

上海交通大學 2022 暑期科研見習計畫（線上）

一、項目概況

上海交通大學利用其學科優勢、師資優勢、設備優勢以及對接產業的優勢，為港澳高校高年級本科生提供科研見習機會。目前機械工程、電子資訊與電氣工程、船舶海洋與建築工程、材料科學與工程、環境科學與工程、生物醫學工程、航空航天、物理學、化學與化學工程、海洋學、生命科學與生物技術、農學與生物學、藥學、醫學、設計、系統生物醫學等 166 個項目提供暑期科研見習崗位。為港澳高校同學提供挑戰自我的平臺，通過學習交流感受科學魅力。

科研見習為期約 6 周，每週都會召開小組會議，指導教師都會與學生進行面對面（線上）的溝通，從而豐富科研經驗，提升實驗技能與學術能力，為將來研究生階段的學習夯實基礎。參與科研見習的學生要求提交中期與終期報告，順利結業的同學將會獲得學校發放的見習證書。

二、活動安排

地點：線上

時間：2022 年 6 月 27 日-8 月 5 日

活動擬安排日程：

時間	行程安排
6 月 27 日	學生報到
6 月 28 日	開學典禮
6 月 27 日-8 月 5 日	暑期科研見習
9 月	成績單寄送

三、報名要求

1. 本項目由各合作高校官方選拔，不接受學生自薦；
2. 可接受每校 10-15 人報名；
3. 暑期科研見習僅限本科生；
4. 報名學生原則上應為香港、澳門本土學生，若有內地籍或臺灣籍學生感興趣，請勿超過提名總數的 10%；

5. 報名截止日期為 4 月 30 日，在各自學校提交學生報名表的同時，報名學生請至上海交通大學指定網站報名申請 ([<>Application](http://summerprogram.sjtu.edu.cn/))。

四、費用

1. 各位同學請自行承擔網路線上報名費用 400 元人民幣；
2. 上海交通大學承擔各位同學的學費。

五、注意事項

1. 具體項目與日程會根據實際情況進行調整；
2. 如因不可抗力等導致未能執行，其最終解釋權歸上海交通大學所有。



上海交通大学
SHANGHAI JIAO TONG UNIVERSITY

SJTU ONLINE SUMMER RESEARCH INTERNSHIP PROGRAM



2022

Contact :
<http://summerprogram.sjtu.edu.cn/>
Email: isc.mobility@sjtu.edu.cn

S J T U
20
SUMMER RESEARCH
INTERNSHIP
PROGRAM
22

Shanghai Jiao Tong University (SJTU) is a higher education institute in China, which enjoys a long history and a world-renowned reputation. Through 126 years of unrelenting effort, SJTU has become a comprehensive and research-oriented top international university in China. SJTU enjoys an ever-increasing level of scientific research excellence and technological innovation.

SJTU Summer Research Internship Program aims to promote international research collaboration and enhance the academic environment at Shanghai Jiao Tong University. It offers excellent undergraduate students from all around the world the opportunity to spend a summer studying at world-class research laboratories, alongside prominent research professors. It will prepare undergraduate students for further studies through intensive research experience with faculty mentors and enrichment activities.

In addition, participants will develop their research skills by enjoying lectures with topics such as "How to Write a Research Essay", "How to Cooperate in a Project". Participants will also learn about Chinese language and culture, which will enhance their intercultural awareness and communication.



🔍 What Participants will receive?

- > Knowledge of the top research projects in China
- > The opportunity to work with top Chinese professors, fellows, and students
- > A good basis for a career in academic research
- > The opportunity to co-author a scientific paper
- > Knowledge of Chinese language and culture
- > A rewarding and unforgettable experience in China

🔍 Eligibility Requirements

- > Students from overseas (Non-Chinese Citizen), Hong Kong, Taiwan, and Macao are eligible to apply.
- > Students must have completed at least one year of an undergraduate program and be enrolled as a current undergraduate.
- > Hold at least a 3.0 GPA on a 4.0 scale or equivalent.
- > Students from non-English speaking countries must provide an English language proficiency certificate: an IELTS with a score no less than 6.0 or a TOEFL with a score no less than 78 points. If you are studying in a fully English taught program, you must provide the relevant certificates.
- > Additional requirements vary per laboratory.

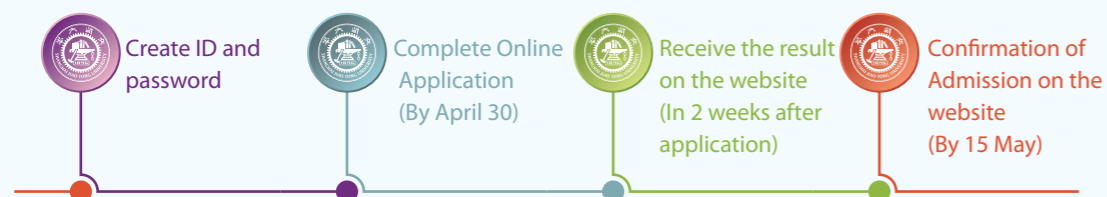
🔍 Duration

27 June, 2022- 5 August, 2022

Academic Information

Credit	3 SJTU Credits
Program duration	In-Lab Hours: 20 hours/week
Assessment	There are three grading sections in this program:
	Attendance = 30%
	Midterm presentation = 30%
	Final written report = 40%

Application Procedures



Please apply through the website: <http://apply.sjtu.edu.cn>¹

The following items shall be uploaded alongside the online application:

- > A scan of the identification page of your passport. The passport must be valid for at least 6 more months for the visa application.
- > ID photo (similar to a passport photo)
- > Curriculum vitae (CV)
- > Copy of your most recent academic transcript
- > Motivation letter
- > Recommendation letter
- > Report of your past research experience (if available)
- > Language proficiency certificate (if available)

Program Fee

Application fee (Non-refundable)	400RMB
Tuition fee	8000RMB

* Tuition fee will be waived for students who are successfully selected to attend summer research internship program.

¹ It is very important that you fill in your name correctly on the online application. You should type in your legal name as it appears on your passport exactly.



Online Application Deadline

30 MAY, 2022

Announcement

You will be notified of the results through our website and an email within two weeks of completing the application.

Certificate and Transcript

After completing the program and submitting the final report, participants will receive an official certificate from the university.

Official transcripts will be sent to the mailing address that you have provided in the application in September, 2022. Students who wish to transfer credits need to obtain pre-approval from the relevant authorities at your home universities.

🔍 Timeline

Preparation for the Application	
Completion of the online application	January to May, 2022
Notification of the application result	February to May, 2022
Registration	27 June, 2022
Opening Ceremony	28 June, 2022
Internship	27 June - 5 August, 2022
Finishing the program survey of issuing of certificates	30 August, 2022
Transcript delivery	September, 2022

🔍 Contact

Email: isc.mobility@sjtu.edu.cn

Website: <http://summerprogram.sjtu.edu.cn/>



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PROJECT

01

The Digital Twin Technology in Workshop

Contact Information:

Prof. Hao Wang

Email: wanghao@sjtu.edu.cn

Project Description and Objectives:

Digital twin technology is developing very rapidly and has been widely used in all aspects of industrial production. This project is to make full use of physical models, sensor updates, and other data to display the condition of equipment in workshops.

Eligibility Requirements:

Interested students from Germany should be very proficient in C++ programming and have basic knowledge of medical image.
Computing.

Main Tasks:

- > Finish a research report.
- > Develop a software.

Website:

Lab: <http://fpcsm.sjtu.edu.cn>

School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT

02

Intelligent Assembly Guidance System

Contact Information:

Prof. Hao Wang

Email: wanghao@sjtu.edu.cn

Project Description and Objectives:

Based on machine vision and machine learning, the main purpose of this system is to guide workers in assembling complex products. In addition, the system can correct an assembly if an error occurs.

Eligibility Requirements:

Interested students from Germany should be very proficient in C++ programming and have basic knowledge of medical image.
Computing.

Main Tasks:

- > Finish a research report.
- > Develop a software.

Website:

Lab: <http://fpcsm.sjtu.edu.cn>

School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT
03

The Development of Myoelectric Recording Device for Motionless Gesture Recognition

Contact Information:

Prof. Xinjun Sheng

Email: xjsheng@sjtu.edu.cn

Project Description and Objectives:

The objective of this project is to develop a myoelectric recording device for motionless gesture recognition. Surface electromyography (sEMG) contains abundant information related to hand motions that can be used to recognize different gestures. Motionless gesture recognition techniques aim to recognize gestures through electrophysiological activities of human muscles even if there are only motor intentions but real motions, which can be utilized to realize human-machine interactions under convert circumstances. To this end, we propose to develop a recording device for local high-density sEMG signals which could be used to decode the motor unit action potential trains (MUAPt). The relationship between motionless gestures and sEMG signals or the decoded MUAPt also will be investigated. Finally, a demonstration based on motionless gesture recognition technique should be given, for example, controlling a computer game.

Eligibility Requirements:

The interested student should have a basic knowledge of electronic engineering and signal processing.

Main Tasks:

- > Finish a research report.
- > Give two research presentations (a. references review; b. technical presentation).
- > Submit one paper to journal as a co-author.

Website:

Lab: <http://bbl.sjtu.edu.cn>

School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT
04

Chemistry in Clean Combustion

Contact Information:

Prof. Fei Qi

Email: fqj@sjtu.edu.cn

Project Description and Objectives:

Combustion provides over 85% of global primary energy supply nowadays. Clean combustion is one of the most important approaches to achieve an environmental-friendly energy supply. To reduce the air pollutants in combustion, many novel combustion concepts have been proposed, where chemistry plays a crucial role. In this study, the chemistry in low-temperature combustion (LTC), which is a novel combustion concept to reduce both NO_x and PM emissions in engine combustion, will be investigated with advanced experimental approaches. Key elementary LTC reactions will be investigated using a newly designed shock tube over a wide range of pressures and temperatures. A flow reactor and a jet-stirred reactor combined with mass spectrometry (MS), gas chromatography (GC), and GC×GC technique will be used to understand the secrets in LTC engine-relevant conditions. Kinetic model for the investigated fuel will be developed and validated based on the experimental findings. The outcome from this study will be used to explore strategies for the control of combustion pollutant emissions in a more intelligent way.

Eligibility Requirements:

- > Understanding of lab safety.
- > Necessity of physical chemistry knowledge.
- > Students who have experience in labs are preferred.

Main Tasks:

- > Measurements of key elementary LTC reactions in a shock tube.
- > Measurements of key intermediates in a flow reactor and a jet-stirred reactor using various diagnostic tools.
- > Development of a kinetic model for a specific engine fuel.

Website:

Lab: <http://combustion.sjtu.edu.cn/home/>

School: <http://202.120.53.238/English/Default.aspx>

PROJECT
05

Gas Turbine Model Reactor: Swirling Flame Dynamics Investigated by Laser Diagnostics

Contact Information:

Prof. Fei Qi
Email: fqj@sjtu.edu.cn

Project Description and Objectives:

Combustion diagnostics techniques based on laser spectroscopy are accurate and nonintrusive techniques that have emerged to become an indispensable tool of combustion science and development of combustion technology. In this study, a swirl-stabilized burner is constructed to investigate flame dynamics and thermoacoustic instability. It consists of a driver unit, a settling chamber, a contraction ended by a constant diameter duct, a horizontal end piece and an enclosed chamber. The rotation of the flow is induced by an axial swirler equipped with eight twisted airfoil vanes. A small bluff body is used to stabilize the flame during the unsteady motion of the flow. A loud speaker installed at the bottom of the setup provides acoustic excitation to the flame. Air and fuel are premixed and then enter the bottom of the burner through two tubes.

To investigate the response of the swirling flame to the acoustic excitation, both the unsteady flow field and the evolution of the flame surface are measured simultaneously. The measurement techniques mainly depend on a high-speed burst mode Nd:YAG laser with a repetition rate of up to 100 kHz and two intensified high-speed CMOS cameras. High speed PIV is used for the measurement of the unsteady flow field. PLIF for the distribution of CH₂O/acetone is used to capture the evolution of the flame front. Tunable diode laser absorption spectroscopy is adopted for the measurement of flame temperature and concentrations of CO₂/H₂O. A hot wire is equipped in the downstream of the swirler used to measure the flow velocity variation due to the acoustic excitation. Raman scattering techniques have also been used in this study.

Eligibility Requirements:

- > Understanding of lab safety.
- > Knowledge of combustion and flame is necessary.
- > Interested students should have basic knowledge of laser and photonics.

Main Tasks:

- > Measurement of swirling flames dynamics using laser diagnostics techniques based on burst mode pump laser, Raman spectroscopy, or absorption spectroscopy.
- > Development of transverse sound measurement of the ring shaped combustor.
- > Developing a flame transfer function between the upstream forcing and flame response.

Website:

Lab: <http://combustion.sjtu.edu.cn/home/>
School: <http://202.120.53.238/English/Default.aspx>

PROJECT
06

Hand-Eye Coordination Algorithm for Minimally Invasive Surgical Robot

Contact Information:

Prof. Qixin Cao
Email: qxcao@sjtu.edu.cn

Project Description and Objectives:



Typical minimally invasive surgical robots are generally used with remote operation, that is, doctors according to the endoscopic image use a main hand device to control the distal surgical robot to carry out operations. This approach has a variety of advantages. On one hand, the robot can be more stable and accurate than the doctor's hand, on the other hand, it's very useful for surgeries that need to be operated in the X-ray environment, such as some orthopedic surgery. More importantly, the isolation

of doctors and patients by geographical location can make the future realize the sharing of genuine medical resources. Excellent doctors can be shared with people around the world. The hand-eye coordination algorithm studied in this project is to establish a mapping between hand movements and endoscopic images to enhance the surgeon's presence. Hand-eye coordination involves the control of the robot, the coordinate system transformation, etc. This is one of the core technologies of the remote operation problem.

Eligibility Requirements:

The interested student should have a basic knowledge of robot controls and coordinate transform.

Main Tasks:

- > Finish a research report.
- > Give two research presentations (a. references review; b. technical presentation).

Website:

Lab: <http://robofab.sjtu.edu.cn/>
School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT
07

Mechanism Design of Medical Robotic System

Contact Information:

Asso. Prof. Yanping Lin
Email: yanping_lin@sjtu.edu.cn

Project Description and Objectives:

This medical robotic system would be used in surgical operations. It was mainly used to accomplish puncturing or drilling operations accurately. In order to meet the requirement of surgical operations, the robotic system should have the following functions: 1) Locating different surgical tools conveniently such as puncture needle or drills in the right location and orientation. 2) Driving the surgical tools moving along its axis. This project mainly researches and designs a novel mechanical structure of the medical robotic system to meet the above functional requirements.

Eligibility Requirements:

The interested student should have a basic knowledge of Mechanical Engineering.

Main Tasks:

- > Complete mechanical structure design of the surgical robot end-effector.
- > Finish 3D modeling and 2D drawing of the end-effector.

Website:

Lab: <http://ssemi.sjtu.edu.cn/CN/Default.aspx>
School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT
08

Key Technology in Surgical Robotics Based on Artificial Intelligence and Augmented Reality

Contact Information:

Prof. Xiaojun Chen
Email: xiaojunchen@sjtu.edu.cn

Project Description and Objectives:

As a modern minimally-invasive surgery, microscopic/endoscopic techniques are widely used in the field of surgery, however, the current orthopedic robots are only applicable for traditional open surgery. Their working principles, operation modes, as well as the software and hardware systems simply do not apply to microscopic/endoscopic surgeries as they are currently. In this project, some leading-edge algorithms based on artificial intelligence regarding multi-modal image registration, automatic segmentation, high quality visualization, and precise planning are proposed for important anatomical structures in the musculo-skeletal system. Then, a surgical navigation system based on Augmented Reality is established based on real time segmentation, non-rigid registration, and 3D reconstruction for an intra-operative ultrasound and endoscopic images, aiming at solving the problems of soft tissue deformation and tracking. Finally, the comprehensive, light, and smart mechanical structures and control systems for surgical robots in endoscopic orthopedics are designed and integrated with our previously self-developed surgical navigation and robotic system, achieving the ultimate prototype of "Microscopic/Endoscopic Surgical Robotics Based on Augmented Reality". The accuracy, effectiveness, and reliability of the whole system will be validated through phantom experiments and clinical trials, for the goal of the mass clinical application. The research outcome of this project will promote the personalization, safety, accuracy, and minimal invasion of microscopic/endoscopic orthopedics, leading the direction in the international field of orthopedic robotics.

Eligibility Requirements:

The interested student should be very proficient in C++ programming and have a basic knowledge of medical image processing.

Main Tasks:

- > Develop a software.
- > Finish a research report.
- > Give two research presentations (a. references review; b. technical presentation).
- > Submit one paper to journal as a co-author.

Website:

Lab: <http://ssemi.sjtu.edu.cn/EN/Default.aspx>
School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT
09

The Research on Digital Design and Manufacturing of Customized Implants (Surgical Templates) Based on Artificial Intelligence and 3D-Printing

Contact Information:

Prof. Xiaojun Chen
Email: xiaojunchen@sjtu.edu.cn

Project Description and Objectives:

Oral disease is one of the most common diseases for mankind. As the treatment of oral diseases, oral and maxillofacial surgery aims to treat the entire craniomaxillofacial complex: anatomical area of the mouth, jaws, face, skull, as well as associated structures. However, the limited intraoperative visibility, especially the anatomical intricacies, makes this kind of surgery a demanding procedure. Also, the accuracy and stability of the operations are very difficult to be guaranteed. In this project, with the integration of artificial intelligence, computer-assisted surgical planning, virtual reality, computer graphics, and 3D-Printing, the methodology of the design and manufacturing of customized template is presented for oral and maxillofacial surgery, aiming to meet the unique demands of China's clinical application.

