool/plugin poisoning, sandbox escape, and protocol exploits, while mainstream agents score below 60% on safety benchmarks such as SafeAgentBench and Agent-SafetyBench. This project aims to build a principled, end-to-end safety framework for autonomous LLM agents. The research will focus on three key aspects: (i) a unified threat model and red-teaming benchmark for open-source agent</p>

	<p>frameworks, covering direct/indirect prompt injection, memory-bank contamination, MCP protocol exploits, and inter-agent contagion attacks; (ii) runtime defense mechanisms that combine contextual-integrity reasoning, taint tracking across the planner-executor pipeline, and lightweight guardrail models to detect policy bypass and privilege escalation without sacrificing task utility; and (iii) behavioral auditing and adversarial training methods targeting intrinsic agentic risks such as goal misalignment and deceptive tool use. The outcome is expected to deliver reproducible benchmarks and deployable safety layers for trustworthy agentic systems in real-world automation and multi-agent deployments.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Zhiheng Ma (mazhiheng@suat-sz.edu.cn) and Prof. Donglong Chen (donglongchen@bnbu.edu.cn).</p>
<b>PhD topic</b>	<b>Knowledge Verification for Evolving Data in Multi Agent Systems</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Qiang Qu</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Zhong CHEN</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>Modern multi-agent systems—such as algorithmic trading networks, payment processing ecosystems, smart city infrastructure, and collaborative AI services—operate on data that continuously evolves through fusion, learning, and deletion. These processes are decentralized and often non-deterministic, making it extremely difficult to verify the correctness, privacy, and compliance of shared knowledge without a global controller. This PhD project aims to develop a verifiable knowledge framework for evolving multi-agent data, grounded in zero-knowledge proofs and decentralized verification mechanisms. The research will focus on three core challenges: (i) formal modeling of evolving knowledge states and dependency graphs; (ii) transforming non-deterministic agent operations (e.g., real-time model updates, random sampling, data deletion) into verifiable arithmetic circuits; and (iii) designing a hybrid off-chain computation and on-chain verification protocol using distributed ledgers. The expected outcomes include a theoretical framework for verifiable knowledge in evolving multi-agent systems, a prototype implementation with domain-specific adapters for finance and smart cities, and open-source benchmarks. This project will provide foundational pathways toward trustworthy, privacy-respecting, and auditable multi-agent collaboration for high-stakes societal applications.</p>

<b>Contact points</b>	Informal inquiries may be addressed to Dr Qiang Qu (qiang@siat.ac.cn) and Dr.Zhong Chen (zhongchen@bmbu.edu.cn).
<b>PhD topic</b>	<b>Can We Build a GPT for Space? Spatial Tokenization and Foundation Models for Generalizable Spatiotemporal Intelligence</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Kang LIU</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Zhong CHEN</a>
<b>Short introduction &amp; description of the PhD project</b>	Recent advances in large models show that foundation models can learn generalizable intelligence from tokenized representations. However, extending this paradigm to spatiotemporal data remains challenging due to continuous space and geographic heterogeneity, which limit cross-region generalization. This PhD project aims to develop spatial foundation models by introducing a unified spatial tokenization framework and learning invariant spatiotemporal representations under distribution shift. The goal is to enable models trained on limited regions to generalize across cities and support diverse tasks such as prediction, generation, and simulation. As a core testbed, the project will focus on human mobility modeling, demonstrating how foundation-model-level capabilities can emerge for real-world spatiotemporal intelligence.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Kang LIU (kang.liu@siat.ac.cn) and Prof. Zhong CHEN (zhongchen@bmbu.edu.cn).
<b>PhD topic</b>	<b>Architecture and Software of AI Processors or Accelerators</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Zhimin Tang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Zhong CHEN</a>
<b>Short introduction &amp; description of the PhD project</b>	There are many different approaches to harness mass transistor resources for AGI applications. The candidate will work on his own innovative approach based on architectural exploration and AI algorithm investigation. Emphasis may be on the architecture design and performance modelling of new AI accelerators, or implementation of RISC-V based ISA extensions for AI applications, and related software optimization methods.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Zhimin Tang ( <a href="mailto:tangzhimin@suat-sz.edu.cn">tangzhimin@suat-sz.edu.cn</a> ) and Prof. Zhong CHEN( <a href="mailto:zhongchen@bmbu.edu.cn">zhongchen@bmbu.edu.cn</a> ).
<b>PhD topic</b>	<b>Research on Cross-Domain High-Precision Real-Time Motion Intent Decoding Algorithm</b>

<b>SUAT Supervisor</b>	<a href="#">Dr. Yongcheng Li</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Wentao Fan</a>
<b>Short introduction &amp; description of the PhD project</b>	Decoding motion intention is a core problem in brain-computer interface (BCI) and neurorehabilitation, aiming to parse out the user's intended limb movement parameters (e.g., movement direction, velocity, joint angle) from neurophysiological signals (such as EEG and EMG) in real time. However, existing decoding algorithms generally face two major bottlenecks: first, signal distribution discrepancies across different individuals, sessions, and task scenarios (i.e., domain shift) lead to a sharp decline in decoding performance; second, the inherent trade-off between real-time performance and decoding accuracy makes it difficult to meet the demands of closed-loop interaction. This project focuses on cross-domain high-precision real-time motion intention decoding and plans to conduct systematic research from three dimensions: domain adaptation, temporal modeling, and lightweight computing, aiming to provide core algorithmic support for intelligent prosthetics, exoskeleton rehabilitation, and neural modulation systems. The research contents include: cross-domain high-precision temporal modeling and continuous decoding of motion parameters; design of real-time lightweight decoding algorithms; and cross-task, cross-modal application validation.
<b>Contact points</b>	Informal inquiries may be addressed to Dr Li (li.yc@siat.ac.cn) and Dr. Fan (wentaoofan@uic.edu.cn).
<b>PhD topic</b>	<b>MLLM-Based Real-World Video Perception and Reasoning</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Ruize Han</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Wentao Fan</a>
<b>Short introduction &amp; description of the PhD project</b>	This Ph.D. project aims to develop a framework for open-world video perception and reasoning by leveraging Multimodal Large Language Models (MLLMs) to understand and segment complex dynamic scenes. Unlike traditional perception methods (e.g., detection, segmentation), which rely on predefined categories and extensive manual annotations, this research will focus on challenging scenarios involving vague instructions, novel objects, and diverse temporal contexts. Building upon the rich knowledge and prior information embedded in MLLMs, this project seeks to advance modeling and reasoning techniques for a deeper understanding of real-world video content. Key explorations will include hierarchical temporal modeling and context synthesis to manage complex interactions among multiple targets. Additionally, the project will employ chain-of-thought imitation