Based on relevant basic theory and innovative algorithms, computer-assisted AI-based preoperative planning system and virtual simulation system will be realized to determine the optimal surgical path for oral and maxillofacial surgery. Then, the system for digital design and manufacturing of customized templates will be presented. Through phantom experiments and clinical trials, the influence of the factors such as the geometrical contours, material properties, and processing parameters of the devices on the processing quality and clinical accuracy will be revealed. Therefore, those parameters can be optimized to demonstrate its accuracy, validity, and reliability. Ultimately, an integrated platform for digital design and manufacturing of customized templates will be formed, aiming to provide innovative technical methods for the personalization, digitalization, and minimal invasion of oral and maxillofacial surgery, and greatly improve the general life quality of the patients.

Eligibility Requirements:

The interested student should be very proficient in C++ programming and have a basic knowledge of medical image processing.

Main Tasks:

- > Develop a software.
- > Finish a research report.
- > Give two research presentations (a. references review; b. technical presentation).
- > Submit one paper to journal as a co-author.

Website:

Lab: <http://ssemi.sjtu.edu.cn/EN/Default.aspx>
School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT
10

Efficient Usage of Low Grade Heat



Contact Information:

Dr. Zisheng LU
Email: zslu@sjtu.edu.cn

Project Description and Objectives:

Commercial and residential buildings consume almost 40% of the primary energy in the United States or Europe and nearly 30% in China. To reduce the dependence of the building on the primary energy, several studies on energy-saving technologies have been done worldwide. On the other hand, renewable energy utilization was regarded as reasonable solutions to global warming, air pollution, and energy security. Through integrating the technologies of energy-efficient and renewable energy utilization in building, net-zero energy building is an innovative concept for a high-performance building.

Eligibility Requirements:

- > The interested student should have basic knowledge of renewable energy, air-conditioning, green building, sorption cooling technologies, etc.
- > The interested student should be at ease with CAD or 3D software.
- > Excellent writing and speaking communication are mandatory.

Main Tasks:

- > Be familiar with different building energy saving technologies, such as adsorption, absorption, dehumidification, etc.
- > Can propose a new design, analyze it and optimize the designs.
- > Carry out simulations of different design concepts.
- > Write a technical report on the results.

Website:

Lab: www.sjtuirc.sjtu.edu.cn
School: <http://me.sjtu.edu.cn/English/Default.aspx>

Modelling and Simulation of Debris Attachment on the CMM Stylus and the Impact on Measurement Accuracy

Contact Information:

Asso. Prof. Xiaobing Feng
Email: xiaobing.feng@sjtu.edu.cn

Project Description and Objectives:

Coordinate measurement machines (CMMs) are widely used in industry to measure the geometrical dimensions of products as a part of the quality control process. During measurement, debris particles adhere to the surface of the CMM stylus tip. Such debris significantly impairs the dimensional accuracy of a CMM, which is critical for the measurement of precision-engineered products. This project will investigate the impact of the debris particles on the measurement accuracy of the CMM. The phenomenon of particle adhesion on the CMM stylus will be modeled. Simulation of particle adhesion and deformation will be conducted. The outcome of the project will help determine the significance of debris attachment during several CMM measurement tasks commonly used in industry and potential measurement errors.

Eligibility Requirements:

- > 3rd year and above undergraduate students majoring in Mechanical/Electrical/Sensory engineering
- > Students with research experience are highly desired.
- > Knowledge on metrology and/or CMNC machine tool is highly desired.

Main Tasks:

Participant will carry out particle mechanics analysis of debris involved in CMM measurement, investigate the debris attachment/detachment mechanism, and conduct a simulation of debris attachment on the CMM stylus tip during measurement.

Website:

Lab: N/A
School: <http://me.sjtu.edu.cn/English/Default.aspx>

Experimental Investigation of Debris Attachment on the CMM Stylus Particles on the Measurement Accuracy of the CMM

Contact Information:

Asso. Prof. Xiaobing Feng
Email: xiaobing.feng@sjtu.edu.cn

Project Description and Objectives:

Coordinate measurement machines (CMMs) are widely used in industry to measure the geometrical dimensions of products as a part of the quality control process. During measurement, debris particles adhere to the surface of the CMM stylus tip. Such debris significantly impairs the dimensional accuracy of a CMM, which is critical for the measurement of precision-engineered products. This project will experimentally investigate the adhesion of debris particles on the CMM stylus. Debris of various materials and shapes from multiple manufacturing processes will be studied and categorized. CMM measurements will be conducted and data analysis will be performed to determine the impact of debris on measurement error. The outcome of the project will help determine the significance of debris attachment and assess measurement errors.

Eligibility Requirements:

- > 3rd year and above undergraduate students majoring in Mechanical/Electrical/Sensory engineering
- > Students with research experience are highly desired.
- > Knowledge on metrology and/or CMNC machine tool is highly desired.

Main Tasks:

Participants will carry out experimental investigations on debris attachment on CMM stylus tips, including the collection and characterization of manufacturing debris, applying different methods for applying collected debris particles onto the workpiece surface with desired distribution, conduct CMM measurement experiment using contaminated workpiece, and determining the extent of contamination on the stylus tips.

Website:

Lab: N/A
School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT
13

On-Machine Measurement of the Workpiece on a CNC Machine Tool towards Industry 4.0 and Intelligent Manufacturing

Contact Information:

Asso. Prof. Xiaobing Feng
Email: xiaobing.feng@sjtu.edu.cn

Project Description and Objectives:

On-machine workpiece measurement is becoming a key part of the next industrial revolution in precision manufacturing. On-machine metrology cannot only assist in automated precision workpiece positioning, but also enable the in-situ detection and compensation of machining errors. This project will implement on-machine metrology by integrating a surface measurement sensor on the machine tool. The software will be developed to simultaneously control sensor readings and the motion of the machine tool. The accuracy of on-machine measurement will be evaluated according to ISO 10360 specification standards. The outcome of the project will demonstrate the capabilities of on-machine metrology utilizing the machine tool as part of the metrology system.

Eligibility Requirements

- > 3rd year and above undergraduate students majoring in Mechanical/Electrical/Sensory engineering
- > Students with research experience are highly desired.
- > Knowledge on metrology and/or CMNC machine tool is highly desired.

Main Tasks:

Participant will carry out experimental investigation on on-machine metrology, including analysis of common measurement sensors, the design, installation and operation of an on-machine sensor on the machine tool, establish communication between the sensor and machine tool, and evaluation of the performance of the developed on-machine measurement sensor according to methods specified in ISO 10360 specification standards.

Website:

Lab: N/A
School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT
14

Preliminary Study on Fuel Cell and DIY for its Catalysts

Contact Information:

Prof. Junliang Zhang
Email: junliang.zhang@sjtu.edu.cn

Project Description and Objectives:

This program aims to cultivate the interest and research ability of overseas students in the field of electrochemical energy, especially in the fuel cell field. And the hope to improve the hardware facilities for students learning, to do experiments and discuss. In the meanwhile, we would build a team of instructors with an international perspective to guide engineers, and consider the characteristics of overseas students to teach, to ensure effective teaching management and communication for overseas students.

Eligibility Requirements:

- > Be interested in new energy.
- > Have basic knowledge of electrochemistry.
- > Have experience in chemical experiments in lab.
- > Ability to write a regular experimental report.

Main Tasks:

- > Develop students' interest in electrochemistry.
- > Let students enjoy the process of basic scientific research in SJTU.

Website:

Lab: <http://fuelcell.sjtu.edu.cn>
School: <http://me.sjtu.edu.cn/English/Default.aspx>

PROJECT
15

Computer Vision for Intelligent Vehicles

Contact Information

Asso. Prof. Xuesong Li
Email: xuesonl@sjtu.edu.cn

Project Description and Objectives

Automotive engineering and related technologies have gained substantial attention and investment in this information era, surprising or not. With the technology of hybrid vehicle, electric vehicle, vehicle-to-everything (V2X), assisted driving and autonomous driving, etc., new insights and rapid growth are seen in this industry, with the embrace of both traditional technologies and new methodologies. This summer research program will focus on some of the hot topics in this field, such as computer vision for the application of assisted-driving and autonomous driving. This program will aim at both theoretical studies including a literature review and report drafting, as well as gaining hands-on experience from programming and image processing to recognize vehicles/pedestrian/signal lights from real images captured. The objective of the project is to help the students build up ideas about how research projects and engineering projects are performed, and also help the students to understand the fundamentals for the chosen topics so that they would be better equipped in continuing or starting education/employment in the field of automotive engineering.

Eligibility Requirements

Basic understanding of programming (Python preferred) and image processing.

Main Tasks

- > Traditional computer technology study such as camera calibration, color space conversion, edge detection, etc. for lane line detection.
- > Image classification using machine technology like SVM and deep neural network such as LeNet, VGGNet, etc. These architectures are used in the up-to-date object detection algorithms like region-proposed CNN.
- > Semantic segmentation of the image for drivable area detection using a fully connected neural network.

Website

Lab: <http://www.auto.sjtu.edu.cn>
School: <http://me.sjtu.edu.cn/>

PROJECT
16

Optical Diagnostics for Optical IC Engines

Contact Information

Asso. Prof. Xuesong Li
Email: xuesonl@sjtu.edu.cn

Project Description and Objectives

Although renewable energy vehicle is attracting increasing attention, traditional energy conversion scheme, such as a gasoline internal combustion engine, is still significant in the years to come. This course will offer a modern touch on how to optimize the new generation of gasoline power using laser diagnostics means. Various laser diagnostics methods, including laser-induced fluorescence, particle imaging velocimetry, high speed imaging, Schlieren Interferometry, etc., will be introduced and implemented on a transparent optical engine. The liner and the piston of this single cylinder engine are made from sapphire glass so that the situations inside can be well observed. Then data processing methods will be used to infer information such as combustion species, in-cylinder velocity distribution, soot formation, etc. This course aims to offer a preliminary experience in advanced optical methods for future studies in thermal and fluid sciences.

Eligibility Requirements

Basic understanding of thermodynamics, fluid mechanics, and/or combustion physics

Main Tasks

- > Perform optical/laser based experiments for fuel spray diagnostics.
- > Work on an actual optical engine and adjust operation parameters to vary the performance of the optical engine.
- > Utilize laser-induced fluorescence, particle imaging velocimetry, Mie scattering, etc. and understand the flow field and combustion characteristics in the engine.

Website

Lab: <http://www.auto.sjtu.edu.cn>
School: <http://me.sjtu.edu.cn/>



PROJECT 17

Knowledge Graph Construction and Its Application in Individual Relationship Analysis

Contact Information:

Asso. Prof. Lihong Jiang
Email: Jianglh@sjtu.edu.cn

Project Description and Objectives:

A knowledge graph is a promising method of representing semantic of information formally, which is mainly used in Web search engine development. For Web searching, knowledge graph acts as knowledge bases providing relationships between searched objects to enhance the searching results. However, it is not easy to construct a knowledge graph automatically. NLP(Natural Language Processing) could be used to handle the problem of a knowledge graph. Based on the Knowledge Graph, entity relationships could be established so that the searching results could be refined.

There exist several NLP toolkits to process sentences of natural language. But they need to be tailored for knowledge graph construct. Also for the recognition of relationships of concepts in the knowledge graph, open linked data need to be involved in to build a bridge between insolated entities. Based on the setup knowledge graph, individual information on Web can be searched, recognized and analyzed semantically.

Eligibility Requirements:

Interested students should be proficient in mobile development and web application development as well as machine learning related knowledge.

Main Tasks:

- > Software development.
- > Finish a research report.
- > Two research presentations.
- > Submit one paper to journal or conference as a co-author.

Website:

Lab: <http://ist.sjtu.edu.cn>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT 18

Cloud-Based Model-Driven Service Development

Contact Information:

Prof. Hongming Cai
Email: hmcai@sjtu.edu.cn

Project Description and Objectives:

Cloud-based software is a service or platform that interacts through the cloud or the Internet. One of its most streamlined delivery models is through the Software-as-a-Service (SaaS) model. These services are hosted and maintained by the vendor, meaning that the vendor hosts the service in a remote data center. Today's enterprise software application development is faced with complex and changing requirements, new needs and growing systems, software systems are becoming more and more complex, and it is difficult for ordinary software development methods to meet user needs quickly. Through model-driven development, code conversion is completed to achieve or various model-driven engine configuration support to reduce development costs and cope with complex requirement changes. The basic idea is to shift the development center from programming to high-level abstraction, and to drive some or all of the automated development by converting models into code or other artifacts. First, we derive the basic model-driven principles of enterprise information systems by learning cloud-based service development methods. Second, by learning data mining related techniques, we generate corresponding process models from data and analyze the results to build corresponding business models. Then, through service application development, we master the driven service configuration and front-end development methods. Finally, the interface prototype of the system is implemented by using the existing cloud-based data modeling platform.

Eligibility Requirements:

Interested students should be proficient in java and web application development. Understanding microservices architecture and docker.

Main Tasks:

- > Software development.
- > Finish a research report.
- > Two research presentations.
- > Submit one paper to journal or conference as a co-author.

Website:

Lab: <http://ist.sjtu.edu.cn>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
19

Energy Router for Future Energy Internet

Contact Information

Prof. Miao Zhu

Email: miaoazhu@sjtu.edu.cn

Project Description and Objectives

With the development of energy and internet technologies, energy router has been becoming a key device for future energy internet. Energy internet is a brand new concept that integrates the Internet with energy generation, transmission and consumption. Energy router is the center of energy conversion and information interaction in energy internet, which is still developing and deepening with the on-going new scientific and technological revolution. This project will focus on the energy router for future networks. First, the basic concept and functions of energy router will be investigated. Typical energy internet scenarios for energy routers will be summarized and presented afterward. Then key technologies, restraints and development trend of energy router will be studied respectively. A general report will be presented as the final achievements.

Eligibility Requirements:

Basic knowledge of EE.

Main Tasks:

- > Investigation on the concept of energy router and energy internet.
- > Summarization on the typical scenarios of energy router in energy internet.
- > Investigation on key technologies of energy router for the typical scenarios.
- > Discussion on the restraints and the development trend of energy router.
- > Finish a research report in this project.

Website:

Lab: <http://www.ssgc.sjtu.edu.cn/>

School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
20

Wind Power Generation and Grid-Integration Control

Contact Information:

Asso. Prof. Jing Lyu

Email: lvjing@sjtu.edu.cn

Project Description and Objectives:

This project focuses on the wind power conversion system and its control. With the rapid development of wind power, the scale of the wind farm is becoming larger and larger, which has a great influence on the stability of the power system. To address these issues, more advanced control strategies are needed for grid-friendly integration of wind turbine generators. This project will study the advanced control for the wind turbine generators to meet the strict grid codes, i.e., frequency support, inertial response, high-voltage fault ride-through and so on.

Eligibility Requirements:

- > Basic knowledge of electric circuit theory is mandatory.
- > Basic knowledge of electrical engineering is needed.
- > Basic knowledge of power electronics is preferred.

Main Tasks:

- > Implement the simulation modeling of wind turbine generators.
- > Do some experiments on the laboratory setup of the wind turbine generator.
- > Finish a research report in this project.

Website:

Lab: <http://www.ssgc.sjtu.edu.cn/>

School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
21

Design and Control of Haptic Systems for Robot Surgery

Contact Information:

Asso.Prof. Hongbing Li
Email: lihongbing@sjtu.edu.cn

Project Description and Objectives:

Haptics is the study of human touch sensing, specifically via kinesthetic (force/position) and cutaneous (tactile) receptors, associated with perception and manipulation. In robotics, haptics is broadly defined as real and simulated touch interactions among robots, humans, and real, remote, or simulated environments, in various combinations. In this project, you will study the design and control of haptic systems, which provide force feedback to human operators interacting with virtual environments or teleoperated surgical robots. You will develop specialized robotic devices and their corresponding control, known as haptic interfaces, which allow human operators to experience the sense of touch in remote (teleoperated) or simulated (virtual) environments. You will explore the use of handheld devices in virtual environments, try to understand the interactions between vision and touch, and enable portable devices to generate compelling touch interactions. Also, you can incorporate machine learning techniques to understand how humans and haptic devices can adapt to each other during use.

Eligibility Requirements:

This project requires a background in robot dynamic systems and C++ programming. Experience with feedback control and mechanical prototyping is also useful.

Main Tasks:

This project covers device modeling (kinematics and dynamics), synthesis and analysis of control systems, design and implementation of mechatronic devices, and human-machine interaction.

Website:

Lab: <http://shiirc.sjtu.edu.cn/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
22

Research on Attack and Defense of the Platform of Multi-robot Cooperative Control

Contact Information:

Asso.Prof. Jianping He
Email: jphe@sjtu.edu.cn

Project Description and Objectives:

In recent years, more and more people focus on multi-robot cooperative control systems, for their excellent abilities to finish complex tasks. However, the safety problem of the system is also fierce, due to its high distributed fashion and openness to the outside world while operating in real environments.

In this research, we aim at designing smart and efficient attack towards the multi-robot system via local information and learning-based methods and then propose defense strategy through a systematic approach. In the end, we'll test our algorithm in simulation and real robot platforms to verify the effectiveness of the proposed theory.

Eligibility Requirements:

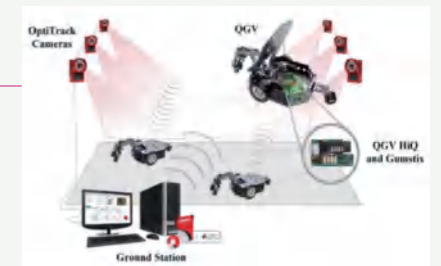
Interested students should be proficient in python/C++ programming and have basic knowledge of robot control. And proficiency in writing and speaking is mandatory.

Main Tasks:

- > Propose a new idea for the attack /defense of multi-robot system.
- > Present the result with either a simulation or an experiment.
- > Finish a report of the internship.

Website:

Lab: <http://iwin.sjtu.edu.cn/>
School: <http://www.seiee.sjtu.edu.cn/>



PROJECT
23

High Speed Integrated Optical Interconnects

Contact Information:

Asso.Prof. Wenjia Zhang
Email: wenjia.zhang@sjtu.edu.cn

Project Description and Objectives:

The rapid development of data centers and high-performance computers demands massive connectivity to orchestrate geographically distributed heterogeneous computation capabilities. Optical interconnects have been inevitable solutions to provide Tbps class transmission capacity to accommodate the increasing demand for high speed interconnects. Advanced equalizations have been proposed to provide powerful linear and nonlinear compensation for bandwidth and noise-limited optical interconnects. In this project, equalization algorithms will be designed and evaluated regarding the computation complexity and transmission performance for the integrated optical interconnects by an in-depth understanding of the connection of the algorithm and physical implication.

Eligibility Requirements:

Basic understanding of photonics, communication principle.

Main Tasks:

- > Learn the basics of integrated optical interconnects
- > Simulation and experiment evaluation of the integrated optical interconnects
- > Off-line signal processing and performance evaluation of equalization through the data collected through simulation and experiment.

Website:

Lab: <http://cip.sjtu.edu.cn>
School: <http://www.seiee.sjtu.edu.cn/>

PROJECT
24

Mode Restruction in Few Mode Fiber Using Digital Holography

Contact Information:

Asso. Prof. Qingwen Liu
Email: liuqingwen@sjtu.edu.cn

Project Description and Objectives:

Few mode fibers (FMF) can transmit several individual modes. The cross-talk between modes is very weak and each mode can carry information. Therefore, FMF can realize high-density information transmission. The modes of the FMF overlap in space and time and the information of each mode cannot be directly detected. In this project, holographic technology will be used to obtain the intensity and phase information of the output light field of the FMF, and then each mode of the FMF can be separated and reconstructed by calculation.

Eligibility Requirements:

Basic understanding of photonics, fiber optics.

Main Tasks:

- > Study the basics of few mode fibers and figure out the intensity and phase distribution of each mode.
- > Learn the principle of holography technology, and recover the wave front of one single mode using the holography figure captured by the digital camera;
- > Setup the system and realize the coherent detection through the digital camera with a reference beam;
- > Learn how to recover all the modes from the few mode fibers, and compare the shape of the recovered mode with the theoretical modes in few mode fiber.

Website:

Lab: <http://cip.sjtu.edu.cn>
School: <http://www.seiee.sjtu.edu.cn/>

PROJECT
25

Improving Gravitational Wave Detection with Neural Networks

Contact Information:

Prof. Yuan Luo
Email: yuanluo@sjtu.edu.cn

Project Description and Objectives:

Sensitive gravitational wave (GW) detectors such as that of Laser Interferometer Gravitational-wave Observatory (LIGO) realize the direct observation of GW signals that confirm Einstein's general theory of relativity. However, it remains challenges to quickly detect faint GW signals from a large number of time series with background noise under unknown probability distributions. Traditional methods such as matched-filtering in general assume Additive White Gaussian Noise (AWGN) are far from being real-time due to its high computational complexity. To avoid these weaknesses, one-dimensional (1D) Convolutional Neural Networks (CNNs) are introduced to achieve fast online detection in milliseconds but do not have enough consideration on the trade-off between the frequency and time features, which will be revisited in this project through data pre-processing and subsequent two-dimensional (2D) CNNs during offline training to improve the online detection sensitivity.

Eligibility Requirements:

- > Good English communication skills.
- > Theoretical analysis ability, logical thinking ability, teamwork ability.
- > Software: Machine Learning Software.
- > Interests in Computer Science, Astronomy, Physics or Mathematics.

Main Tasks:

- > Feature extraction analysis.
- > Sensitivity performance analysis under real noise.
- > Interpretability analysis.

Website:

Lab: N/A
School: <http://www.cs.sjtu.edu.cn/PeopleDetail.aspx?id=87>

PROJECT
26

Distributed Storage Coding Scheme in HDFS-RAID

Contact Information:

Prof. Yuan Luo
Email: yuanluo@sjtu.edu.cn

Project Description and Objectives:

Distributed Storage are widely used in industry. The optimal tradeoff between node storage and repair bandwidth is an important issue for distributed storage systems (DSSs). For realistic DSSs with clusters, while repairing a failed node, downloading more data from intra-cluster nodes than from cross-cluster nodes is effective. Therefore, differentiating the repair bandwidth from intra-cluster and cross-cluster is useful. For cluster DSSs, the tradeoff is considered with special repair assumptions where all alive nodes are used for repairing a failed node. In this project, we investigate the optimal tradeoff for the cluster DSSs under more general storage/repair parameters.

Eligibility Requirements:

- > Good English communication skills.
- > Theoretical (Algebra) analysis ability, logical thinking ability, teamwork ability.
- > Software: Hadoop HDFS.
- > Interests in Computer Science, Mathematics.

Main Tasks:

- > MDS code performance analysis.
- > IO and bandwidth analysis of Hadoop HDFS and RAID.
- > Program Development.

Website:

Lab: N/A
School: <http://www.cs.sjtu.edu.cn/PeopleDetail.aspx?id=87>

PROJECT
27

Screening and Auxiliary Diagnosis System of Diabetic Retinopathy Based on Artificial Intelligence

Contact Information:

Asso. Prof. Bin Sheng
Email: shengbin@cs.sjtu.edu.cn

Project Description and Objectives:

The harm of diabetes to health is mainly caused by a variety of chronic complications (retinal, kidney, peripheral nerve and cardiovascular diseases) caused by long-term and chronic hyperglycemia, which seriously affects the quality of life of the population. Complications screening is the main measure to prevent and cure related complications. How to effectively improve the efficiency of diabetes complications screening and reduce the cost of screening is a common problem faced by many developing countries. This project develops artificial intelligence algorithms for screening diabetic retinopathy and other diabetic complications; The system has been used to screen developing countries for diabetes complications worldwide under the leadership of the international diabetes federation (IDF).

Eligibility Requirements:

Applicants must have some computer programming skills, basic understanding of neural networks and artificial intelligence, and a passion for medical care.

Main Tasks:

Understand digital medical image processing.
Perform experiments, analyze experimental, and write a research report.
Give a research presentation: technical presentation.

Website:

Lab: <https://www.deepdrdoc.com/>
School: <http://www.cs.sjtu.edu.cn/en/PeopleDetail.aspx?id=149>

PROJECT
28

A Diabetes Monitoring and Health Management System Based on Machine Learning

Contact Information:

Asso. Prof. Bin Sheng
Email: shengbin@cs.sjtu.edu.cn

Project Description and Objectives:

The incidence of long-term complications of type 2 diabetes is high. One of the main reasons for this phenomenon is the contradiction between the large population of diabetes patients and limited medical resources. This study aims to build a set of multi-scene integrated diabetes intelligent decision-making system based on neural network and reinforcement learning for the linkage between hospitals and communities, to realize intelligent and to accurate treatment guidance for patients with diabetes in different scenarios such as hospital hospitalization and daily life.

Eligibility Requirements:

Applicants must have some computer programming skills, an understanding of neural networks and artificial intelligence, and a passion for medical care.

Main Tasks:

Understand digital medical image processing.
Perform experiments, analyze experimental, and write a research report.
Give a research presentation: technical presentation.

Website:

Lab: <https://www.deepdrdoc.com/>
School: <http://www.cs.sjtu.edu.cn/en/PeopleDetail.aspx?id=149>

PROJECT
29

Intelligent Analysis and Auxiliary Diagnosis System Based on Renal Tissue Pathological Image

Contact Information:

Asso. Prof. Bin Sheng
Email: shengbin@cs.sjtu.edu.cn

Project Description and Objectives:

The incidence rate of kidney diseases is up to 10.8%, and glomerular diseases are the important part of kidney diseases. This project aims to develop an imaging system that can objectively analyze typical glomerular diseases through the analysis of digital pathological images. The project results can not only assist doctors in the image analysis of glomerular diseases, but also provide objective and quantitative analysis results, improve the diagnostic efficiency, and make the pathological diagnosis of glomerular diseases, a highly difficult diagnostic technology, more commonly applied in primary medical care.

Eligibility Requirements:

Applicants must have some computer programming skills, an understanding of neural networks and artificial intelligence, and a passion for medical care.

Main Tasks:

Understand digital medical image processing.
Perform experiments, analyze experimental, and write a research report.
Give a research presentation: technical presentation.

Website:

Lab: <https://www.deepdrdoc.com/>
School: <http://www.cs.sjtu.edu.cn/en/PeopleDetail.aspx?id=149>

PROJECT
30

Digital Artist: Creating ART with Deep Learning

Contact Information:

Prof. Lizhuang Ma
Email: ma-lz@cs.sjtu.edu.cn

Project Description and Objectives:

Neural style transfer is one of the main techniques in machine learning area for combining the artistic style of one image with the content of another image. The basic idea is to take the feature representations learned by a pre-trained deep convolutional neural network to obtain separate representations for the style and content of an image. Once these representations are found, we can then try to optimize a generated image to recombine the content and style of different targets. Since 2015, much progress has been made on style transfer to make training and inference faster and also to extend the style transfer technique from still images to videos and even to game scenes. Besides, one of the most attractive research areas in Computer Vision is colorizing the grey-scale images or sketches. Focusing on clear and plausible colorization of images or sketches to obtain a final realistic result is the main goal of the researches in this area. Picture colorization has been shown as an inverse problem, and there are final multimodal solutions for these kinds of problems. Numerous studies have been done in image colorization, among them, some teams have been working on presenting the robust colorization for cartoon black-white pictures. However, there are some bugs in the final results of the previously proposed method, such as the disability of their methods in showing a smooth background for some images and some special kind of reference colors.

In this project, our purpose is presenting an efficient and robust solution to the problem of generating a plausible cartoon-style picture and colorizing the cartoon sketches, thereby giving more inspiration to the original painting that could be accepted as the human vision conception.

Eligibility Requirements:

An Ideal candidate is expected to

- > have experience in deep learning, as well as excellent programming skills especially in python or C/C++.
- > be self-motivated and active.
- > respect the rules of the laboratory as well as the department.

Main Tasks:

- > Preparing a final report of the internship.
- > Providing a presentation.
- > Proposing a new idea for converting a given a scene photo into the desired 2D style scene by an algorithm.
- > Proposing a new idea to enhance the reliability of output colored pictures for automatic coloring a line art image.

Website:

Lab: <http://dmcv.sjtu.edu.cn/>
School: <http://seiee.sjtu.edu.cn/>

PROJECT
31

Quantum Computation for Wireless Communications

Contact Information:

Asso. Prof. Zhiyong Chen
Email: zhiyongchen@sjtu.edu.cn

Project Description and Objectives:

Recently, quantum computation technology is making great breakthroughs and is part of triggering the next technological revolution. Specifically, quantum computation is now widely used in machine learning design for speeding up, the quantum hardware-based machine learning algorithms, the convex optimization algorithm.

This project mainly focuses on how quantum computation can solve the convex optimization problem in wireless communications, including wireless resource allocation, machine learning, and quantum convex optimization algorithm design.

Eligibility Requirements:

Interested students should have basic knowledge of wireless communications and the convex optimization.

Main Tasks:

- > Finish a research report.
- > Submit a paper to a conference or a journal as a co-author.

Website:

Lab: <http://iwct.sjtu.edu.cn/>
School: www.seiee.sjtu.edu.cn/

PROJECT
32

Active Device Detection in MIMO Massive Access Communication

Contact Information:

Asso. Prof. Yongpeng Wu
Email: yongpeng.wu@sjtu.edu.cn

Project Description and Objectives:

Massive access is an emerging technology that accommodates the number of users per transmission medium by possible orders of magnitude higher compared to the current state-of-the-art. A typical application for massive access is a distributed sensor network which intelligently monitors and manages a large number of devices. Normally, the activation of these devices is intermittent, i.e., each device is periodic active based on a random pattern and constitutes a massive random-access scenario.

For massive random access, the receiver needs to decode the messages transmitted by these random active devices on each transmission. This project mainly focuses on how to design active device detection algorithms for MIMO massive access communication based on tools of compress sensing, estimation and detection theory, and matrix theory.

Eligibility Requirements:

Interested students should have basic knowledge on wireless communications and the matrix theory.

Main Tasks:

- > Finish a research report.
- > Submit a paper to a conference or a journal as a co-author.

Website:

Lab: <http://iwct.sjtu.edu.cn/>
School: www.seiee.sjtu.edu.cn/

PROJECT
33

Internet-Distributed Hardware-in-the-Loop Simulation for Renewable Energy Generations

Contact Information:

Prof. Keyou Wang

Email: wangkeyou@sjtu.edu.cn

Project Description and Objectives:

In the power system research, the hardware experiment is an accurate testing method at the cost of the high expenditure and poor flexibility. The software simulation is flexible and efficient, but the accuracy is limited by the mathematic models. The hardware-in-the-loop (HIL) simulation is a hybrid testing method, in which part of the system is simulated in software while the rest is the actual hardware.

The modern power system is integrated with more and more renewable energy generations, which have a great impact on the dynamic characteristics of the power system. The internet-distributed hardware-in-the-loop simulation for renewable energy generations is to simulate the main grid on the simulation platform and interact with the actual renewable energy system in real-time via a cloud server.

Eligibility Requirements:

Interested students should have the basic knowledge of the electrical engineering and master one or more programming languages.

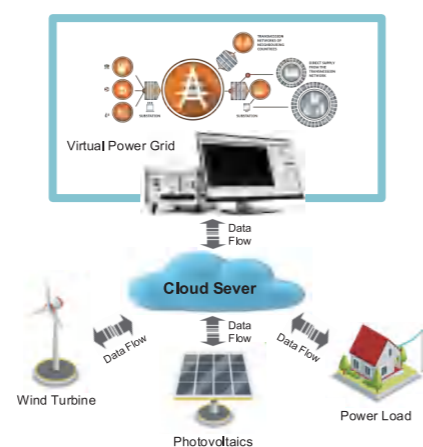
Main Tasks:

- > Midterm technical presentation.
- > Final project report.

Website:

Lab: <http://www.ssgc.sjtu.edu.cn/>

School: www.seiee.sjtu.edu.cn/



PROJECT
34

Real Time Simulations of Renewable Energy System with High Penetration of Power Electronic Apparatus

Contact Information:

Asso. Prof. Dewu Shu

Email: shudewu@sjtu.edu.cn

Project Description and Objectives:

This project focuses on the real-time simulations of a renewable energy system with high penetration of power electronic apparatus. Real-time simulations of large-scale AC/DC grids, integrating a large number of converters, are becoming the recent research hotspots. This is due to the dynamics of the power system which is dramatically reshaped by the dynamics of large-scale AC grids and multi-converters. In this project, the following issues are targeted to be resolved:

- (1) Efficient electromagnetic transient (EMT) and transient stability models of the large-scale AC/DC systems containing the line commutated converters (LCCs), voltage sourced converters (VSCs) and the modular multi-level converters (MMCs).
- (2) The coordination control strategies between the HVDC and renewable energy, such as wind farms in China or Denmark.
- (3) Study on the oscillation mechanism aroused by interactions of converters and the AC grids. To damp or eliminate these oscillations, the active damping control strategies should be carefully designed.

Eligibility Requirements:

- > Basic ability in C++ programming.
- > Basic knowledge of PSCAD/EMTDC, BPA.

Main Tasks

- > Design the multi-rate interface model for the hybrid simulation method.
- > Software and hardware design for the hybrid simulation method.

Website:

Lab: <http://eei.sjtu.edu.cn/>

School: <http://eei.sjtu.edu.cn/>



PROJECT
35

Learning-Driven Power Maps

Contact Information:

Asso. Prof. Ce Shang
Email: shangce@sjtu.edu.cn

Project Description and Objectives:

Using machine learning tools to depict a nation-wide map of power and energy supply and demand. The power system that connects the power supply and demand with the uncountable devices it is made of has become the biggest and most complex artificial system of data of all time. The well-functioning of the power system with a balanced power supply-demanded determines the well-being of all aspects in modern society. Mapping the power supply and demand benefits the system operation in the short term, and planning in the long run. Extracting useful information drives the application of machine learning tools to power systems, especially when the power system is being developed towards the ubiquitous Internet of Things and the data capacity consequently explodes. This program studies to apply machine learning tools for drawing power maps, which is aimed to assist power system operation and planning.

Eligibility Requirements:

- > Power System Analysis; Linear Algebra, Probability and Statistics; Computer Programming (with C or Python language).
- > This program involves inter-disciplinary study of machine learning and power engineering. Background knowledge with both is required as well as interest in them and willingness to do hands-on programming work. In-term oral presentation and a final written report is required for a mark to be given.

Main Tasks:

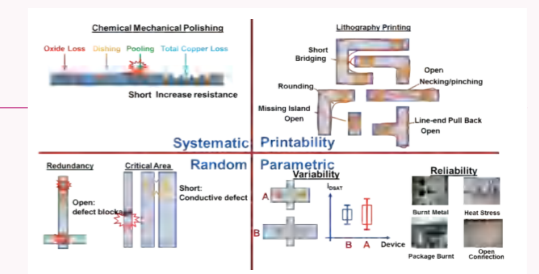
- > Learning the background knowledge of power system: its history, the cutting-edge research topics with a focus on power system operation and planning.
- > Reviewing machine learning tools: different algorithms, basic math it requires, typical problems it can solve.
- > Implementing a machine learning tool, which can be either supervised or unsupervised learning; targeting a specific group data of the power system, which can either be operational or planning data.
- > Training learning tool with acquired power system data; mapping power system supply demand either in the short term of operation or in the long term of planning.