	<p>learning and reinforcement learning-based optimization to enhance the system's interpretability and data efficiency. Furthermore, the research will investigate the development of scalable evaluation protocols and benchmarks tailored for open-world settings. The anticipated outcome is a new generation of reasoning-enhanced video perception systems capable of autonomously interpreting and acting within complex environments. These systems are expected to have significant applications in fields such as autonomous driving, robotics, and large-scale multimedia analysis.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Han (hanruize@suat-sz.edu.cn) and Dr. Fan (wentaoan@uic.edu.cn).</p>
<b>PhD topic</b>	<p><b>Research on Synergistical Assessment and Interaction Mechanisms of Neuro-Muscular and Cardiopulmonary-Circulatory Functions After Stroke Based on Multimodal Information Fusion</b></p>
<b>SUAT Supervisor</b>	<p><a href="#">Prof. Peng Fang</a></p>
<b>BNBU Supervisor(s)</b>	<p><a href="#">Dr. Wentao Fan</a></p>
<b>Short introduction &amp; description of the PhD project</b>	<p>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.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Peng Fang (peng.fang@siat.ac.cn) and Prof. Wentao FAN</p>

	(wentaofan@bmbu.edu.cn).
<b>PhD topic</b>	<b>Construction of a Systematic Biological Research Framework for Multi-omics Integration, Cross-scale Modeling, and Intelligent Virtual Cells</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Yang Min</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Wentao Fan</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>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.</p>
<b>Contact points</b>	Informal inquiries may be addressed to pro. Yang Min (yangmin@suat-sz.edu.cn) and Dr. Wentao FAN (wentaofan@uic.edu.cn)
<b>PhD topic</b>	<b>Research on Generative Learning and Interpretability</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Ruxin WANG</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Wentao Fan</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>Aiming to address key challenges in intelligent medicine—such as limited annotated samples, weak model generalization, and poor interpretability—this project is structured around three main research topics: (a) Investigating the use of unsupervised learning to extract essential feature representations from large-scale unannotated medical images. (b) Developing multi-modal and cross-modal generative models for data augmentation and synthesis. (c) Leveraging generative models as intrinsic interpretability tools, using counterfactual generation to intuitively reveal the internal logic behind model decisions.</p>
<b>Contact points</b>	Informal inquiries may be addressed to Dr. Wentao FAN (wentaofan@uic.edu.cn) and Prof Ruxin Wang

	(rx.wang@siat.ac.cn).
<b>PhD topic</b>	<b>Scene Understanding for Service Robotics: from Segmentation to Affordance Learning</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Zhengkun YI</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr Wentao Fan</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>Scene understanding is fundamental for service robots to interact with the physical world. In recent years, Vision Foundation Models (VFMs) like the Segment Anything Model (SAM) have achieved remarkable success in general-purpose segmentation, opening new possibilities for robot perception. However, existing foundation models still face challenges when directly applied to specific downstream tasks, especially in complex indoor environments. For instance, current methods often underperform in fine-grained segmentation tasks and are sensitive to environmental noise such as variations in lighting and shadows, and they are not inherently designed to process three-dimensional (3D) data. This project will focus on 1) robotic scene segmentation methods with foundation models to better handle complex 2D and 3D scenes, especially for segmenting and identifying objects in zero-shot or one-shot scenarios, 2) developing novel affordance learning algorithms to enable robots to understand the functionality of objects and provide a basis for decision-making in subsequent interaction tasks like grasping, and 3) exploring sequential affordance reasoning to allow robots to understand and execute complex multi-step tasks.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Dr Zhengkun YI (e-mail address: zk.yi@siat.ac.cn) and Dr. Wentao CHENG (e-mail address: wentaocheng@uic.edu.cn).</p>
<b>PhD topic</b>	<b>RoboAgent: Bridging High-Level Reasoning and Low-Level Control for Robotics</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Xiaobo Wang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Ricky Yuen-Tan HOU</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>This project focus on RoboAgent, a hierarchical framework designed for complex, unstructured environments. It features a decoupled high-low level control architecture. The cognitive "brain" utilizes Vision-Language Models (VLMs) for semantic reasoning, long-horizon task decomposition, and dynamic error recovery. Concurrently, the motor "cerebellum" employs lightweight Vision-Language-Action (VLA) models to process multi-modal sensory feedback for robust, real-time 6-DoF manipulation. By decoupling high-level planning from high-frequency execution, RoboAgent bridges the gap between abstract human instructions and precise physical interaction, enabling highly generalizable and resilient robotic operations in dynamic real-world scenarios.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Xiaobo Wang (wangxiaobo@suat-sz.edu.cn) and Prof. Ricky Yuen-Tan HOU</p>

	(rickyhou@bmbu.edu.cn).
<b>PhD topic</b>	<b>Trustworthy AI for Closed-Loop Discovery of High-Performance Materials</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Jing JIANG</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Changwu HUANG</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>This project aims to develop a trustworthy AI framework for closed-loop materials discovery, integrating AI agents, multi-fidelity materials simulations, and high-throughput experiments to accelerate the discovery of previously unknown high-performance materials and reactions. The central challenge is not only to improve search efficiency in vast chemical and process spaces, but also to ensure that AI-driven decisions are reliable, interpretable, and aligned with physical constraints and experimental feasibility. To address this, the project will focus on three tightly connected aspects: (i) developing trustworthy optimization and decision-making methods that combine uncertainty-aware machine learning, evolutionary or reinforcement learning strategies, and physics-informed constraints for materials design; (ii) building human-AI collaborative workflows in which domain experts can guide, verify, and correct agent behavior during simulation and experimental loops; and (iii) validating the framework in representative materials systems such as batteries, catalysis, or perovskites, with the goal of discovering genuinely new materials or reaction conditions that deliver substantial performance improvements. More broadly, this project seeks to establish a rigorous methodological foundation for trustworthy autonomous scientific discovery, with target outcomes spanning both high-impact materials journals and AI-for-science venues.</p>
<b>Contact points</b>	Informal inquiries may be addressed to Dr Jing JIANG (j.jiang@suat-sz.edu.cn) and Dr. Changwu HUANG (changwuhuang@bmbu.edu.cn).
<b>PhD topic</b>	<b>Explainable Artificial Intelligence (XAI) for Spatiotemporal Data</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Kang LIU</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Guanyao LI</a>

<p><b>Short introduction &amp; description of the PhD project</b></p>	<p>This project focuses on Explainable Artificial Intelligence (XAI) for spatiotemporal data, targeting representative application scenarios such as urban traffic, air pollution, and epidemic transmission. It aims to overcome the “black-box” limitations of conventional deep learning models by developing a spatiotemporal intelligent analysis framework that achieves both high performance and interpretability with enhanced trustworthiness. The research will integrate domain knowledge and mechanism-based models, combining spatiotemporal Transformers, causal inference, and knowledge constraints to explore explicit modeling of spatiotemporal dependencies and mechanism interpretation. Ultimately, this study seeks to advance spatiotemporal AI from a performance-oriented paradigm toward one that is mechanistically interpretable and decision-reliable.</p>
<p><b>Contact points</b></p>	<p>Informal inquiries may be addressed to Prof. Kang LIU (kang.liu@siat.ac.cn) and Prof. Guanyao LI (guanyaoli@bmbu.edu.cn).</p>
<p><b>PhD topic</b></p>	<p><b>Trustworthy AI for Urban Computing</b></p>
<p><b>SUAT Supervisor</b></p>	<p><a href="#">Prof. Ling Yin</a></p>
<p><b>BNBU Supervisor(s)</b></p>	<p><a href="#">Dr. Guanyao LI</a></p>
<p><b>Short introduction &amp; description of the PhD project</b></p>	<p>Human mobility modeling and intervention driven by multi-source spatiotemporal data, such as mobile phone tracking data and vehicle tracking data, is a critical research topic in urban computing and social computing. It can fundamentally support various fields, including urban governance, sustainable transportation development, environmental protection, and public physical and mental health. In response to the current research challenges in this field, this project, based on GeoAI technology, will focus on the following areas: 1) Leveraging AIGC technology to develop generative models for human mobility patterns with various generalizability across space, time, populations, and public events; 2) Utilizing reinforcement learning technology to develop robust policies for human mobility intervention under specific scenarios (e.g., epidemic control), capable of addressing uncertainties in a complex spatiotemporal system.</p>
<p><b>Contact points</b></p>	<p>Informal inquiries may be addressed to Prof. Yin (yinling@siat.ac.cn) and Dr. Li (guanyaoli@bmbu.edu.cn).</p>
<p><b>PhD topic</b></p>	<p><b>Mining and Mechanism Analysis of Typhoon Disaster Chains in Coastal Areas</b></p>
<p><b>SUAT Supervisor</b></p>	<p><a href="#">Prof. Qinglan LI</a></p>

<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Hongjian SHI</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>This PhD project focuses on the mining and mechanism analysis of typhoon disaster chains, integrating core methods including Data Analysis and Prediction, Bayesian Network, and Probabilistic Graphical Models and Uncertainty Reasoning to conduct interdisciplinary research: 1) Employ Data Analysis and Prediction techniques to process multi-source heterogeneous data (e.g., meteorological observations, disaster records, geographic information) related to typhoons, extracting temporal-spatial characteristics and potential correlation signals of disaster-causing factors and cascade hazards; 2) Construct Probabilistic Graphical Models (with Bayesian Network as the core framework) to model probabilistic dependencies between typhoon primary hazards, secondary disasters, and influencing factors, realizing systematic parsing of disaster chain association structures; 3) Rely on Uncertainty Reasoning methods integrated with Bayesian Network to quantify uncertainties from data noise, typhoon forecasting deviations, and hazard propagation, identify key disaster-causing factors and their threshold effects, and achieve reliable inference of disaster chain evolution trends, thereby providing scientific support for typhoon disaster risk assessment and prevention.</p>
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Hongjian SHI(shihj@bnbu.edu.cn) and Prof. Qinglan LI (ql.li@siat.ac.cn).
<b>PhD topic</b>	<b>AI-Driven Multimodal Integration of Medical Imaging and ECG Signal Analysis for Intelligent Cardiovascular Diagnosis and Prediction</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Caizhi Liao</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Hongjian SHI</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>Cardiovascular diseases remain the leading cause of global mortality, where early detection and risk stratification are critically dependent on accurate interpretation of multimodal clinical data, including medical imaging and electrocardiogram (ECG) signals. However, conventional diagnostic approaches are often limited by fragmented data analysis, reliance on manual interpretation, and insufficient integration of structural and functional information. This project aims to develop an intelligent, multimodal analysis framework that integrates medical imaging, pattern recognition, and ECG cardiovascular signal processing for improved diagnosis and prediction of cardiac conditions. The research will focus on three key aspects: (i) development of advanced image processing and feature extraction algorithms for cardiac imaging modalities (e.g., MRI,</p>