Website:

Lab: <http://www.ssgc.sjtu.edu.cn/>
School: www.seiee.sjtu.edu.cn/

PROJECT
36

Research in the Next Generation of DFM Physical Design Modeling, Verification, and Optimization Algorithm Based on Deep Learning Techniques



Contact Information:

Assoc. Prof. Yongfu Li
Email: yongfu.li@sjtu.edu.cn

Project Description and Objectives:

With the increasing demand for more integrated circuit chips, ranging from automotive vehicles, computers/servers, and mobile devices, it has been reported that the cost of producing new bleeding-edge chips in the latest technology now cost more than \$500 million. To lower down the barriers to design chips, reduce design cycle and increase design robustness, it is important to have a comprehensive circuit verification and optimization tools. In this research internship program, we aim to cultivate the next generation of EDA software engineers through the development of machine/deep learning-based EDA software. The researcher will be involved in one of the existing research projects and assist the post-graduate researchers in their work. One example of our current research is based on using deep learning technology to develop new pattern-matching software to detect all the outlier polygon shapes in a layout which prevents any catastrophic failure in the chip. The intern will need to have a basic understanding of CMOS process, deep learning techniques, and python programming language. The intern will explore different deep learning model and hyper parameters optimization to identify the best model for physical verification.

Eligibility Requirements:

- Proficiency in English writing and speaking is mandatory.
- Basic knowledge of machine learning, semiconductor, and circuit design.
- Programming skills on Unix operating system and Python programming.

Main Tasks:

- Develop a prototype software.
- Finish a report of the internship.
- Give two research presentations (a. references review; b. technical presentation).
- Submit one paper to a journal.

Website:

Lab: <https://www.bicasl.com/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
37

Research on DNN-based Deep Fake Face Detection Technology

Contact Information:

Prof. Yue Wu
Email: wuyue@sjtu.edu.cn
Prof. Shilin Wang
Email: wsl@sjtu.edu.cn

Project Description and Objectives:

Deepfake detection is an adversarial research on the detection and defense of manipulated faces, it usually exploits the specific tampered dynamic and static artifacts presented in the facial texture, which is important in the scenes of digital media forensics and authentication protection. Although there have been efforts devoted to designing face forgery detection methods, they always experience a severe performance drop in the cross-database scenario due to the diversified data distributions generated by different manipulation techniques, thus limiting broader applications. This project aims to devise a more generalizable deepfake detector based on DNN to apply it to practical complex scenes.

Eligibility Requirements:

- > Elementary knowledge on machine learning, deep learning.

Main Tasks:

- > Review literature on deepfake technology and deepfake detection algorithm.
- > Design a deepfake detection model with high generalization performance in the cross-database scenario.

Website:

Lab: <http://nelcat.sjtu.edu.cn/>
School: <http://infosec.sjtu.edu.cn>

PROJECT
38

Method of Detecting and Defending Network Attacks in Internet of Vehicles

Contact Information:

Prof. Yue Wu
Email: wuyue@sjtu.edu.cn
Prof. Xiuzhen CHEN
Email: chenxz@sjtu.edu.cn

Project Description and Objectives:

With the increasing types and numbers of onboard terminals in intelligent and connected vehicle networks, security threats which internet of vehicles face are also increasing. The information security of intelligent and connected vehicle networks has attracted more and more attention all over the world. This project focuses on the detection and defense of common network attacks in Internet of vehicles, especially Sybil attack. As an important type of attacks in the Internet of Vehicles environment, Sybil attacks cause confusion and obstruction of road information by simulating the operating characteristics of normal vehicles, which brings huge challenges to the safe driving of vehicles. The main goal is to propose a detection method based on trust management system. And a series of validity tests of the proposed approach are done through simulation experiments under Veins and in the road test scenario.

Eligibility Requirements:

- > Have professional knowledge of Computer, Communication, and Information Security;
- > Good working attitude and self-learning ability;
- > Good team spirit

Main Tasks:

- > Review literature on Sybil detection algorithm of IoV environment.
- > Design a trust based detection model for detecting Sybil attack.
- > Perform the work model test both in the simulation environment and in the real road test scenario.

Website:

Lab: <http://nelcat.sjtu.edu.cn/>
School: <http://infosec.sjtu.edu.cn>

PROJECT
39

Watermarking Deep Learning Models with Differentially Privacy-Preserving Penetrative Backdoors

Contact Information:

Prof. Yue Wu

Email: wuyue@sjtu.edu.cn

Prof. Shilin Wang

Email: wsl@sjtu.edu.cn

Project Description and Objectives:

Watermarking deep learning models is the basic method for ownership verification (OV) and intellectual property regulation. Backdoor is a promising option in the black-box OV scenario, yet its feasibility relies on the backdoor's power, especially its ability in penetrating adversarial filtering. Although there have been efforts devoted to designing penetrative backdoors, they either lack provable value or leak substantial knowledge on the author's data, which is a violation of data privacy. Differential privacy has been considered as a plausible definition of privacy, this project aims to combine these two elements to facilitate the applicability of black-box deep learning model watermark with privacy-preserving backdoors with the penetrative ability.

Eligibility Requirements:

- > Elementary knowledge on machine learning, deep learning, and statistics

Main Tasks:

- > Review literature on deep learning model watermarking and differential privacy.
- > Design a prototype of differentially privacy-preserving backdoor for watermarking.

Website:

Lab: <http://nelcat.sjtu.edu.cn/>

School: <http://infosec.sjtu.edu.cn>

PROJECT
40

Optimization for the Multi-layer Convolutional Sparse Coding

Contact Information:

Asso. Prof. Wenrui Dai

Email: daiwenrui@sjtu.edu.cn

Project Description and Objectives:

Convolutional sparse coding (CSC) has been demonstrated to facilitate the representation of high-dimensional visual signals in the tasks of image classification, visual recognition, image reconstruction, and feature extraction. This unsupervised method improves the efficiency of sparse representation by posing a global model with localized dictionaries. Recently, online learning and consensus optimization have been studied to enable scalability in high-dimensional feature learning, but still suffers from a degraded reconstruction performance for multi-layer cases. This project aims at developing a multi-layer dictionary learning method for multi-layer CSC. This optimization method is supposed to guarantee convergence with a bounded approximation error under the varying sparsity requirement for multiple layers. Furthermore, this project also plans to study the connection between multi-layer dictionary learning and deep convolutional neural networks.

Eligibility Requirements:

- > Basic knowledge of signals and systems, digital signal processing, digital image processing, matrix analysis, and optimization theory.
- > Mastering of more than one programming language, C/C++ and MATLAB preferred.

Main Tasks:

- > Develop a multi-layer dictionary learning method for multi-layer convolutional sparse coding.
- > Analyze the convergence condition and approximation error of the proposed method.
- > Establish its connection with deep convolutional neural networks for interpretability.

Website:

Lab: <http://min.sjtu.edu.cn/>

School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
41

Optimal Coding for 360-degree Video Streaming

Contact Information:

Asso. Prof. Chenglin Li
Email: LCL1985@sjtu.edu.cn

Project Description and Objectives:

For 360-degree spherical images and videos, current methods to directly encode them into a bitstream are not yet mature. Therefore, the state-of-the-art 360-degree video streaming systems usually seek an alternative way by exploiting the advantages of two-dimensional video coding technology (e.g., H.264/AVC, HEVC), which first projects the 360-degree spherical surface onto a rectangular image/frame and then applies the advanced two-dimensional video coding encoder to encode the rectangular image/frame into a bitstream. To support the pixel resolution of the displayed viewport as 4K (3840 X 2160), the resolution of the rectangular projection should be at least 12K (11520 X 6480), which indicates that the viewport area covers roughly 14% of all pixels in the rectangular projection. This leads to recent researches on an efficient streaming technique for 360-degree videos, namely tile-based approach, where the two-dimensional projection is divided spatially into small rectangular tiles and each temporal sequence of these small rectangular tiles in the same spatial location is treated as an individual source for video encoding. In this way, only the tiles that cover the viewport will be transmitted to the user.

The size of the tiles affects conversely coding efficiency and transmission efficiency. If we decrease the tile size, the transmission efficiency is improved since the non-overlapped area between the viewport and the transmitted tiles becomes smaller. On the other hand, a smaller tile size results in a larger number of tiles per frame, which in turn increases the number of headers for the tiles and results in efficiency reduction in the intra- (spatial) and inter- (temporal) prediction. Therefore, we need to study the optimal determination of the tile size, by considering both the video content statistics and the viewports (and viewport prediction) of users. Another promising research direction is that, instead of fixed tiling, we may want to cover the whole rectangular frame with some sub-rectangular tiles with different sizes, which, if encoded together, could achieve the optimal tradeoff between coding and transmission efficiency.

Eligibility Requirements:

- > Basic knowledge of video codec (e.g., H.264 and HEVC), signals and systems, digital signal processing, digital image processing, matrix analysis, optimization theory.
- > Mastering of more than one programming language, C/C++ and MATLAB preferred.

Main Tasks:

- > Develop the overall adaptive video streaming system framework for tile-based 360-degree videos.
- > Formulate the relationship between the coding efficiency and the tile size, and the relationship between the transmission efficiency and the tile size.
- > Solve the optimal trade-off between the coding efficiency and the transmission efficiency, by determining the optimal tile size.

Website:

Lab: <http://min.sjtu.edu.cn/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
42

Performance Evaluation of Visual Tracking on Encoded Videos

Contact Information:

Prof. Hongkai Xiong
Email: xionghongkai@sjtu.edu.cn

Project Description and Objectives:

In computer vision, visual tracking deals with non-stationary image streams that change over time, intending to detect and locate moving objects. It can be used in various multimedia applications, such as visual surveillance, human-computer interaction, augmented reality, and visual servoing control (control task based on computer vision data). In some applications, the video has to be encoded and transmitted to another end for implementing the tracking task, the performance of which might be affected by the distortion introduced by video encoding. Therefore, it is interesting to see the visual tracking algorithms' performance under differently encoded video versions, which will further affect the control accuracy of the visual servoing control tasks.

Eligibility Requirements:

- > Basic knowledge of video codec (e.g., H.264 and HEVC), control theory and computer vision.
- > Mastering of more than one programming language, C/C++ and MATLAB preferred.

Main Tasks:

- > Create a library of distorted video versions by choosing different combinations of critical encoding parameters.
- > Use the created library to test the performance of some of the selected tracking algorithms under differently encoded video versions.
- > Try to understand and explain the performance curves that are obtained from the previous step based on the implementation detail of each tracking algorithm.

Website:

Lab: <http://min.sjtu.edu.cn/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
43

Blockchain and its Application in Energy Internet

Contact Information:

Asso. Prof. Sijie Chen
Email: sijie.chen@sjtu.edu.cn

Project Description and Objectives:

Blockchain is a decentralized ledger that can enable trustworthy systems at large scales. A copy of the ledger is stored by each participating party and synchronized using a consensus algorithm, making the ledger transparent and robust against cyberattacks. While these technologies have already significantly impacted the financial industry (e.g., Bitcoin), they also have many applications to the power and energy society.

Applications of blockchain in the energy sector include automatic energy transactions, power system asset ownership tracking, etc. Several demonstrations have been deployed around the world, such as the peer-to-peer energy transaction project deployed in Brooklyn, NY, by LO3Energy, the PowerLedger project backed by the Australian government, and Enerchain joined by a large number of European utilities. Hopefully, it will revolutionize the way that energy transactions and power system asset tracking is performed, bringing opportunities for numerous small-scale players.

This project aims to help students learn the basic knowledge of blockchain, explore some typical applications of blockchain technology in the energy sector, build blockchain-enabled energy trading simulation platforms; visit some related pilot projects in Shanghai, and lay the foundation for students to explore further applications.

Eligibility Requirements:

- > Interested students should be proficient in python/go language and have basic knowledge of energy/power systems.

Main Tasks:

- > Learn basic knowledge of blockchain.
- > Understand typical applications of blockchain technology in the energy sector.
- > Explore new applications of blockchain in energy Internet.
- > Finish a report.

Website:

Lab: <http://eei.sjtu.edu.cn/en/default.aspx>
School: <http://www.seiee.sjtu.edu.cn/>

PROJECT
44

Optimal Design and Operation of Multi-Energy Communities

Contact Information:

Dr. Xuezhi Liu
Email: liuxz@sjtu.edu.cn

Project Description and Objectives:

This project proposes a whole-system approach to planning the deployment and operation of energy storage and conversion devices in integrated energy systems to approach the overall optimum energy system (in terms of flexibility, economy, reliability and emissions reduction targets). Conversion devices include gas-fired power generators, combined heat, power (CHP) plants, heat pumps, gas boilers, electric boilers, and absorption chillers located at different levels of the networks. Renewables and energy storage include solar photovoltaics (PV), concentrated solar power, wind power, solar thermal energy, battery energy storage, ice storage, electric vehicles, hydrogen vehicles, etc. The problem of multi-vector energy system design and operation is to identify the optimal combination of energy supply, conversion, and storage technologies as well as the network infrastructure required to meet the estimated energy demand and its future evolution.

Eligibility Requirements:

- > Majored in energy systems engineering and relevant subject.
- > Mathematical programming skill (MATLAB, CPLEX etc.).

Main Tasks:

- > Identify the optimal combination of energy supply, conversion and storage technologies.

Website:

Lab: <http://eei.sjtu.edu.cn/en/default.aspx>
School: <http://www.seiee.sjtu.edu.cn/>

PROJECT
45

Optimization Scenario Design and Practice for Electric Vehicles and Smart Grid Interaction

Contact Information:

Dr. Yun Zhou

Email: yun.zhou@sjtu.edu.cn

Project Description and Objectives:

Governmental policies and incentives have been beneficial for the adoption of electric vehicles (EVs) all around the world. Higher penetration of EVs brings down the greenhouse gas emission but also increases noticeable power demand on the power system. The increased load must be dealt with economically either by adding power generation or effective demand-side management techniques for the sound operation of the power system. Typical interaction modes for EVs and power grid include coordinated EV charging, ancillary services provided by the EVs, etc. With the development of Energy Intent, changing factors exist in the interactions of EVs and power grid or other energy grid. It has important practical significance to further design and practice newer optimization scenarios for EVs and smart grid interaction.

Eligibility Requirements:

- > Majored in Engineering.
- > Strong analysis and design capability.
- > At least one programming skill (MATLAB, C++, Java etc.).
- > Fluent in English.

Main Tasks:

- > Designing and modeling optimization scenarios for electric vehicles and smart grid interaction.
- > Programming practice to realize the models proposed.

Website:

Lab: <http://eei.sjtu.edu.cn/en/default.aspx>

School: <http://www.seiee.sjtu.edu.cn/>

PROJECT
46

Secure Intelligent Wireless or Optical Networks

Contact Information:

Prof. Xuelin Yang

Email: x.yang@sjtu.edu.cn

Project Description and Objectives:

Based on long-term experiences in networks, we will integrate artificial intelligence technologies, to investigate the following two targets in the related research platforms:

1. Intelligent hardware fingerprint;
2. Intelligent security during data transmission.

Eligibility Requirements:

Applicants are expected to have a strong hands-on ability and certain knowledge of artificial intelligence methods. It will be better if he/she has solid knowledge of data networks, or data communications.

Main Tasks:

- > Investigate the intelligent hardware fingerprints from radio-frequency or optical transmitters by introducing the artificial intelligence technologies to support the decision in the network control and management, in order to meet the requirements of distinguishing the possible illegal attacks for future networks.
- > Combined with the artificial intelligence technologies, we will investigate a secure transmission in data transmission wireless or optical network platforms. The related performances of data security, confidentiality, and transmission will be comprehensively evaluated.

Website:

Lab: <http://loct.sjtu.edu.cn>

School: <http://www.seiee.sjtu.edu.cn/>

PROJECT
47

Multimodal Event Detection Under Unparalleled Situations

Contact Information:

Assistant Prof. Mengyue Wu
Email: mengyuewu@sjtu.edu.cn

Project Description and Objectives:

Audio-based event detection is challenging due to data imbalance and various durations of audio events. This project investigates how to introduce video information for multi-modal event detection and improve the robustness of event detection. However, with unparalleled data, it is critical to explore the fusion method according to the scenario and select corresponding information according to the modal confidence at different times.

Eligibility Requirements:

- > Interested students should have basic knowledge of machine learning.

Main Tasks:

- > Development of a paradigm to fuse audio and video for robust event detection.
- > Completion of a research report.

Website:

Lab: <https://speechlab.sjtu.edu.cn/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
48

Spoken Language Understanding with Graph Neural Network

Contact Information:

Prof. Kai Yu
Email: kai.yu@sjtu.edu.cn

Project Description and Objectives:

In the task-based human-machine dialogue system, it is important to convert the sentence of user input or speech recognition automatically into the semantic understanding of structured information. This topic aims at the structural and hierarchical definition of semantic objects (domain knowledge). It aims to use graph neural network to combine relevant domain knowledge with a general semantic understanding model to construct a robust and extensible semantic understanding system.

Eligibility Requirements:

- > Interested students should have basic knowledge of machine learning.

Main Tasks:

- > Development of a paradigm to employ knowledge graph in spoken language understanding.
- > Completion of a research report.

Website:

Lab: <https://speechlab.sjtu.edu.cn/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
49

Automatic Speech Recognition of Accented Speech and Medical Terminology

Contact Information:

Prof. Kai Yu
Email: kai.yu@sjtu.edu.cn

Project Description and Objectives:

Automatic speech recognition is one of the fields that have seen great advances over the last few decades thanks to deep learning, however under non-cooperative conditions, the performance is still not ideal. Data imbalance and sparsity are difficulties in accented speech recognition with medical terminology. This leads to the key scientific problems of structured modeling of sparse data with uneven distribution. This project aims to investigate the implementation of transfer by learning to effectively improve the speech recognition effect of medical terms under different accents.

Eligibility Requirements:

- > Interested students should have basic knowledge of machine learning.