	CT, echocardiography) to capture structural and functional biomarkers; (ii) design of robust signal processing and pattern recognition methods for ECG data to identify subtle electrophysiological signatures associated with cardiovascular abnormalities; and (iii) implementation of deep learning and multimodal data fusion strategies to integrate imaging and ECG features for accurate disease classification and risk prediction. This system is expected to enable automated, precise, and clinically interpretable cardiovascular assessment, with significant potential for early diagnosis, personalized treatment planning, and intelligent healthcare systems.
<b>Contact points</b>	Informal inquiries may be addressed to Dr. Caizhi Liao (liaocaizhi@suat-sz.edu.cn) and Prof. Hongjian SHI (shihj@bnu.edu.cn).
<b>PhD topic</b>	<b>AI-powered Magnetic Resonance Imaging Analysis</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Na ZHANG</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Hongjian SHI</a>
<b>Short introduction &amp; description of the PhD project</b>	This research focuses on developing advanced AI and deep learning models to revolutionize magnetic resonance image analysis. Key areas include image enhancement through denoising and super-resolution, automated and precise lesion segmentation for quantitative assessment, and the integration of multi-modal data (e.g., combining MRI with clinical or genomic data) for improved disease diagnosis, stratification, and outcome prediction. The ultimate goal is to create robust computational tools that assist in clinical decision-making and advance the field of precision medicine.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Na ZHANG (na.zhang@siat.ac.cn) and Prof. Hongjian SHI (shihj@uic.edu.cn).
<b>PhD topic</b>	<b>Causality-driven Deep Multi-modal Representation Learning for large-scale screening of common malignant tumors</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Ruxin WANG</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Hongjian SHI</a>

<p><b>Short introduction &amp; description of the PhD project</b></p>	<p>Currently, the development of innovative auxiliary diagnostic models that integrate machine learning, statistical inference, and mathematical optimization, along with the establishment of accurate, intelligible, and attributable representation and inference analysis methods, holds immense theoretical and practical significance in supporting medical and healthcare decision-making. This project aims to conduct theoretical and technical research from a causal learning perspective, addressing challenges encountered in intelligent medical applications based on deep learning, such as significant distribution differences and fusion representation difficulties in multimodal medical images, limited accuracy with annotated samples, and poor cross-domain generalization of models. On the application front, the project focuses on the practical medical scenario of large-scale screening for some common malignant tumors. By leveraging multimodal medical data, we intend to construct a high-precision risk early screening and auxiliary diagnostic optimization model. Through this project, we hope to provide valuable academic and applied insights into key analysis methods and real-world applications within the realm of intelligent medicine.</p>
<p><b>Contact points</b></p>	<p>Informal inquiries may be addressed to Prof. Hongjian SHI (shihj@uic.edu.cn) and Prof Ruxin Wang (rx.wang@siat.ac.cn).</p>
<p><b>PhD topic</b></p>	<p><b>Interventional surgical robots with autonomous navigation capabilities</b></p>
<p><b>SUAT Supervisor</b></p>	<p><a href="#">Dr. Shoujun ZHOU</a></p>
<p><b>BNBU Supervisor(s)</b></p>	<p><a href="#">Prof. Hongjian SHI</a></p>
<p><b>Short introduction &amp; description of the PhD project</b></p>	<p>Interventional surgical robots (ISR) are now widely used in clinical diagnosis and treatment. However, their current form relies heavily on surgeons' experience and manual operation. ISR with autonomous navigation capabilities can address this clinical challenge. They are expected to help alleviate the uneven distribution of high-quality medical resources and promote the evolution of interventional procedures toward standardization and intelligence. The key technologies involved include: high-precision visual perception and real-time scene interpretation, interventional surgical path planning and intelligent decision-making algorithms, as well as precise control with force feedback and safe interaction mechanisms. Accordingly, the fundamental research components of the doctoral student joint training program integrated with this project include: i) real-time 3D tracking and localization of organs and instruments based on multimodal data (such as various medical images and sensor data); ii) reinforcement learning and verification of autonomous</p>

	operation strategies; and iii) construction of safety framework for human-machine collaboration and closed-loop control in several specific scenarios.
<b>Contact points</b>	Informal inquiries may be addressed to Dr. Shoujun ZHOU (sj.zhou@siat.ac.cn) and Dr. Hongjian SHI (shihj@uic.edu.cn).
<b>PhD topic</b>	<b>AI Technology Innovation for Surgical and Interventional Operating Rooms and the OR-ROBOT-SURGEON Convergence</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Lei Wang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Hongjian SHI</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>The hybrid interventional and surgical operating room (HOR) aims to improve surgical quality and safety by integrating intraoperative imaging systems with surgical platforms. This integration allows coordinated diagnosis and treatment, as well as combined procedures, within a single operative space. HORs have thus become an important research area in medical artificial intelligence. Recently, HORs have increasingly incorporated surgical robots, AI-assisted decision tools, and telemedicine technologies. However, achieving real-time and deep integration remains challenging. Three key technical bottlenecks exist. First, at the operating room level, multiple heterogeneous devices must coordinate effectively in a multi-agent system. Second, at the surgical robot level, accurate scene perception and context-aware navigation are required for safe and precise operation. Third, at the physician control level, heterogeneous clinical data must be fused efficiently, and multi-agent surgeon–robot interaction must be supported. To address these challenges: First, multimodal surgical foundation models are being developed to enable heterogeneous data fusion and intelligent clinical decision support. Second, intelligent and scalable robotic surgery systems are being explored to enhance scene perception and context-aware navigation. Third, deeper integration of operating room infrastructure, surgical robots, and surgeons is being investigated to support coordinated multi-device operation and effective surgeon–robot collaboration. These research directions represent important frontiers in intelligent surgery and have strong</p>

	potential for clinical applications
<b>Contact points</b>	Informal inquiries may be addressed to Dr. Lei Wang, (wang.lei@siat.ac.cn) and Dr. Hongjian SHI (shihj@uic.edu.cn)
<b>PhD topic</b>	<b>Agent-driven framework for optimizing multimodal data fusion in biomedicine</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Hongyan Wu</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Hongjian SHI</a>
<b>Short introduction &amp; description of the PhD project</b>	This project proposes an AI Agent-driven framework for optimizing multimodal data fusion in biomedicine. We aim to develop advanced fusion algorithms—leveraging adaptive attention and graph neural networks—to effectively integrate heterogeneous data (e.g., medical imaging, genomics, EHRs). A key innovation is embedding these algorithms within an autonomous, reasoning-capable Agent that can actively plan analysis workflows, retrieve relevant clinical knowledge via Agentic RAG, and generate interpretable, evidence-based insights. The system will be validated in real-world applications such as early cancer diagnosis and aging-related prediction, with the goal of enhancing diagnostic accuracy, personalizing treatment, and supporting clinical decision-making through intelligent, proactive data synthesis.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Hongyan Wu hy.wu@siat.ac.cn and Prof. SHI(shihj@bnbu.edu.cn)
<b>PhD topic</b>	<b>Multimodal Medical Data Fusion for Prognostic Prediction and Interpretability</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Qieshi Zhang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Hongjian SHI</a>
<b>Short introduction &amp; description of the PhD project</b>	Prognostic prediction is a fundamental task in personalized medicine and clinical decision-making. The increasing availability of heterogeneous medical data, including medical imaging, clinical text, and genomic information, provides rich and complementary insights into patient status. However, effectively integrating these multimodal data sources remains challenging due to modality heterogeneity, data incompleteness, and the lack of interpretable modeling frameworks. This project aims to develop a unified multimodal data fusion framework for accurate and interpretable prognostic prediction. The research focuses on three main aspects: (i) learning robust multimodal representations to effectively align and integrate imaging, clinical text, and genomic data; (ii) designing predictive models that can handle heterogeneous and partially missing data while ensuring strong generalization performance; (iii) developing interpretable mechanisms to identify clinically relevant features, including key biomarkers, imaging patterns, and textual evidence. The expected outcome is an interpretable and reliable prognostic prediction system that enhances clinical decision-making in applications

	such as disease progression assessment, treatment optimization, and precision medicine.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Qieshi ZHANG (qs.zhang@siat.ac.cn) and Prof. Hongjian SHI (shihj@bmbu.edu.cn).
<b>PhD topic</b>	<b>Model-driven Ophthalmic OCT Data Generation for Controllable Intraoperative Scenario Simulation</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Heng LI</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Weifeng SU</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>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’</p>

	performance in surgery.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Heng LI (liheng@suat-sz.edu.cn) and Prof. Weifeng SU (wfsu@bnnu.edu.cn)
<b>PhD topic</b>	<b>Multimodal AI for Cardiovascular Care: Integrating Imaging and ECG for Diagnosis and Prediction</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Caizhi Liao</a>
<b>BNNU Supervisor(s)</b>	<a href="#">Prof. Weifeng SU</a>
<b>Short introduction &amp; description of the PhD project</b>	Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide, with early detection and risk stratification critically dependent on the effective interpretation of multimodal clinical data, particularly medical imaging and electrocardiogram (ECG) signals; however, current diagnostic approaches are limited by fragmented analysis, reliance on manual expertise, and inadequate integration of structural and electrophysiological information. This project aims to develop an intelligent multimodal analysis framework that seamlessly integrates cardiac imaging, ECG signal processing, and advanced pattern recognition to enhance cardiovascular diagnosis and prediction, focusing on three key components: (i) advanced image processing and feature extraction for modalities such as MRI, CT, and echocardiography to quantify structural and functional biomarkers; (ii) robust ECG signal analysis to identify subtle electrophysiological signatures associated with cardiovascular abnormalities; and (iii) deep learning-based multimodal fusion strategies to jointly model imaging and ECG data for accurate

	disease classification and risk prediction. The resulting system is expected to provide automated, precise, and clinically interpretable cardiovascular assessment, enabling earlier diagnosis, personalized treatment planning, and the advancement of intelligent healthcare systems.
<b>Contact points</b>	Informal inquiries may be addressed to Dr. Caizhi Liao (liaocaizhi@suat-sz.edu.cn) and Prof. Weifeng SU (wfsu@bnbu.edu.cn).
<b>PhD topic</b>	<b>Mining and Mechanism Analysis of Typhoon Disaster Chains in Coastal Areas</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Qinglan LI</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Weifeng SU</a>
<b>Short introduction &amp; description of the PhD project</b>	This PhD project focuses on the mining and mechanism analysis of typhoon disaster chains, integrating knowledge graphs, large language models (LLMs), and Bayesian probability models for interdisciplinary research: 1) Construct knowledge graphs to model entities (e.g., typhoon events, hazard types) and their relationships extracted from multi-source data, with LLMs processing unstructured information (e.g., disaster reports) to supplement and refine the graphs, realizing systematic parsing of disaster chain cascading pathways; 2) Leverage LLMs' data mining capability to identify potential disaster-causing factors (meteorological, geographic, human activity-related) from heterogeneous data, and use Bayesian probability models to quantify the probabilistic relationships between these factors and disaster chain evolution, clarifying key drivers and their threshold effects; 3) Utilize Bayesian models to model uncertainties in typhoon forecasting and hazard propagation, with knowledge graphs providing prior knowledge (e.g., historical disaster patterns) to constrain inference, achieving quantitative prediction of disaster chain trends under uncertain conditions and offering scientific support for disaster risk reduction.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Weifeng SU(wfsu@uic.edu.cn) and Prof. Qinglan LI (ql.li@siat.ac.cn).
<b>PhD topic</b>	<b>Agent-driven framework for optimizing multimodal data fusion in biomedicine</b>

<b>SUAT Supervisor</b>	<a href="#">Dr. Hongyan Wu</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Weifeng SU</a>
<b>Short introduction &amp; description of the PhD project</b>	This project proposes an AI Agent-driven framework for optimizing multimodal data fusion in biomedicine. We aim to develop advanced fusion algorithms—leveraging adaptive attention and graph neural networks—to effectively integrate heterogeneous data (e.g., medical imaging, genomics, EHRs). A key innovation is embedding these algorithms within an autonomous, reasoning-capable Agent that can actively plan analysis workflows, retrieve relevant clinical knowledge via Agentic RAG, and generate interpretable, evidence-based insights. The system will be validated in real-world applications such as early cancer diagnosis and aging-related prediction, with the goal of enhancing diagnostic accuracy, personalizing treatment, and supporting clinical decision-making through intelligent, proactive data synthesis.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Hongyan Wu <a href="mailto:hy.wu@siat.ac.cn">hy.wu@siat.ac.cn</a> and Prof. Su ( <a href="mailto:wfsu@bnbu.edu.cn">wfsu@bnbu.edu.cn</a> )
<b>PhD topic</b>	<b>Neuro-SLAM: Fusion of Electrocardiac Signals and LiDAR for Adaptive Brain-Driven Mapping</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Shuqiang Wang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Zhe XUANYUAN</a>
<b>Short introduction &amp; description of the PhD project</b>	The project investigates whether neural correlates of spatial attention (frontal midline $\theta$ and parietal $\alpha$ ) can be fused with LiDAR data to let a brain-controlled robot build and refine maps in previously unknown environments. A multimodal neural-metric SLAM algorithm will be developed: EEG features will cue loop-closure hypotheses and drive information-gain exploration, while geometric scan matching keeps the map metrically consistent. Deep variational filters will arbitrate between neural priors and sensory evidence, enabling the robot to operate during intermittent BCI drop-out. Deliverables include open EEG-robot datasets, real-time ROS modules, and user studies demonstrating faster map convergence and reduced cognitive fatigue versus traditional joystick or purely autonomous exploration.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Shuqiang Wang ( <a href="mailto:sq.wang@siat.ac.cn">sq.wang@siat.ac.cn</a> ) and Prof. Zhe Xuanyuan (e-mail address: <a href="mailto:zhexuanyuan@uic.edu.cn">zhexuanyuan@uic.edu.cn</a> ).
<b>PhD topic</b>	<b>Automated motion analysis, planning and scheduling in robot-aided neurorehabilitation</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Lin Wang</a>