Main Tasks:

- > Development of a paradigm for accented speech recognition;
- > Completion of a research report.

Website:

Lab: <https://speechlab.sjtu.edu.cn/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
50

Theory and Practice of Federated Learning

Contact Information:

Prof. Fan Wu
Email: fwu@cs.sjtu.edu.cn

Project Description and Objectives:

The concept of federated learning was first proposed by Google research scientists in 2015, which is a general collaborative machine learning framework for billions of mobile devices with the coordination of the cloud. Under this framework, (1) a mobile device first downloads a global model from the cloud, then trains a local personalized model using its user data, and finally uploads the model update to the cloud (2) the model updates from multiple mobile clients are securely aggregated to form a consensus update to the global model in the cloud (3) the above process is repeated for the timeliness of the global model and the local models.

In this project, we intend to investigate several theoretical aspects of federated learning, including learning theory, security and privacy, and game theory. We also plan to develop an on-device training framework, and further to deploy our design in practice, benefitting millions of worldwide users.

Eligibility Requirements:

- > Basic knowledge of machine/deep learning is mandatory.
- > Basic knowledge of mobile computing, cryptography, and game theory is preferred.
- > Experience of Android/iOS development is preferred.
- > Proficiency in writing and speaking in English.
- > Interest in theoretical analysis or coding.

Main Tasks:

- > Propose an intriguing idea in the scope of project.
- > Present a novel solution and validate its practical feasibility.
- > Finish a research report in this project.

Website:

Lab: <http://www.cs.sjtu.edu.cn/~fwu/>
<http://anl.sjtu.edu.cn/en>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
51

Pricing and Protection Mechanisms for Big Data

Contact Information:

Prof. Fan Wu
Email: fwu@cs.sjtu.edu.cn

Project Description and Objectives:

The intrinsic value of the big data, which has been regarded as a new kind of oil, has been paid a great amount of attention from people across the globe. However, due to the lack of effective data trading platforms, the existing data sets are mostly analyzed and used by the data owners in the enterprise, resulting in a large number of data islands. Therefore, it is highly necessary to implement open data trading platforms to promote the circulation of big data over the Internet. Thus, we can further exploit the economic value of big data and discover potential applications based on various kinds of data. In this project, we will investigate closely connected issues of data exchange including data collection, data pricing, and data protection. First we will study market demand-oriented data collection schemes to provide high-quality and massive data resources to the market. Second, we will design pricing strategies for data in the market with asymmetric information that will determine the selling form and market price of data goods to maximize the revenue of data sellers. Third, we will study privacy-preserving and verifiable data trading mechanisms to guarantee individual users' protections and high availability of data goods at the same time.

Eligibility Requirements:

- > Basic knowledge of algorithm design is mandatory.
- > Basic knowledge of game theory or cryptography is preferred.
- > Proficiency in writing and speaking in English.
- > Interest in theoretical analysis and experiment.

Main Tasks:

- > Propose a novel idea in the scope of project.
- > Present the design result with either a simulation or an experiment.
- > Finish a research report in this project.

Website:

Lab: <http://www.cs.sjtu.edu.cn/~fwu/>
<http://anl.sjtu.edu.cn/en>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
52

Remote Sensing Image Classification with Deep Learning Methods

Contact Information:

Asso. Prof. Zenghui Zhang
Email: zenghui.zhang@sjtu.edu.cn

Project Description and Objectives:

Remote sensing image classification aims to identify regions of unique or dominant land cover from their attributes of spectral signature, texture, and context. For example, classify images into water, buildings, forest, grass, road, and other classes. In general, remote sensing image classification techniques include unsupervised/supervised methods, pixel-based or object-based methods, and deep learning-based methods. Recent researches show that the deep neural networks, such as a fully convolutional network (FCN) and SegNet, can far outperform traditional segmentation methods providing with a large training dataset. This internship aims to realize the deep learning-based image classification methods and do some improvements with the dataset provided by the lab.

Eligibility Requirements:

- > Fundamentals of digital image processing.
- > Programming skills of MATLAB and Python.

Main Tasks:

- > Study the remote sensing concepts, principles, and traditional methods for image segmentation.
- > Realize the fully convolutional network (FCN) and test the performance on remote sensing image dataset.
- > Improve the FCN method with dense connection, pyramid pooling or multi-task training and do further experiments.

Website:

Lab: <http://ast.sjtu.edu.cn>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
53

Radar Based Human Gesture and Movement Detection and Classification

Contact Information:

Asso. Prof. Dongying Li
Email: dongying.li@sjtu.edu.cn

Project Description and Objectives:

The project aims at a series of theoretical and practical explorations with the main target being extracting key features of human body movements and recognizing/classifying different types of these movements using radar sensors. Techniques including Deep Convolutional Networks are suggested to be used in the recognition and classification process to ensure accurate results.

Eligibility Requirements:

Applicants shall have basic knowledge and have attended courses regarding electromagnetism, signal processing, and communication theory. Experience in C++/MATLAB programming and deep learning is preferable.

Main Tasks:

- > Collect, extract, and tag human body movement data from the radar sensor.
- > Study the methodology of using deep learning technologies regarding classification of the tagged radar echo wave data.

Website:

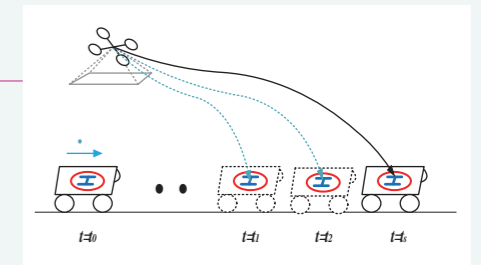
Lab: <http://ast.sjtu.edu.cn>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
54

Autonomous Quadrotor Landing on a Moving Platform

Contact Information:

Prof. Wang Hesheng
Email: wanghesheng@sjtu.edu.cn



Project Description and Objectives:

This project focuses on the research of autonomous quadrotor landing on moving platforms. The autonomous landing of the quadrotors on moving platform is one of the recent research hotspots. Due to under actuation of the quadrotor dynamical system and difficulties of estimating the states of the quadrotor, this problem remains a challenge to be further investigated. The project plan is to use the down-facing camera and IMU to accurately estimate the states of the quadrotor. At the same time, the down-facing camera is also used to estimate and predict the motion states of the moving landing platform. Taking dynamical under actuation as well as visibility issue into account, the project can optimize landing trajectory planning work and thus realize the task of autonomous quadrotor landing performance.

Eligibility Requirements:

- > Basic ability in C++ programming.
- > Basic knowledge of robot control and optimizations.

Main Tasks:

- > Complete numerical analysis of landing performance.
- > Conduct physical experiments.
- > Complete a technical report.

Website:

Lab: <http://robotics.sjtu.edu.cn/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
55

Fabrication and Modeling of Underwater Bio-inspired Soft Robot

Contact Information:

Prof. Wang Hesheng
Email: wanghesheng@sjtu.edu.cn

Project Description and Objectives:

The project aims to explore the capacity of the soft robot in a specific underwater operating environment by learning the morphology and motion mode from the marine organisms. Bio-inspired soft robots have been gaining a lot of attention due to their optimal performance in specific environments stemming from their unique morphology and sensorimotor capabilities. The project intends to complete both fabrication and modeling work of the newly constructed soft robot. The students will first cooperate on mechanical design and select appropriate actuators to realize autonomous motion of the robot in an underwater environment. Thereafter, mathematical modeling work is required. Discrete and continuous modeling methods are alternative depending on the morphology and mechanism characteristics of the prototype. The contribution of control algorithm aims to realize specific control tasks such as positioning, tracking, and so forth. The lab provides diverse hardware facilities such as silicone molding tools, visual measuring system, optical motion capture system, etc. Students can also cooperate with our researchers who specialize in soft robotics.

Eligibility Requirements:

- > Basic knowledge SolidWorks and other modeling software.
- > Basic knowledge of MATLAB and C++.
- > Basic knowledge of robot modeling and control.

Main Tasks:

- > Complete design, fabrication and modeling of a soft robot.
- > Cross validate the performance of the prototype.

Website:

Lab: <http://robotics.sjtu.edu.cn/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
56

Unmanned Delivery Robot

Contact Information:

Prof. Wang Hesheng
Email: wanghesheng@sjtu.edu.cn

Project Description and Objectives:

The unmanned delivery robot is one of the most popular research fields, which is acknowledged as an important channel to realize the commercialization of the driverless car. This can effectively change the conventional lifestyle of humans overall. Despite the smaller size than a real car, the unmanned delivery car includes different kinds of sensors such as 3D-lider, stereo camera, RTK-GPS, sonar radar, and so forth. These can help to realize real-time highly accurate localization, road area, and lane detection as well as obstacle detection and classification. The project aims to realize autonomous package delivering tasks by the unmanned delivery robot. The main parts of the project are self-localization, perception in both interior, and the exterior environment through multisensory fusion, trajectory planning, and motion control. The project also emphasizes path planning algorithms to realize obstacle, avoid overloading, and stable self-driving performance on the specific and required road.

Eligibility Requirements:

- > Basic knowledge of robot control and coordinate transformation.
- > Basic knowledge of ROS is preferred.
- > Carefulness, patience, accountability, and interest in the work.

Main Tasks:

- > Finish a research report.
- > Choose one research direction (localization, perception and navigation) and propose the optimization scheme.
- > Realize the proposed scheme with ROS in the robot.

Website:

Lab: <http://robotics.sjtu.edu.cn/>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
57

Computer Aided Diagnosis Based on Artificial Intelligence and Medical Image Analysis

Contact Information:

Prof. Jie Yang
Email: jieyang@sjtu.edu.cn

Project Description and Objectives:

With the significant development of artificial intelligence in recent years which has been motivated by great demand from clinical practice, computer-aided diagnoses have become more and more important. Advances in artificial intelligence and medical imaging technology will greatly contribute to the diagnoses of many diseases. Especially, computer-aided diagnoses that can reduce the disequilibrium of medical resources in China, where there is a significant difference between the main top hospitals are located in big cities, such as Shanghai and Beijing, and smaller more localized hospitals.

In this project, some important and typical problems will be investigated and close collaborations with hospitals and institutes abroad will be pursued, including osteosarcoma (with Renji Hospital), diabetic retinopathy (with Shanghai the First Hospital), Alzheimer's disease (with Chalmers University of Technology), and chromosome mutation (Ruijin Hospital). The objectives of this project consist of:

- 1) Study medical imaging process methods and artificial intelligence techniques for one particular disease.
- 2) Experiments on clinical data with the developed techniques.
- 3) Interpretation analysis for the neural networks that trained for computer-aided diagnosis.

Eligibility Requirements:

- > Basic knowledge of artificial intelligence and image processing.
- > Programming skills on python, C; experience on TensorFlow, PyTorch is preferred.

Main Tasks:

- > Processing on clinical images and AI methods implantation.
- > Experiments on clinical data for one particular disease.
- > Interpretation analysis for the neural networks for clinical applications.

Website:

Lab: <http://www.pami.sjtu.edu.cn/En/Home>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
58

Advanced Kernel Methods for Machine Learning

Contact Information:

Prof. Xiaolin Huang
Email: xiaolinhuang@sjtu.edu.cn

Project Description and Objectives:

Kernel methods, which implicitly maps data into feature spaces, are very important in machine learning and have been widely applied in many fields. In recent years, the success of deep learning implies that enhancing the flexibility with the support of big data is promising to improve machine learning performance. The route is also applicable to advancing kernel methods, which are traditionally restricted to shallow structures.

In this project, we will investigate several key issues for advanced kernel methods. First, it is necessary to design a deeper structure, with several nonlinear layers, and develop the corresponding training methods. Second, making kernels flexible usually violates positive definiteness condition, that is usually required by classical kernels, and investigation on indefinite kernel methods is desirable. Third, flexible kernels need to admit value-defined matrices, for which the out-of-sample extension technique is necessary.

The objectives of this project consist of:

- 1) Novel kernel methods in one of the three topics: deep kernel/indefinite kernel/out-of-sample extension;
- 2) Toolbox for the developed techniques.

Eligibility Requirements:

- > Basic knowledge on machine learning.
- > Programming skills in MATLAB, Python, C.

Main Tasks:

- > Develop novel machine learning methods based on flexible kernels.
- > Establish and release toolbox for the developed methods.

Website:

Lab: <http://www.pami.sjtu.edu.cn/En/Home>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
59

Machine Learning for Optical Communications

Contact Information:

Prof. Lilin Yi
Email: lilinyi@sjtu.edu.cn

Project Description and Objectives:

Machine learning and neural network have become very popular these years and have shown their strength especially in the domain of computer vision and machine translation. The neural network also comes into view of optical communities with more layers, more intrinsic inter-layer relationship. A much more powerful tool, convolutional neural network (CNN), is now widely used in the domain of computer vision and also is the key for AlphaGo to defeat various professional Go players. CNN has also shown its powerful capability in optical performance monitoring and modulation formats identification.

This project mainly focuses on how machine learning can solve the signal performance distortion in optical fiber transmission, including dispersion, nonlinearities, and bandwidth limitation-induced inter symbol interference. The performance of different machine learning structures such as supported-vector machine (SVM), fully-connected neuron network, CNN, and recurrent neuron network (RNN) will be compared and evaluated.

Eligibility Requirements:

- > Interested students should have basic knowledge on optical communications and programming.

Main Tasks:

- > Finish a research report.
- > Give two research presentations (1. Background review, 2. Technical progress).
- > Submit a paper to a conference or a journal as a co-author.

Website:

Lab: http://front.sjtu.edu.cn/~llyi/index_en.html
School: www.seiee.sjtu.edu.cn/

PROJECT
60

Cross-Culture Emotion Recognition from EEG and Eye Tracking Data

Contact Information

Prof. Bao-Liang Lu
Email: bllu@sjtu.edu.cn

Project Description and Objectives

Emotion plays a significant role in our daily life and has been described as the 'driving force' behind motivation, endowing meaning to all human interactions. As we all know, various environments and cultures influence a human's physical peculiarity, the way humans think, and many other aspects. Humans all over the world may have different emotional patterns or possess similar emotional characteristics. Recently, multicultural research concerning emotion recognition has provided explanations for cross-cultural differences as well as similarities.

This project mainly investigates the emotional neural patterns among different cultures using EEG and eye movement signals. As we all know, facial expressions for different emotions are similar all over the world, regardless of culture. This study aims to find out whether people sharing the same emotions have similar neural patterns and to discover more facts about human emotions.

Eligibility Requirements:

- > Interested students should have basic knowledge of machine learning; programming skills on python
- > Experience on TensorFlow or PyTorch is preferred.

Main Tasks:

- > Finish a research report.
- > Carry out at least 10 EEG experiments to collect emotional EEG and eye tracking data. Analyze EEG and eye tracking data using machine learning methods.

Website:

Lab: <http://bcmi.sjtu.edu.cn>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
61

Cross-Subject Emotion Recognition with Transfer Learning

Contact Information:

Prof. Bao-Liang Lu
Email: blu@sjtu.edu.cn

Project Description and Objectives:

Emotion plays a critical role in human lives, which affect our behavior and thoughts. As a signal which directly reflects brain activity, electroencephalography (EEG) has been demonstrated to be a reliable and promising indicator of human mental state. However, due to the physical and mental variance of the human brain, traditional machine learning models may fail when training data and testing data are from different subjects. Recently, transfer learning has attracted the attention of many researchers, which has a high potential in developing cross-subject brain-computer interface systems.

In this project, we will investigate cross-subject emotion recognition using EEG and eye movement signals with transfer learning methods. Based on the existing research and dataset, the study aims to classify five basic emotions (happy, sad, neutral, fear, disgust) among different subjects and to discover more facts about human emotions.

Eligibility Requirements:

- > Interested students should have basic knowledge of machine learning; programming skills on python
- > Experience on TensorFlow or PyTorch is preferred.

Main Tasks:

- > Explore cross-subject emotion recognition with transfer learning methods.
- > Collect EEG and eye tracking experimental data if needed.
- > Finish a research report.

Website:

Lab: <http://bcmi.sjtu.edu.cn>
School: <http://english.seiee.sjtu.edu.cn/>

PROJECT
62

Cross-Domain Vigilance Estimation with Transfer Learning

Contact Information

Prof. Bao-Liang Lu
Email: blu@sjtu.edu.cn

Project Description and Objectives:

In this project, we will recruit subjects to take part in lab and real driving tasks. We use dry electrodes to collect EEG signals and implement different domain adaptation models. The goal is to build cross-domain vigilance estimation models.

Eligibility Requirements:

- > Interested students should have basic knowledge of machine learning; programming skills on python
- > Experience on TensorFlow or PyTorch is preferred.

Main Tasks:

- > Finish a research report.
- > Conduct experiments.
- > Master different domain adaptation methods.

Website:

Lab: <http://bcmi.sjtu.edu.cn>
School: <http://english.seiee.sjtu.edu.cn/>



PROJECT

63

Vortex-induced Vibration of Catenary Riser

Contact Information:

Prof. ZHOU Dai

Email: zhoudai@sjtu.edu.cn

Project Description and Objectives:

Highly flexible risers, such as steel catenary risers, are widely deployed for deep-water drilling industry to convey oil from the seabed to the sea surface since it can offer a low-cost alternative to conventionally used rigid risers on floating platforms and can also provide economic riser design solutions for fixed platforms. As placed within ocean currents, Vortex-induced vibrations (VIV) would be excited for such a long flexible structure with bluff cross-sections and possible fatigue damage resulting from VIV on these structures requires a careful calculation and prediction of the responses. In this project, three-dimensional spectral/hp computations will be performed to study the fundamental mechanisms of vortex-induced vibration of a flexible catenary riser in the laminar flow regime. This will be a first step to understand the complex responses of a long flexible riser in the turbulent flow regime in real engineering situation.

Eligibility Requirements:

- > The interested student should have a basic knowledge of hydrodynamics and numerical simulation.