<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Zhe XUANYUAN</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>Robotic systems are increasingly utilized in rehabilitation contexts, offering tailored support for neural motion functions, e.g. physical and cognitive functions. Enabling these systems to autonomously personalize treatments entails a critical role for automated planning and scheduling methodologies. However, a comprehensive study to map the control architectures of robotic rehabilitation systems that leverage automated planning for long-term customization is lacking, addressing a key gap in the previous studies. This project will focus on works employing automated planning in robot-aided motion rehabilitation across physical and cognitive domains, as well as multi-user robotic environments. The study will include the motion analysis from elderly and relevance to automated planning, and a focus on robotic systems in rehabilitation.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Lin Wang(<a href="mailto:lin.wang1@siat.ac.cn">lin.wang1@siat.ac.cn</a>) and Prof. Zhe Xuanyuan (<a href="mailto:zhexuanyuan@uic.edu.cn">zhexuanyuan@uic.edu.cn</a>).</p>
<b>PhD topic</b>	<b>Adaptive Resource Scheduling and Model-Aware Optimization for AI Infrastructure</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Minxian XU</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Zhe XUANYUAN</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>The rapid growth of large-scale AI models, such as large language models and multimodal systems, has created significant challenges for computing infrastructure due to their dynamic, heterogeneous, and resource-intensive nature. Efficient management of computing, storage, and networking resources across cloud, edge, and hybrid environments is critical to ensure high performance, scalability, and energy efficiency. This project will focus on two main dimensions: (i) AI system resource management, including adaptive scheduling, hardware-aware workload placement, energy-aware orchestration, and dynamic resource allocation; and (ii) infrastructure design and optimization, exploring cloud-native and edge-aware architectures, containerization, hybrid deployments, and model compression techniques. By integrating these approaches, the project aims to develop practical strategies for optimizing throughput, latency, and energy consumption in AI infrastructure. The outcomes will support sustainable, high-performance AI deployment for both research and industrial applications, enabling more efficient and environmentally conscious computing for large-scale AI workloads.</p>

<b>Contact points</b>	Informal inquiries may be addressed to Prof. Minxian XU (mx.xu@siat.ac.cn) and Prof. Zhe XUANYUAN (zhexuanyuan@uic.edu.cn).
<b>PhD topic</b>	<b>Multi-Source Sensing-Based Integrated Recognition and Compliant Grasping Technology for Maritime Small Targets</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Yimin Zhou</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Zhe XUANYUAN</a>
<b>Short introduction &amp; description of the PhD project</b>	In complex marine environments, high turbidity, low light, and hydrodynamic disturbances severely degrade single-modal sensing (vision or sonar), making it difficult to accurately recognize and safely grasp small targets (e.g., biological organisms, debris, fragile components). Existing underwater manipulators mostly rely on rigid control, lacking fine contact perception, which leads to instability, slippage, or target damage. Thus, an integrated multi-source sensing and compliant grasping technology is urgently needed. This project will focus on the following problems, i.e., 1) Robust fusion and consistent representation of multi-source (vision, sonar, tactile) sensing under degraded conditions; 2) Fine-grained recognition and joint state (pose, stiffness, contact) estimation of small targets with incomplete information; 3) Perception-driven cooperative decision-making and control that closes the loop from recognition to grasping; 4) Safe interactive grasping that balances high load capacity with compliance, ensuring stability without damaging targets.
<b>Contact points</b>	Informal inquiries may be addressed to Dr. Yimin Zhou (e-mail: ym.zhou@siat.ac.cn) and Dr. Zhe Xuanyuan (zhexuanyuan@bnbu.edu.cn).
<b>PhD topic</b>	<b>3D Reconstruction&amp;Perception for Embodied Manipulation</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Xiaobo Wang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Amy Hui ZHANG</a>
<b>Short introduction &amp; description of the PhD project</b>	This PhD project investigates advanced 3D reconstruction and perception frameworks tailored for embodied manipulation in complex, unstructured environments. Traditional vision systems often struggle with severe occlusions and challenging surface materials during physical interaction. To overcome this, the research focuses on developing lightweight, real-time 3D representations through multi-modal sensor fusion, seamlessly integrating vision, sparse point clouds, force, and tactile feedback. Ultimately, the project aims to bridge the gap between fine-grained 3D spatial understanding and advanced downstream control policies, such as Vision-Language-Action (VLA) models, enabling robots to robustly execute complex, highly generalized