Main Tasks:

- > Finish a research report.
- > Give two research presentations (a. references review; b. technical presentation).
- > Submit one paper to journal as a co-author.

Website:

Lab: N/A

School: <http://naoce.sjtu.edu.cn/en/>

PROJECT

64

Dynamic Damage of Geotechnical Structures

Contact Information:

Asso. Prof. Jianliang Deng

Email: dengjianliang@sjtu.edu.cn

Project Description and Objectives:

In Shanghai as well as numerous other coastal cities in China, the foundations of many old buildings contain liquefiable soil layers. The destructive effects of these liquefiable soil layers on buildings have been observed in many countries.

The goal of this internship will be to study the liquefaction of soils and evaluate the destructive effects on the buildings by using a shaking table, and to study the destructive effects of traffic loading and sea wave loading.

Eligibility Requirements:

- > Have a good knowledge of soil properties.
- > Have a good dexterity and be familiar with manual works in a laboratory.

Main Tasks:

- > Understanding basic theory.
- > Learning basic skills in experimentation.

Website:

Lab: <http://celab.sjtu.edu.cn/>

School: <http://naoce.sjtu.edu.cn/en/>

PROJECT
65

Model Tests on Marine Renewable Energy Devices

Contact Information:

Prof. Ye Li
Email: ye.li@sjtu.edu.cn

Project Description and Objectives:

Renewable energy has occupied the forefront of energy supply studies around the world. With the advancement of science and technology, the use of renewable energy has expanded towards being done in the ocean in the last decade. Particularly, tidal current and wave energy are regarded as the two kinds of marine renewable energy with the greatest prospects. In this project, models of tidal current turbines and/or wave power generators will be tested in a ship model towing tank to measure their hydrodynamic performance. This performance is the key to marine renewable energy extraction.

Eligibility Requirements:

- > Have a basic knowledge of ocean engineering, mechanical engineering, energy engineering and/or similar fields.
- > Proficiency in speaking and writing is essential.

Main Tasks:

- > Preparation of the facilities and instruments.
- > Model test of the tidal current turbines and/or wave power generators.
- > Data acquisition and analysis.

Website:

Lab: <http://towingtank.sjtu.edu.cn/En/Default>
School: <http://naoce.sjtu.edu.cn/en/>

PROJECT
66

Study of Transportation and Environment in an Urban Area

Contact Information:

Prof. Hongdi He
Email: hongdihe@sjtu.edu.cn

Project Description and Objectives:

Transportation and environmental engineering is an interdisciplinary project which aims to teach students how to solve transportation and environmental problems independently. In this project, students will spend their time monitoring traffic pollution, collecting the original data, and conducting statistical analysis and mathematical modeling. The transportation and environment team aspires to foster leadership, problem-solving skills, and hands-on field experience. Team members will be able to utilize their classroom knowledge in order to optimize and solve real-world transportation environment problems.

Eligibility Requirements:

- > Be good at communication.

Main Tasks:

- > Learn how to use environmental monitoring equipment.
- > Learn traffic emission models.
- > Participate in projects about transportation and the environment.
- > Participate in the measurement of traffic pollutants.
- > Complete a project presentation and a project report.

Website:

Lab: <http://uav.sjtu.edu.cn/>
School: <http://naoce.sjtu.edu.cn/en/>

PROJECT
67

Green Building Materials

Contact Information:

Prof. Jian Yang

Email: j.yang.1@sjtu.edu.cn

Project Description and Objectives:

This project primarily focuses on the use of recycled materials in modern construction. In particular, the demolition and construction wastes will be recycled and utilized to replace new materials (mainly in the form of recycled aggregates) in the new construction. To compensate for the loss of the strength, the recycled aggregates will be strengthened in advance. Meanwhile, scrap tire rubber will also be used as a fine aggregate to replace sand. The methods of enhancing the interfacial transition zone will be examined. The percentage of replacement, particle size distribution, and size of recycled aggregates will be studied to investigate their effects on the properties of the resulting concrete. The performances to be studied include workability, strength, and durability. MIP, SEM, XRD tests and inspection will be carried out to investigate the micro structure and composition of the material. The objectives of this project are to get students to be familiar with the production of recycled concrete that is used in modern construction such as precast concrete for modular construction and the top layer for smart motorway. The possibility of using this kind of materials for 3D printing will also be researched.

Eligibility Requirements:

- > Interested students should have a basic knowledge of building materials.

Main Tasks:

- > Becoming familiar with the production of recycled materials in modern construction.
- > Completing a research report.
- > Delivering two research presentations, being a reference review and a technical presentation.
- > Submitting one paper to a journal as a co-author.

Website:

Lab: N/A

School: <http://naoce.sjtu.edu.cn/>

PROJECT
68

Modular Construction

Contact Information:

Prof. Jian Yang

Email: j.yang.1@sjtu.edu.cn

Project Description and Objectives:

The technology and application of modular construction is developing rapidly. Modular construction is based on three-dimensional units that are usually fabricated and fitted out in a factory and are delivered/assembled to the site as the main load-bearing elements for buildings. In the past, the main use of modular structures were for mobile or temporary buildings. However, due to the modern pre-fabricated construction technology using volumetric units, it is now used in a wide range of building types, being for schools, hospitals, offices, and even to high-rise residential buildings. This demand has been driven by the off-site nature of the of the construction process, which leads to quantifiable economic and sustainability benefits. This project mainly investigates the design and assessment of modular construction using novel construction materials. It aims to introduce the key features of the modular construction and to offer training for students about how to design buildings using this new technology.

Eligibility Requirements:

- > Interested students should have a basic knowledge of building engineering.

Main Tasks:

- > To complete the design and drawing of buildings using modular construction.
- > To check and validate the design adequacy as well as optimize the design.
- > To deliver a presentation about the design philosophy and demonstrate the novelty of its design.

Website:

Lab: N/A

School: <http://naoce.sjtu.edu.cn/>

PROJECT
69

Automated Construction Systems of High Rise Buildings

Contact Information:

Prof. Jian Yang
Email: j.yang.1@sjtu.edu.cn

Project Description and Objectives:

The total output value of the construction industry accounts for 5.7% of the global GDP. However, the productivity of the construction industry has been declining in the past 30 years. Automated construction systems provide a modern and efficient way to build the high-rise buildings in the urban city. The favorite benefits this type of system can offer include significant reduction in wastes, improved safety at sites, and a more controllable quality of construction projects. This project aims to develop a virtual control system for the automated construction equipment by utilizing the digital innovations (including BIM, 3D laser scanning, and multi-sensor technology). The system should be capable of updating the building information model on a real-time basis by using 3D laser scanning and the robotic survey technology. It should also provide a synchronized monitoring system for equipment during operation by using multi-sensor technology.

Eligibility Requirements:

- > Basic knowledge of building construction.
- > Preference in students studying civil engineering or architecture.

Main Tasks:

- > To become familiar with BIM software.
- > To complete a research report.
- > To submit one paper to a journal as a co-author.

Website:

Lab: N/A
School: <http://naoce.sjtu.edu.cn/>



MATERIALS SCIENCE AND ENGINEERING

PROJECT
70

Study on the Microstructure and Mechanical Properties of the Laser Additive Manufactured CrCoNi Medium Entropy Alloy

Contact Information:

Asso. Prof. Kai Feng
Email: fengkai@sjtu.edu.cn

Project Description and Objectives:

Equiatomic CrCoNi medium entropy alloy (MEA) has excellent cryogenic mechanical properties including high strength and toughness. It approaches the best combinations of strength, ductility and toughness on record. These advantages endow its great potential in cryogenic extremes such as in the aerospace and petrochemical industry. In this project, we will use selective laser melting and one of the laser additive manufacturing technologies to fabricate the CrCoNi MEA build. Its microstructure and mechanical properties with different fabrication parameters will also be investigated.

Eligibility Requirements:

- > Should have solid background knowledge on materials science, solidification, mechanics of metallic materials etc.
- > Should know about the selective laser melting.
- > Candidates who have related experience is preferred.
- > Should be familiar with various materials characterization and test methods.

Main Tasks

- > Explore the optimal parameters to fabricate the CrCoNi MEA build by selective laser melting.
- > Observe the microstructure and test the mechanical properties (including cryogenics) of selective laser melted CrCoNi MEA samples.
- > Correlate the parameters, microstructure, and mechanical properties.
- > Reveal the deformation mechanism of selective laser melted CrCoNi MEA (especially in the cryogenic temperature).

Website

Lab: lpl.sjtu.edu.cn
School: <http://smse.sjtu.edu.cn>

PROJECT
71

The Joining Between Polymer and Metal for Biomedical Application

Contact Information:

Asso. Prof. Ke Chen

Email: chenke83@sjtu.edu.cn

Project Description and Objectives:

The joining between polymer and metal has attracted significant attention recently due to its advantage of excellent integrated physical and chemical properties. There is an increasing demand for high quality metal-polymer hybrid structures in biomedical industries. Friction stir welding (FSW) has advantages in the joining between metal and polymer materials and has been proved to be a suitable technology to produce dissimilar metal-polymer overlapping joints. In this project, we will complete the realization and optimization of the joining process between metal and polymer. The welding temperature (TW) and axial load (FZ) evolution will be measured during welding to study the temperature-force coupling process. A lot of focus will be put into the bonding mechanisms (including macroscopic interlocking mechanism and microscopic bonding mechanism) and their effects on the mechanical properties of the joints which is studied through the Transmission Electron Microscope (TEM), X-ray Photoelectron Spectroscopy (XPS), Fourier Transform Infrared Spectroscopy (FTIR) and Electron Energy Loss Spectroscopy (EELS). The obtained results will fulfill the urgent needs of polymer/metal joints in biomedical applications and also contribute to the understanding and further development of FSW and other welding methods for joining metals and polymers together.

Eligibility Requirements:

- > Interested students should have a basic knowledge of polymeric and metallic materials.
- > Interested students should be familiar with SEM and EBSD and have hands-on capabilities.

Main Tasks:

- > Finish a research report.
- > Give two research presentations, being a literature review and a technical presentation.

Website:

Lab: lpl.sjtu.edu.cn

School: <http://smse.sjtu.edu.cn>

PROJECT
72

Microstructural/Phase Evolution and the Mechanical Property of Wire-Arc Additively Manufactured Nickel-Titanium Shape Memory Alloy

Contact Information:

Assistant Prof. Chen Shen

Email: cshen486@sjtu.edu.cn

Project Description and Objectives:

Nickel-titanium (NiTi) has been continuously attractive for applications in aerospace and medical devices industries due to the excellent functional features such as shape memory and super-elasticity effect which are based on the solid-solid phase transformation between martensite and austenite. Besides the low stiffness, biocompatibility, and excellent erosion it has, corrosion and wears resistance of NiTi are what truly make this alloy the most competitive candidate for biomedical applications such as artificial bones and bio-parts. The Current Additive Manufacturing (AM) method (selective-laser-melting, SLM) for NiTi always brings a porosity defect which is unacceptable for a structural component. Because of this, Wire-Arc Additive Manufacturing (WAAM) has currently been introduced for the AM of NiTi due to its full-density manufacturing nature. The present research project aims to: (1) systematically characterize the microstructural performance and mechanical properties of the WAAM fabricated NiTi alloy under both as-fabricated and heat-treated conditions; (2) analyze the phase evolution of WAAM fabricated NiTi alloy during heat treatment using in-situ diffraction method.

Eligibility Requirements:

- > Applicant should have a basic knowledge of metal additive manufacturing.
- > Applicant should have a basic knowledge of crystallography and diffraction experiments (XRD, EBSD).

Main Tasks:

- > Finishing a research thesis.
- > Giving two presentations (1. Literature review; 2. Technical presentation).

Website:

Lab: lpl.sjtu.edu.cn

School: <http://smse.sjtu.edu.cn>

PROJECT
73

Design and Application Research of Bio-inspired Hierarchical Hygroscopic Material

Contact Information:

Research Assistant Yao Li
Email: liyaosjtu@sjtu.edu.cn

Project Description and Objectives:

The moisture in the air has drawn great concerns in various industries, including food preservation and processing, chemical and petrochemical industry, microelectronics, architecture materials, pharmaceuticals, cosmetics, and paper making. Due to the limited amount of fresh water (being approximately 3% of the world's water) in the world, atmospheric moisture is potentially an alternative renewable water resource as the earth is surrounded by over 12.9×10^{12} m³ of atmospheric moisture. This could potentially be collected by adsorptive dehumidification from the moist air. Therefore, air dehumidification has become a prime research topic worldwide. In this study, bio-inspired hierarchical porous materials possessing effective adsorption-desorption characteristics will be designed and researched for the application of water harvesting.

Eligibility Requirements:

- > Experience in porous material design and fabrication.
- > Basic measurement skills.

Main Tasks:

- > Through a variety of set parameters, the student will master three different synthesis techniques and the principle of hierarchical Hygroscopic Material.
- > Use similar chemometric methods for water adsorption ability identification (LDA, PCA, least squares, etc.).

Website:

Lab: <http://sklcm.sjtu.edu.cn/>
School: <http://smse.sjtu.edu.cn>

PROJECT
74

Design and Fabrication of Wood-inspired Monolithic Porous Carbon Material

Contact Information:

Research Assistant Yao Li
Email: liyaosjtu@sjtu.edu.cn

Project Description and Objectives:

With the depletion of fossil fuels and increasing environmental pollution, there is an urgent need for efficient, clean, and sustainable materials. Wood with its mesoporous, low-tortuosity, and hierarchical structure has attracted much research interest recently, most importantly, it is renewable, environmentally friendly, naturally abundant, and biodegradable. In recent years, wood has found a range of applications, including transparent and haze paper for optoelectronics, biodegradable electronics, and solar cells. These advanced applications using wood-based materials are promising toward a sustainable future. In this project, we utilize the unique structure of the wood to fabricate wood-derived monolithic porous carbon materials by changing the conditions of the experiment to cater for different practical applications.

Eligibility Requirements:

- > Experience in materials preparation.
- > Familiarity with the structure of natural wood.

Main Tasks:

- > Attempt a variety of fabrication methods and raw materials to explore the influence of these conditions on the structure of wood-derived monolithic porous carbon materials so that they can better cater for different uses.

Website:

Lab: <http://sklcm.sjtu.edu.cn/>
School: <http://smse.sjtu.edu.cn>

PROJECT
75

Design and Application Research of Bio-inspired Stimulus-Response Material

Contact Information:

Research Assistant Yao Li
Email: liyaosjtu@sjtu.edu.cn

Project Description and Objectives:

The stimuli-responsive photonic crystals have many potential applications in physical, chemical and biological detections. The colors of the stimuli-responsive photonic crystals, which are a kind of the smart color shifting materials, can be tuned by the external stimuli, such as temperature, pH, ions, or electric fields. When external conditions change, the physical or chemical properties of the materials will change correspondingly, leading to change of the periodic lengths or the refractive indexes of the photonic crystals, which will eventually cause change to the structural colors of these materials. Thus, the external stimuli signals will transfer into the color change of the photonic crystals, which can be detected by the spectra or directly observed by naked eyes, providing an effective and intuitionistic detection for the stimuli signals.

During the billions of years' evolution, nature has formed diverse kinds of tiny structures which match with the functions of the creatures. In nature, many living creatures have shining colors which are related to their photonic structures. This study focuses on the synthesis of the stimuli-responsive photonic crystals by using biomaterials as the templates and investigation of the properties.

Eligibility Requirements:

- > Experience in material chemical synthetic, material structure characterization and analysis or simulation are preferred.

Main Tasks:

- > Preparation of stimuli-responsive photonic polymers with hierarchical structures.
- > Preparation of organic-inorganic multi-stimuli responsive systems with hierarchical structures.
- > Characterization of stimuli-responsive photonic structures and properties.
- > Simulation of the photonic structures and responsive mechanism study.

Website:

Lab: <http://sklcm.sjtu.edu.cn/>
School: <http://smse.sjtu.edu.cn>

PROJECT
76

High performance HEA (High Entropy Alloy) Composite

Contact Information:

Prof. Mingxu Xia
Email: mingxu.xia@sjtu.edu.cn

Project Description and Objectives:

High entropy alloy has attracted more and more attentions due to its unique properties. Due to the nature of the complex atomic structure, most HEAs are too brittle to be used as a structural material. In order to enhance the ductility, a heterogeneous structure of bimodal grains was developed in conventional alloys and in HEAs through alloying element addition and cold rolling. In this project, we will utilize the self-oxidation technique to strengthen HEAs with higher ductility. The effect of in situ formed oxide particles on the strength and ductility will be discussed based on the results of metallurgical analysis and transmission electronic microscopy analysis. The interface between oxides and the HEA matrix will be profoundly investigated. The interaction of the movement of the dislocations with oxide particles will be discussed in detail. The obtained results will extend the understanding of the deformation mechanism of particle enhanced HEA composite and a new high performance HEA is expected to be fabricated.

Eligibility Requirements:

- > Interested students should have a basic knowledge of composite.
- > Interested students should be familiar with SEM and EBSD.

Main Tasks:

- > Finish a research report.
- > Give two research presentations (1. References review; 2. Technical presentation).

Website:

Lab: <http://iams.sjtu.edu.cn>
School: <http://smse.sjtu.edu.cn>



PROJECT

77

Coupled Solar Driven Electro-catalytic Purification of Natural Gas via Simultaneous CO₂ and H₂S Conversion

Contact Information:

Asso. Prof. Bai Jing

Email: Bai_jing@sjtu.edu.cn

Project Description and Objectives:

Natural gas is an important clean energy source. However, the large number of natural gas produced from gas fields contains about 15% hydrogen sulfide and 10% carbon dioxide which must be removed before use. Traditional separation methods are difficult to remove CO₂ and H₂S simultaneously. This is because apart from consuming lots of chemical reagents, the separated CO₂ and H₂S require subsequent processing which is complicated and expensive. Hence, if CO₂ and H₂S can be separated and respectively converted into CO and S, the treatment process will be simplified and bring huge economic benefits. Thus, this project will focus on developing a new catalytic system and equipment that combine solar energy conversion technology and CO₂ and H₂S catalytic technology.

Eligibility Requirements:

- > Chemistry or material Science background.

Main Tasks:

- > Fabrication of electrode materials and testing of a catalytic system.

Website:

Lab: <http://sese.sjtu.edu.cn/research/1970.html>

School: <http://sese.sjtu.edu.cn/>

PROJECT

78

Photocatalytic Production of H₂O₂ on Modified C₃N₄ under Simultaneous Sunlight

Contact Information:

Prof. Mingce Long

Email: long_mc@sjtu.edu.cn

Project Description and Objectives:

H₂O₂ is one of the fastest growing industrial chemicals in the world. In the recent ten years, it has been widely used as a multi-purpose environmentally friendly oxidant in biological process, water purification and chemical industry since it only emits water as a final byproduct. Industrial production of H₂O₂ is through anthraquinone oxidation which is limited by the high energy input and tedious steps for multiple hydrogenation and oxidation reactions. It is still challengeable but highly demanding to produce H₂O₂ in a facile, clean, and safe way. Photocatalytic production of hydrogen peroxide (H₂O₂) using water and molecular oxygen as the sole material source is a promising and sustainable solar fuel approach. However, the efficiency is limited by the low efficiency of oxygen reduction reaction (ORR) in H₂O₂ formation and the simultaneous decomposition of H₂O₂. C₃N₄ is a promising visible light driven photocatalyst for H₂O₂ production. In this study, we plan to synthesize highly active C₃N₄ by improving crystallinity and doping single atoms. The prepared catalysts will be fully characterized. The performance for H₂O₂ production and enhanced mechanism will be explored.

Eligibility Requirements:

- > Basic knowledge of Math/Chemistry/Physics.
- > High motivation for scientific studies and experiments.
- > Majors in chemistry, material science, or environmental science and engineering are preferred.

Main Tasks:

Students are required to work with the graduate students under the supervision of the mentor(s), to working on the above projects. The students need to attend the regular lab meetings, and make a weekly report to the mentor(s). By the end of the intern, a project report should be submitted.

Website:

Lab: <http://sese.sjtu.edu.cn/people/2784.html>

School: <http://sese.sjtu.edu.cn/>

PROJECT
79

Ecotoxicity Assessment of Emerging Environmental Contaminants

Contact Information:

Asso. Prof. Yanbin Zhao

Asso. Prof. Kun Zhang

Email: zhaoyanbin@sjtu.edu.cn ; kunzhang@sjtu.edu.cn

Project Description and Objectives:

With the development of modern chemical industries, more and more chemicals are synthesized and released into the environment. Many pieces of evidences have shown that environmental contaminants exposure is one of the important factors that affect human and ecological health. In recent years, the contamination of emerging organic pollutants in our environment has attracted people's attention. Normally, they occur in surface and ground waters in low ng/L-several µg/L range. In influent/effluent of wastewater treatment plants, higher concentrations of up to hundreds of µg/L occur. However, their potential reproductive and developmental effects on aquatic organisms are largely unknown. Therefore, the objective of this study is to investigate the developmental effects and cardiovascular and neurodevelopmental toxicities of emerging organic pollutants on a zebrafish model.

Eligibility Requirements:

- > Basic knowledge of chemistry/biology.
- > Self-motivation and the enjoyment of lab work.
- > Majors in environmental science, biology or Chemistry are preferred.

Main Tasks:

- > Systematically assess the toxicity of environmental contaminants.
- > Explore the possible mechanism of action behind the observed toxicity with molecular biological and chemical techniques.

Website:

Lab: <http://sese.sjtu.edu.cn/people/2808.html> ; <http://sese.sjtu.edu.cn/people/2848.html>

School: <http://sese.sjtu.edu.cn/>

PROJECT
80

Mechanism Analysis of the Difference in the Separation and Rejection Performance of Metal-organic Composite Membrane

Contact Information:

Prof. Jiahui Shao

Email: jhshao@sjtu.edu.cn

Project Description and Objectives:

Nanofiltration (NF) is a kind of precise membrane separation process under low pressure conditions. It has high retention efficiency for multivalent ions and organic small molecules (150-2000Da). In our previous study, Metal-polyphenol nanofiltration membranes were prepared by a layer by layer (LBL) method and spin-LBL method on PES membranes. The membranes prepared by spin-LBL method showed higher rejections to dyes and water permeability than those of LBL method. However, mechanisms of the difference in separation and rejection performance between the two membranes still need to be investigated.

Eligibility Requirements:

- > Major in environmental engineering, chemical engineering, polymer or other related areas.
- > Motivation to work.
- > The computational method of the molecular modeling is preferred.

Main Tasks:

- > Mechanism analysis of the difference in separation and rejection performance.

Website:

Lab: <http://sjtu.cf.labscout.cn/lims/>

School: <http://sese.sjtu.edu.cn/>



PROJECT

81

Effects of Freeze of Gait Prediction with Laser Cue Intervention on Patients with Parkinson's Disease

Contact Information:

Prof. Dongyun Gu
Email: dongyungu@sjtu.edu.cn

Project Description and Objectives:

Freezing of gait (FoG) is one of the most common disabling symptoms among patients with Parkinson's disease (PD). A possible way to prevent FoG is by providing pre-emptive cueing when FoG is predicted. We have developed a machine learning algorithm to predict the FoG event with impaired gait acceleration patterns and personalized labeling. This project aims at investigating the effects of the FoG prediction with a laser cue on PD patients for future clinical translation. A portable device through the detection of FoG and intervention with lasers will be developed.

Eligibility Requirements:

The students should have an interest in sports biomechanics and portable devices to solve biomedical problems. The prerequisites being engineering training, e.g. motion analysis, and/or electronic engineering are desirable.

Main Tasks:

Students are required to cooperate with graduate students, engineers, and clinicians under the supervision of their mentor(s) to work on the above projects. The students need to attend regular lab meetings and make weekly reports to their mentor(s). By the end of the internship a project report should be submitted.

Website:

Lab: http://dm.sjtu.edu.cn/En_Default.aspx
School: <http://bme.sjtu.edu.cn/en/>

PROJECT

82

Smart Imaging-Based Functional Evaluation for Contemporary Arthroplasty

Contact Information:

Prof. TsungYuan Tsai
Email: tytsai@sjtu.edu.cn

Project Description and Objectives:

More than a million people in the US received primary total joint replacements in 2018. The demand for joint arthroplasty is rapidly growing each year. Although significant pain relief and improvement of the functional capacity have been observed in post-operative patients, the negative effects being a reduced range of motion, asymmetric gait pattern, and an inability to restore their normal joint kinematics is still prevalent. Advances in arthroplasty have largely focused on the development of improving implant tribology and implant fixation methods. However, the performance of contemporary arthroplasty is related to adverse in-vivo dynamic phenomenon. This includes edge loading, wearing, impingement and dislocation. Accurate knowledge of in-vivo joint dynamics is crucial for further improvement of arthroplasty. This project will include investigations on the bone geometry of Asian people. Statistical shape modeling will be used to extract ethnic characteristics. Non-invasive imaging tracking methods, including skin-marker based motion analysis and dual fluoroscopic imaging tracking technique, will be employed to quantify accurate joint kinematics during daily functional activities. Subject-specific bone modeling and inverse dynamics will enable estimations of joint forces and moments. This study aims to compare the performance of contemporary total joint replacements and hopefully lead to innovations in arthroplasty.

Eligibility Requirements:

- > Interested students should have basic knowledge of human anatomy, computer vision, biomechanics, and MATLAB programming.

Main Tasks:

- > Collect minimal 10 subject's CT, MRI, fluoroscopic or motion capture data.
- > Develop custom-made scripts and analyze the collected data.
- > Review relevant literature.
- > Finish a research report.

Website:

Lab: <http://obl.sjtu.edu.cn/>
School: <http://bme.sjtu.edu.cn/en/>

PROJECT
83

Effects of Carpal Tunnel Pressure-induced Changes in Transverse carpal Ligament Structure on the Shear Wave Velocity: A Multiphysics Study

Contact Information:

Asso. Prof. Yifei Yao
Email: yifeiyao@sjtu.edu.cn

Project Description and Objectives:

Carpal Tunnel Syndrome (CTS) is one of the most common hand disorders. Carpal tunnel pressure measurement can facilitate the prevention, diagnosis and assessment of treatment for CTS. So far, there is not an economical and efficient way to measure the carpal tunnel pressure non-invasively. Acoustic Radiation Force Impulse (ARFI) imaging on Transverse Carpal Ligament (TCL) may be an ideal tool to measure carpal tunnel pressure non-invasively. The relationship between the carpal tunnel pressure and the shear wave velocity is critical for the estimation of tunnel pressure in vivo. This project aims to establish the theoretical relationship between TCL shear wave velocity and carpal tunnel pressure in silico using a multi-physics finite element analysis with mechanical and acoustic simulation to explore the theoretical function of relationship between SWV on TCL and carpal tunnel pressure. The investigation will have a clinical influence on CTS prevention, diagnosis and treatment.

Eligibility Requirements:

The students should have the desire of using engineering and technologies to solve biomedical problems. A prerequisite of engineering training, e.g. data analysis (using Matlab toolbox), finite element software (COMSOL, ANSYS or ABAQUS), and/or biomechanics are desirable.

Main Tasks:

Students are required to work with the graduate students under the supervision of their mentor(s) to work on the above projects. The students need to attend the regular lab meetings and make weekly reports to their mentor(s). By the end of the internship, a project report should be submitted.

Website:

Lab: http://dm.sjtu.edu.cn/En_Default.aspx
School: <http://bme.sjtu.edu.cn/en/>

PROJECT
84

bFGF Genetically Engineered Endothelial Progenitor Cells for Ischemic Stroke Treatment

Contact Information:

Prof. Yongting Wang
Email: ytwang@sjtu.edu.cn

Project Description and Objectives:

Stem cells are being tested in several clinical trials for the treatment of Ischemic Stroke. The genetic engineering of stem cells takes advantage of the stem cells not only as a therapeutic moiety but also as a factory and cargo for the gene product. In addition, genetic modification of stem cells can also augment the survival and function of the transplanted stem cells. Previously, our lab had identified that bFGF plays a key role in tissue protection after ischemic insult. In this project, we aim to investigate the potential of the bFGF genetically engineered endothelial progenitor cells in treating ischemic injury. The students will join a team of graduate students and research faculty members. Techniques used in this project will include but not be limited to stem cell culture, exosome preparation, animal surgery, and data analysis.

Eligibility Requirements:

- > Must be at least in their sophomore year.
- > Skills desirable but not required: cell culture, molecular cloning.

Main Tasks

- > Attend weekly lab meetings and carry out experiments.
- > Give two research presentations. (one on literature review, one on research progress)
- > Finish a research report.

Website:

Lab: <http://bme.sjtu.edu.cn/>
School: <http://bme.sjtu.edu.cn/>

PROJECT
85

Developing Molecular Probes for Tracking Stem Cell Derived Exosomes in Live Animals

Contact Information:

Asso. Prof. Yaohui Tang
Email: yaohuitang@sjtu.edu.cn

Project Description and Objectives:

Stem cell derived exosomes were beneficial for treating Ischemic Stroke, which is the major cause of disability and the second cause of death worldwide. However, quantitatively tracking exosomes and investigating their therapeutic efficacy and mechanism are still challenging. This project aims to develop multi-functional molecular probes to dynamically track exosomes that are intravenously or intra-arterially injected into mice as well as explore their therapeutic efficacy and underlying mechanisms. The students will join a team of graduate students and research faculty members. Techniques used in this project will include but not be limited to stem cell culture, exosome preparation, animal surgery, and data analysis.

Eligibility Requirements:

- > Must be at least in their sophomore year.
- > Skills desirable but not required: cell culture.

Main Tasks:

- > Attend weekly lab meetings and carry out experiments.
- > Give two research presentations, (one on literature review, one on research progress).
- > Test 2-3 molecular probes.
- > Finish a research report.

Website:

Lab: <http://bme.sjtu.edu.cn/>
School: <http://bme.sjtu.edu.cn/>

PROJECT
86

Development of Microsphere Hydrogel as Stem Cell Carrier for Treating Ischemic Stroke

Contact Information:

Asso. Prof. Yaohui Tang
Email: yaohuitang@sjtu.edu.cn

Project Description and Objectives:

Stem cells-based therapy has shown great potential for treating Ischemic Stroke. However, most stem cells that are injected into the brain have died quickly thus significantly reduced their therapeutic efficacy. Recently, biomaterials such as hydrogel have been demonstrated as a cell carrier that could improve stem cell viability and differentiation. In this project, we will develop a microsphere hydrogel by using a microfluidic technique and we will test the effects of microsphere as a stem cell carrier for treating ischemic stroke. The students will join a team of graduate students and research faculty members. Techniques used in this project will include but not be limited to stem cell culture, hydrogel development, animal surgery, and data analysis.

Eligibility Requirements:

- > Must be at least in their sophomore year.
- > Skills desirable but not required: cell culture, molecular cloning.

Main Tasks:

- > Attend weekly lab meetings and carry out experiments.
- > Give two research presentations, (one on literature review, one on research progress).
- > Finish a research report.

Website:

Lab: <http://bme.sjtu.edu.cn/>
School: <http://bme.sjtu.edu.cn/>

PROJECT
87

Medical Image Synthesis and Multi-Modal Fusion

Contact Information:

Asso. Prof. Qian Wang
Email: wang.qian@sjtu.edu.cn

Project Description and Objectives:

Using multi-modal medical imaging technology is essential to assist diagnosis and treatment in healthcare. However, from the technical perspective, multi-modal fusion has been daunting for decades, due to the giant incoherence of visual cues in images of different modalities. Recently, deep learning based image synthesis has provided a revolutionary chance to mitigate this issue, by performing image-domain or feature-domain data conversion. In this project, we expect students to develop tools for multi-modal fusion, by utilizing the fast evolving technique of image synthesis. The outcome of this project, which consists of both novel algorithm development and user case demonstration, is expected to benefit clinicians and patients significantly.

Eligibility Requirements:

Solid background in mathematics and programming, enthusiasm to cutting-edge artificial intelligence technique and its application to healthcare.

Main Tasks:

- > Develop core algorithms to complete image synthesis.
- > Develop methods to complete the pipeline of multi-modal fusion.
- > Develop and deploy tools for user-case demonstration of the algorithms and methods.

Website:

Lab: <http://mic.sjtu.edu.cn/>
School: <https://bme.sjtu.edu.cn/>

PROJECT
88

A Mass Spectrometry Technique Based on Inductively Coupled Plasma Mass Spectrometry Combined with Mass tags

Contact Information:

Prof. Xianting Ding
Email: dingxianting@sjtu.edu.cn

Project Description and Objectives:

Single-cell biology has been a hot new field of research in recent years. In this field, the most advanced is the single cell protein detection technology. Mass Cytometry (also named, CyTOF) is a multi-parameter detection technique for single cells using mass spectrometry. It inherits the characteristics of high-speed analysis of traditional flow cytometry and has high resolution of mass spectrometry, which is a new development direction of flow cytometry. This project will focus on developing CyTOF technique for single-cell analysis. CyTOF is a mass spectrometry technique based on inductively coupled plasma mass spectrometry combined with mass tags that allows accurate measuring of various molecular species on single cells in a highly multiple fashion.

Eligibility Requirements:

The students should have an interest in personalized disease diagnostics and personalized disease therapeutics and should have a background in biomedicine, analytical or synthetic chemistry, oncology and immunology, instrumentation, or biostatistics and bioinformatics.

Main Tasks:

The students are required to cooperate with other graduate students under the supervision of their mentor(s) to work on the above projects. The students need to attend regular lab meetings and make weekly reports to their mentor(s). By the end of the internship a project report should be submitted.

Website:

Lab: www.dinglab.com.cn
School: <http://ipmsjtu.sjtu.edu.cn/>

PROJECT
89

Surface-enhanced Raman spectroscopy for accurate disease diagnosis

Contact Information:

Prof. Jian Ye
Email: yejian78@sjtu.edu.cn

Project Description and Objectives:

Accurate diagnosis is of great concern in clinics and a technique that can realize early diagnosis will especially benefit the patients. However, a high level of heterogeneity makes the examination on single molecular targets or tissue pieces extremely limited. Multiple metabolites detection, which provides a comprehensive metabolic profile of a biological system, can be leveraged to indicate the disease-related physiological status and has the potential in discovering the biomarkers that are likely to be overlooked before.

This project will focus on using surface-enhanced Raman scattering (SERS) to directly probe the detailed metabolites in the biofluids based on the molecule-fingerprinting spectral nature with the advantage of ultra-high throughput and single-molecule sensitivity. SERS technique, as the non-targeting, non-invasive and efficient technique, will pave a new way of the accurate disease diagnosis and basic pathological studies with high practical and popularizing value.

Eligibility Requirements:

- > Background in biomedical nanomaterials and clinical diagnosis
- > Prerequisite of biomedical statistics and basic algorithms for data analysis
- > Enthusiasm to advancing the in vitro diagnostics (IVD) techniques

Main Tasks:

- > Synthesis and optimization of SERS nanomaterials for metabolite detection
- > Practicing SERS measurements of the biofluids
- > Developing and optimization of the algorithms for spectral analysis
- > Writing final reports.