	tasks in dynamic real-world scenarios.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Xiaobo Wang (wangxiaobo@suat-sz.edu.cn) and Prof. Amy Hui Zhang (amyzhang@bnbu.edu.cn).
<b>PhD topic</b>	<b>Video-based Surgical Spatial Computing</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Weixin SI</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Amy Hui ZHANG</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>This PhD project aims to build a new generation of surgical foundation models that enable comprehensive spatial understanding of surgical scenes. The research focuses on constructing large-scale, multi-modal models tailored to surgical video data, leveraging and extending architectures such as Vision-Language Models (VLMs), Segment Anything Model 2 (SAM 2), DINO v3 and so on. These models will learn from diverse video–language pairs to achieve unified perception of instruments, tissues, and surgical workflows, enabling accurate scene segmentation, 3D spatial reconstruction, and semantic reasoning. By capturing both visual and procedural knowledge, the models will serve as the foundation for intelligent surgical guidance, decision support, and autonomous robotic collaboration. In parallel, the project emphasizes real-world translation of these foundation models through efficient adaptation and neuromorphic optimization. Techniques such as model compression, quantization, and knowledge distillation will be explored to ensure robust performance on resource-limited surgical devices. Inspired by biological computation principles, the research will also design brain-inspired computing prototypes using spiking neural networks and event-driven processing to achieve energy-efficient, real-time inference. Together, these efforts will establish an end-to-end framework bridging large-scale learning and embodied intelligence in surgical environments, advancing the frontier of intelligent surgery toward interpretable, adaptive, and safe human–AI collaboration.</p>
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Weixin SI (siweixin@suat-sz.edu.cn) and Prof. Amy Hui ZHANG (amyzhang@uic.edu.cn).
<b>PhD topic</b>	<b>Craniotomy Surgical Robot Based on Computer Vision and Artificial Intelligence</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Chang Liu</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Amy Hui ZHANG</a>

	Brain tumours, aneurysms, and epilepsy are major neurological health challenges in China. Craniotomy is one of the most essential neurosurgical procedures for treating these conditions and thus holds great importance within the healthcare system. Currently, craniotomy operations still rely heavily on manual skull cutting, which introduces potential risks such as cerebral tissue damage. This project aims to develop a highly autonomous, precise, and flexible craniotomy robotic system based on computer vision and artificial intelligence technologies. The system will integrate hand–eye calibration for the robotic platform, rapid registration between preoperative 3D medical images and intraoperative point clouds, six-degree-of-freedom pose tracking of surgical targets, 3D scene reconstruction, and intelligent robot control (e.g., dynamic path planning).
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Zhang (amyzhang@uic.edu.cn) and Dr. Liu (chang.liu2@siat.ac.cn).
<b>PhD topic</b>	<b>Interventional surgical robots with autonomous navigation capabilities</b>
<b>SUAT Supervisor</b>	<a href="#">Dr. Shoujun ZHOU</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Amy Hui ZHANG</a>
<b>Short introduction &amp; description of the PhD project</b>	Interventional surgical robots (ISR) are now widely used in clinical diagnosis and treatment. However, their current form relies heavily on surgeons' experience and manual operation. ISR with autonomous navigation capabilities can address this clinical challenge. They are expected to help alleviate the uneven distribution of high-quality medical resources and promote the evolution of interventional procedures toward standardization and intelligence. The key technologies involved include: high-precision visual perception and real-time scene interpretation, interventional surgical path planning and intelligent decision-making algorithms, as well as precise control with force feedback and safe interaction mechanisms. Accordingly, the fundamental research components of the doctoral student joint training program integrated with this project include: i) real-time 3D tracking and localization of organs and instruments based on multimodal data (such as various medical images and sensor data); ii) reinforcement learning and verification of autonomous operation strategies; and iii) construction of safety framework for human-machine collaboration and closed-loop control in several specific scenarios.
<b>Contact points</b>	Informal inquiries may be addressed to Dr. Shoujun ZHOU (sj.zhou@siat.ac.cn) and Dr. Hui ZHANG

	(amyzhang@uic.edu.cn).
<b>PhD topic</b>	<b>3D scene reconstruction based on 3D Gaussian Splatting under challenging conditions</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Mingwen Shao</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Amy Hui ZHANG</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>The rapid advancement of virtual reality and metaverse technologies has significantly heightened the demand for realistic 3D scene reconstruction, which holds vast potential across various application domains, including entertainment, education, medicine, etc. With technological advancements, 3D reconstruction is gradually transitioning toward real-time environments, aiming to simultaneously estimate camera motion trajectories and construct environmental maps for localization and navigation.</p> <p>In 2023, 3D Gaussians emerged as a novel scene representation method, offering greater flexibility and expressiveness. Similar to Neural Radiance Fields (NeRF), it employs SfM (Structure from Motion)-calibrated cameras and initializes the 3D Gaussian set based on the sparse point cloud generated during the SfM process. Unlike point cloud methods that rely on multi-view stereo matching (MVS) data, it achieves high-quality 3D reconstruction results using only the sparse point cloud produced by SfM.</p> <p>Based on 3D Gaussian Splatting, this project will focus on three major issues on (i) 3D reconstruction under adverse conditions such as sparse viewpoints, occlusions, and degraded scenes; (ii) 3D reconstruction in dynamic scenes; (iii) high-efficiency large-scale 3D reconstruction.</p>
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Mingwen Shao (shaomingwen@suat-sz.edu.cn) and Prof. Amy Hui Zhang (amyzhang@uic.edu.cn).
<b>PhD topic</b>	<b>Brain-Inspired 3D Dynamic Reconstruction and Synergistic Action Understanding</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Qieshi Zhang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Amy Hui ZHANG</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>Brain-inspired intelligence, characterized by spatiotemporal memory and parallel processing, offers a promising paradigm for advancing intelligent perception and action understanding in complex, dynamic environments. However, existing 3D dynamic reconstruction methods suffer from limited accuracy and robustness under occlusion and rapid motion, while conventional action analysis approaches lack the ability to model multi-joint/multi-target synergy and adaptive reasoning. This project aims to develop a unified brain-inspired framework for high-precision 3D dynamic reconstruction and synergistic action understanding. The research focuses on three aspects: (i) a brain-</p>

	<p>inspired spatiotemporal model integrating frame–event fusion and metric scale recovery for robust 3D reconstruction; (ii) a multimodal action analysis framework combining muscle synergy theory and deep reinforcement learning for modeling coordinated actions; (iii) an end-to-end system that tightly couples reconstruction and action understanding, enhanced by feedback-driven adaptation for real-time performance and generalization. This topic is expected to enable robust perception and brain-like decision-making in high-dynamic environments, with applications in embodied robotics, industrial collaboration, intelligent motion analysis, and public safety.</p>
<b>Contact points</b>	<p>Informal inquiries may be addressed to Prof. Qieshi ZHANG (qs.zhang@siat.ac.cn) and Prof. Amy Hui ZHANG (e-mail address).</p>
<b>PhD topic</b>	<p><b>Embodied Autoregressive World Models for Integrated Robot Perception, Prediction, and Decision-Making in Complex Open Environments</b></p>
<b>SUAT Supervisor</b>	<p><a href="#">Prof. Jun Cheng</a></p>
<b>BNBU Supervisor(s)</b>	<p><a href="#">Prof. Amy Hui ZHANG</a></p>
<b>Short introduction &amp; description of the PhD project</b>	<p>This project aims to develop an embodied autoregressive world model framework to support the integrated needs of robot perception, future-state prediction, and decision-making in complex open environments. Current robotic systems still face major challenges in handling heterogeneous sensory inputs, maintaining physical consistency during interaction, coordinating diverse control policies, and adapting efficiently to new tasks, scenes, and robot embodiments. To address these limitations, this research will establish a unified system covering multimodal perception encoding, physically consistent autoregressive modelling, heterogeneous policy co-generation, and rapid adaptation and deployment.</p> <ol style="list-style-type: none"> <li>1) Unified multimodal representation and plug-and-play sensor alignment mechanisms are investigated. Visual, linguistic, force, tactile, and proprioceptive signals will be jointly modelled through modular encoders and cross-modal alignment modules, enabling compatibility across different robot platforms, sensor combinations, and sampling rates.</li> <li>2) A physically consistent autoregressive world model is built for complex interaction scenarios. By introducing temporal autoregressive modelling together with physical priors, dynamics consistency learning, and contact-affordance reasoning, the model will predict environmental evolution, object motion, contact events, and action consequences in an interpretable and causally grounded manner.</li> <li>3) Collaborative generation of heterogeneous policy heads is studied under a shared world-state representation, supporting manipulation, navigation, grasping, and mobile manipulation within a unified perception–prediction–decision closed loop. The world model will further enable action evaluation, behaviour</li> </ol>

	rollout, and online correction to improve robustness and task success.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Cheng (jun.cheng@siat.ac.cn) and Prof. Zhang (amyzhang@bnnu.edu.cn).
<b>PhD topic</b>	<b>Learning-based 3D Human Reconstruction for Natural Human-Machine Interaction</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Lei Wang</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Prof. Amy Hui ZHANG</a>
<b>Short introduction &amp; description of the PhD project</b>	Traditional approaches to reconstructing human bodies from monocular or multi-view inputs often struggle with clothing variations, fine-grained motion, and real-time performance. The project will develop learning-based techniques that leverage neural implicit representations, diffusion models, and hybrid geometric priors to achieve accurate, temporally consistent reconstructions of full-body human models, including pose, shape, and surface details. A central focus will be the integration of reconstructed human models into interactive systems, enabling lifelike communication with machines in virtual, augmented, and robotic environments. By modeling dynamic interactions—such as gestures, facial expressions, and body movements—the project aims to bridge perception and embodiment, providing machines with a deeper understanding of human intent. The outcome will advance 3D vision, embodied AI, and multimodal interfaces, contributing to next-generation virtual collaboration, telepresence, and assistive robotics.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Lei Wang (lei.wang1@siat.ac.cn) and Prof. Amy Hui ZHANG (amyzhang@uic.edu.cn).
<b>PhD topic</b>	<b>Proactive Health-Driven Chronic Disease Management: Integration of Advanced Sensing Technologies and AI Algorithms</b>
<b>SUAT Supervisor</b>	<a href="#">Prof. Zedong Nie</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr. Weipeng ZHUO</a>
<b>Short introduction &amp; description of the PhD project</b>	With the rising global prevalence of chronic diseases (e.g., cardiovascular diseases, diabetes), traditional passive healthcare fails to meet the demands of "early prevention, early diagnosis, and early treatment" for chronic disease control. This project, rooted in the proactive health concept, aims to address technical bottlenecks in chronic disease management by integrating advanced sensing technologies and AI algorithms. Key research includes developing high-sensitivity radio frequency (RF) and electrochemical sensors for real-time physiological monitoring, applying advanced functional materials to enhance wearable device performance, and designing AI algorithms for risk early

	warning, dynamic disease assessment, and personalized intervention. It ultimately seeks to drive the shift of chronic disease control from passive response to active management.
<b>Contact points</b>	Informal inquiries may be addressed to Prof. Zedong Nie (zd.nie@siat.ac.cn) and Dr Weipeng ZHUO (weipengzhuo@uic.edu.cn).

## Available PhD topic in Applied Mathematics

<b>PhD topic</b>	High-Performance Computing Algorithms for Blood Flow Simulations and Applications
<b>SUAT Supervisor</b>	<a href="#">Dr.Rongliang Chen</a>
<b>BNBU Supervisor(s)</b>	<a href="#">Dr Yana Di</a>
<b>Short introduction &amp; description of the PhD project</b>	<p>This PhD project focuses on developing and optimizing high-performance computing (HPC) algorithms to address the grand challenges in blood flow simulations, a multiscale, multiphysics problem critical to cardiovascular research and clinical practice. Blood, modeled as a complex mixture of plasma and deformable red blood cells (RBCs), exhibits non-Newtonian behavior and interacts dynamically with vascular geometries, posing extreme computational demands that traditional methods cannot efficiently resolve. The research will advance state-of-the-art algorithms tailored for heterogeneous HPC architectures (CPU-GPU clusters). Applications span translational medicine: from thrombosis risk assessment and stroke research to personalized therapy optimization for conditions like aortic coarctation. By integrating medical imaging data (CT/MRI) with HPC-accelerated simulations, the project aims to bridge the gap between computational fluid dynamics (CFD) research and clinical decision-making, providing unprecedented insights into microcirculation and hemodynamic mechanisms while pushing the boundaries of HPC scalability for biomedical engineering.</p>
<b>Contact points</b>	Informal inquiries may be addressed to Dr Rongliang Chen (rl.chen@siat.ac.cn) and Dr. Yana Di (yandi@bnbu.edu.cn).