Website:

Lab: <http://www.yelab.sjtu.edu.cn/>
School: <https://bme.sjtu.edu.cn/>

PROJECT
90

Machine-learning based Raman spectroscopy for the early diagnosis of gastric cancer

Contact Information:

Prof. Jian Ye
Email: yejian78@sjtu.edu.cn

Project Description and Objectives:

Gastric cancer is one of the most commonly occurring malignant tumors and seriously threatens human health. Early diagnosis and treatment are globally recognized as the most effective approach to improving survival, and early diagnosis is particularly crucial. Diseases initiate from changes in tissue and intracellular structure and chemical composition. Raman spectroscopy is non-invasive technique that can specifically detect the chemical and structural information of molecules. The signature Raman spectra of genomic DNA, nuclei, and tissue of normal gastric mucosa and gastric cancer has been proven different. This project aims to investigate the spectral difference between normal gastric tissue and cancers. It involves the usage of machine learning algorithm for the clustering or classification of Raman spectra that collected from cancer patients. The goal is to develop a model that can be used to determine tumor boundary, stages, and types with high accuracy and specificity. This work will facilitate the application of Raman spectroscopy in the early clinical diagnosis of gastric cancers.

Eligibility Requirements:

- > Background in biomedical nanomaterials and clinical diagnosis
- > Prerequisite of biomedical statistics, algorithms and software (python, Matlab etc.) for data analysis
- > Enthusiasm to advancing the in vivo diagnostics techniques

Main Tasks:

- > Developing and optimization of the machine learning algorithms for Raman analysis
- > Practicing the early diagnostics of cancer tissues with high accuracy
- > Writing final reports.

Website:

Lab: <http://www.yelab.sjtu.edu.cn/>
School: <https://bme.sjtu.edu.cn/>



PROJECT

91

Smartphone Decimeter Challenge

Contact Information:

Asso. Prof. Xin Zhang
Email: xin.zhang@sjtu.edu.cn

Project Description and Objectives:

The challenge is initiated by the Institute of Navigation, sponsored and technically supported by Google. The motivation is to encourage students interested in GNSS to develop high precision GNSS positioning on smartphones and exploiting every qualified state-of-the-art technique to fuse data from an inertial measurement unit (IMU) and GNSS. The developed algorithms will be such a universal package that with slight modification of the incoming sensor data stream, it can even perform the navigation tasks required for Mars rovers such as perseverance launched in 2020. Participants will go through a systematic training in GNSS positioning programming, Android app development and deployment, after which will be encouraged to compete in a challenge using a pool of GNSS datasets collected from smartphones, and high accuracy ground truth. They will also interact with our brilliant faculty, graduates, and undergraduate students in the team.

Eligibility Requirements:

- > Basic knowledge of linear algebra is required. Ability to program in C++ will be a plus.

Main Tasks:

- > Learn how to do sensor fusion for navigation as it is done within Mars rovers 'perseverance' using raw data from a phone that you use in your daily life.
- > Students will be encouraged to go for the second Google-ION (Institute of Navigation) Smartphone Decimeter Challenge, by using the developed algorithms.

Website:

Lab: <https://gnc.sjtu.edu.cn>
School: <https://www.aero.sjtu.edu.cn>

PROJECT

92

High-Fidelity Peridynamic Modeling Strategy for Advanced Composites

Contact Information:

Asso. Prof. Yile Hu
Email: yilehu@sjtu.edu.cn

Project Description and Objectives:

Various numerical methods have been developed and used to analyze the progressive damage and failure in advanced composite materials. However, the spatial derivatives needed to solve differential equations, are not defined at the crack surface, or tip. This introduces an inherent limitation to the classical theory. An alternative approach for simulation failures and damages in advanced composite materials is highly needed to improve the shortcomings in classical mechanics. In this project, a new continuum mechanics theory, PeriDynamic(PD) theory, will be applied to analyze progressive failures in advanced composite structures. Students can have fundamental and practical knowledge on numerical implementation of peridynamics. Moreover, student will be able to perform some experimental investigation of composite materials to verify their observation in numerical simulation.

Eligibility Requirements:

- > Knowledge in Solid Mechanics and Finite Element class;
- > Programming with C/C++, Fortran, Python or other language;
- > Students with working experience in lab are preferred.

Main Tasks:

- > Develop a peridynamic model for simulating matrix cracking and delamination in aerospace composite material;
- > Perform experimental study with standard testing method to measure material properties of composites.

Website:

Lab: N/A
School: <https://www.aero.sjtu.edu.cn>



PROJECT
93

Imaging Topological Materials via a Scanning Tunneling Microscopy

Contact Information:

Prof. Jinfeng Jia
Email: jfjia@sjtu.edu.cn

Project Description and Objectives:

Scanning Tunneling Microscopy is capable of visualizing atoms on a crystal surface and thus becomes a top priority for the scientist who works in either atomic scale physics, chemistry or material science. Topology, a special kind of advance mathematics, was introduced into solid state physics and breeds the emergence of topological materials. This project aims to utilize a low temperature Scanning Tunneling Microscopy to directly image the atoms on several typical topological materials, including Bi₂Te₃, stanine, etc.

Eligibility Requirements:

- > Understanding of lab safety.
- > Interested students should have basic knowledge of quantum mechanics and solid-state physics.
- > Proficiency in writing and speaking is mandatory.

Main Tasks:

- > Finish a research report.
- > Give two research presentations (a. references review; b. technical presentation).

Website:

Lab: <http://lodiphie.physics.sjtu.edu.cn/>
School: <http://www.physics.sjtu.edu.cn/>

PROJECT
94

Molecular Beam Epitaxy Growth of Topological Insulator Thin Films

Contact Information:

Prof. Jinfeng Jia
Email: jfjia@sjtu.edu.cn

Project Description and Objectives:

Molecular beam epitaxy (MBE) is a delicate technology that was designed to synthesize high quality single crystalline ultra-thin films and atomic layers. Topological insulators are a hot topic and also a frontier of condensed matter physics research in recent years. This project aims to show the interested student how to use MBE method to successfully grow high quality thin films of topological insulator material, Bi₂Te₃.

Eligibility Requirements:

- > Understanding of lab safety.
- > Interested students should have basic knowledge of quantum mechanics and solid-state physics
- > Proficiency in writing and speaking is mandatory.

Main Tasks:

- > Finish a research report.
- > Give two research presentations (1. References review; 2. Technical presentation).

Website:

Lab: <http://lodiphie.physics.sjtu.edu.cn/>
School: <http://www.physics.sjtu.edu.cn/>



PROJECT
95

Enantioselective Addition of Inactivated Alkenes

Contact Information:

Prof. Yongqiang Tu
Email: tuyq@sjtu.edu.cn

Project Description and Objectives:

Selective functionalization of the carbon–carbon double bond in olefins provides a tremendous number of fundamental transformations that hold widespread applications in organic synthesis and exert great impact on the development of organic chemistry. Transition metal catalysis is one of the most important tools to accurately forge chemical bonds in modern organic synthesis. Organocatalysis, a biomimetic catalyst, usually catalyzes with metal-free small organic molecules, is a relatively young research area that started to flourish at the beginning of this century. In this project, we will investigate the enantioselective addition reaction of inactivated alkenes enabled by transition metal/organocatalysis cooperative catalysis, resulting in successive multiple bond-forming events, further to form useful building blocks, existing extensively in bioactive molecules and pharmaceuticals.

Eligibility Requirements:

- > Basic knowledge of organic chemistry.
- > Motivation to work and with an interest in organic synthesis chemistry.
- > Majors in organic chemistry preferred.

Main Tasks:

- > Finish a research report.
- > Submit a paper to a conference or a journal as a co-author.

Website:

Lab: N/A
School: <http://scce.sjtu.edu.cn/en/>

PROJECT
96

Synthesis and Self-Assembly of Asymmetric Organic Cages

Contact Information:

Asso. Prof. Shaodong Zhang
Email: sdzhang@sjtu.edu.cn

Project Description and Objectives:

Unlike the Cross-linked Metal Organic Framework (MOF) and Covalent Organic Framework (COF) that cannot be processed once they are synthesized, discrete organic cages not only have well-defined intrinsic cavity, but also can be easily processed as they are solvent-soluble and can be melted. Moreover, depending on their interaction with guest molecules, organic cages can be used as a building block to construct guest-responsive supramolecular structures, providing a versatile platform for novel materials discovery. The aim of the project is to design organic cages with asymmetric geometry, which can self-assemble into various hierarchical superstructures with different superlattices. This can be realized by introducing different guest molecules into the cavity of those cages via specific host-guest chemistry.

Eligibility Requirements:

The successful candidates should be fluent in English and will need basic knowledge of organic chemistry, characterization techniques (NMR, Mass Spectroscopy, MALDI-TOF...), or crystallography.

Main Tasks:

Design, synthesis and characterization of precursors, and organic cages under the guidance of the postdocs or Ph.D. students in the group.

Website:

Lab: <https://thezhanggroup.sjtu.edu.cn/>
School: <http://scce.sjtu.edu.cn/en/>

PROJECT
97

Monitor the Tryptophan and Fluorescence through Fluorescence Spectroscopy

Contact Information:

Asso. Prof. Bei Ding
Email: bei.ding@sjtu.edu.cn

Project Description and Objectives:

Fibrillar amyloid proteins are known to be related to neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease and Amyotrophic Lateral Sclerosis (ALS). Recently, researchers have determined a novel corkscrew-like structure of a cytotoxic segment of an ALS-related protein superoxide dismutases 1 (SOD1) (PNAS, 2017, 114, 33). This five-month intern project will be focused on understanding how this corkscrew-like structure is formed. The student is expected to use fluorescence spectroscopy to monitor the tryptophan fluorescence during the aggregation process for the purpose of unveiling the mystery of this novel structure.

Eligibility Requirements:

- > Interest in physical chemistry or biological chemistry.

Main Tasks

- > Synthesize a short ALS peptide segment.
- > Use fluorescence spectroscopy to monitor the tryptophan fluorescence during the aggregation process.

Website

Lab: <http://scce.sjtu.edu.cn/en/jiaoshi.php?aid=475&c=3>
School: <http://scce.sjtu.edu.cn/en/>

PROJECT
98

Biomimetic Total Synthesis of Ergot Alkaloids

Contact Information:

Asso. Prof. Gang CHEN
Email: gchen2018@sjtu.edu.cn

Project Description and Objectives:

Ergot alkaloids are typical indole alkaloids with 3,4-fused ring, and natural or semi-synthetic ones were approved for treatment or relief of neurodegenerative diseases. Due to their unique structure and good biological activities, both the biosynthetic and total syntheses of these natural products were widely studied. Especially the development of transitional metal catalyzed reaction provided new synthetic strategies for the total syntheses, for example, Heck reaction, allylic reaction and C-H activation. In this project, we proposed the biomimetic strategy using the C-H activation and decarboxylative reaction. The key steps of synthesis of lysergic acid include indole C4-H olefination and intramolecular decarboxylative Giese reaction, a chiral route by asymmetric decarboxylative allylic reaction will also be investigated; similarly, indole C4-H alkylation followed by intramolecular decarboxylative coupling with alkyne provided the key precursor of agroclavine. The aim of this project is not only to provide another efficient route of ergot alkaloids with biomimetic way, but also to prepare lots of ergot alkaloids for the further medical chemistry studies.

Eligibility Requirements:

- > Major in chemistry, including chemistry & biochemistry, chemistry & chemical biology.

Main Tasks:

- > Learn about organic chemistry experiments and total synthesis.
- > Synthesize some structures by the established route.
- > Explore the following synthetic steps.

Website:

Lab: N/A
School: <http://scce.sjtu.edu.cn/en/jiaoshi.php?aid=502&c=2>

PROJECT
99

Microalgae and Ecosystem Sustainability

Contact Information:

Asso. Prof. Ji Li
Email: Liji81@sjtu.edu.cn

Project Description and Objectives:

Marine biology internships offers you the opportunity to learn how to become a marine biologist while getting experiences and skills in marine ecosystem research. In the midst of all global environmental challenges (melting ice caps, declining species, climate change, eutrophication, plastic pollution, yikes), marine biology and ecology is a field that is not only increasing with opportunities and positions, but also desperate for more people to join and find solution for the future. It quite literally, saves the world.

This internship is for students interested in marine science. The program includes lectures, lab training, field trips, and hands-on activities. This internship will give you the opportunity to gain hands-on experience in microalgae related marine ecological research, data collection, educational techniques and the inner workings of a marine biologist.

Eligibility Requirements:

- > Have a cumulative GPA of 3.0 or higher.

Main Tasks

- > Propose a novel design/application of microalgae in the scope of project.
- > Give two research presentations (a. references review; b. technical presentation).
- > Finish a research report in this project.

Website

Lab: <http://soo.sjtu.edu.cn/en/szTeachers/3638.html>
School: <http://soo.sjtu.edu.cn/en>

PROJECT
100

Genetic Analysis of the Arabidopsis Hippo Homolog SIK1 and SIK1-interacting Partners

Contact Information:

Prof. Qingqiu Gong
Email: gongqingqiu@sjtu.edu.cn; gongq2@gmail.com

Project Description and Objectives:

How organ size is controlled is a fundamental question in developmental biology. In animals, the Hippo pathway restricts cell proliferation and promotes apoptosis to negatively regulate organ size. Our lab had previously characterized the Arabidopsis protein kinase SIK1 and its scaffold protein MOB1 as the Hippo-Mats signaling circuit in plants. In order to establish a complete plant Hippo/SIK1 pathway, we carried out protein-protein interaction screens with SIK1-GFP plants and obtained many candidates. The objective of this project is to verify the genetic interactions between SIK1 and some of these candidates by generating double mutants and by doing subsequent genotype and phenotype analyses. The results will contribute to our understanding of plant organ size control, development, and yield.

Eligibility Requirements:

- > Undergraduate student (senior) major in Biological Sciences.

Main Tasks:

- > To generate double knock-out mutants by crossing or targeted genome editing (CRISPR-Cas).
- > To grow the mutants and verify the double mutants by genomic PCR and RT-PCR.
- > To observe and document the phenotypes of the double mutants.

Website:

Lab: https://www.researchgate.net/profile/Qingqiu_Gong?ev=prf_high
<https://scholar.google.com/citations?user=E1gLh-EAAAAJ&hl=en>
School: <http://life.sjtu.edu.cn/>

PROJECT
101

Assessment of Dopamine Neuron number in the Mouse Models of Parkinson's Disease

Contact Information:

Asso. Prof. Ilya A. Vinnikov
Email: i.vinnikov@sjtu.edu.cn

Project Description and Objectives:

Parkinson's disease is the most prevalent neurodegenerative movement disorder with tremor, rigidity, bradykinesia and postural instability. These symptoms develop upon progressive degeneration of dopaminergic neurons in the substantia nigra pars compacta. MicroRNAs are essential during the development of most tissues, including the dopaminergic system. The rapidly emerging field of microRNA has already suggested several molecular mechanisms relevant to the pathogenesis of PD. However, the comprehensive functional analysis of specific microRNAs in dopaminergic neurons is still missing.

The objective of the proposed project is to identify the physiological and pathophysiological functions of midbrain-expressed microRNAs in a neurodegenerative context. The project will involve counting of adult dopaminergic neurons in the in vivo models of Parkinson's disease. In particular, we will implement genetically engineered mice with over-expression of Dicer, the endonuclease crucial for microRNA maturation. The data generated as a result of this project might aid both neurologists and researchers studying mechanisms of neurodegenerative diseases.

Eligibility Requirements:

Background knowledge in image analysis, computer sciences, molecular biology, biochemistry or neuroscience is an asset.

Main Tasks:

Image analysis and neuronal number quantification.

Website:

Lab: <http://vinnikov.science>
School: <http://life.sjtu.edu.cn/>

PROJECT
102

Production of Autophagy Regulating Peptides by Yeast

Contact Information:

Prof. Zhiping Xie
Email: zxie@sjtu.edu.cn , cnxzpum@gmail.com

Project Description and Objectives:

When too much damage and waste materials accumulate in our cells, they may undergo programmed cell death, or even worse, mutate to become cancer cells. Normally, large structures like dysfunctional mitochondria or protein aggregates need to be cleared by the autophagy/lysosome system. This project aims to produce autophagy regulating peptides by budding yeast. Our research will help provide safe and economical peptide-based medicine for the society.

Eligibility Requirements:

Applicants are expected to possess a good understanding of basic biochemistry and cell biology concepts.

Main Tasks:

This project involves working with yeast and human cells. Participants will learn to design and construct plasmids and yeast strains to produce peptides that can cross the cell membrane of recipient cells and regulate autophagy. The efficacy of the peptides will be accessed using a variety of biochemical assays and live cell imaging techniques. Based on initial results and further optimization of the design, expression and purification of the peptides will be performed.

Website:

Lab: <http://cbi.sjtu.edu.cn/En/Data/List/ZhipingXie>
School: <http://life.sjtu.edu.cn/>

PROJECT
103

Molecular Mechanisms Controlling Inflorescence and Spikelet Development in Rice and Barley

Contact Information:

Prof. Dabing Zhang
Email: zhangdb@sjtu.edu.cn

Project Description and Objectives:

When too much damage and waste materials accumulate in our cells, they may undergo programmed cell death, or even worse, mutate to become cancer cells. Normally, large structures like dysfunctional mitochondria or protein aggregates need to be cleared by the autophagy/lysosome system. This project aims to produce autophagy regulating peptides by budding yeast. Our research will help provide safe and economical peptide-based medicine for the society.

Eligibility Requirements:

Applicants are expected to possess good understanding of basic biochemistry and cell biology concepts.

Main Tasks:

This project involves working with yeast and human cells. Participants will learn to design and construct plasmids and yeast strains to produce peptides that can cross the cell membrane of recipient cells and regulate autophagy. The efficacy of the peptides will be accessed using a variety of biochemical assays and live cell imaging techniques. Based on initial results and further optimization of the design, expression and purification of the peptides will be performed.

Website:

Lab: <http://zhanglab.sjtu.edu.cn/Default.aspx>
School: <http://life.sjtu.edu.cn/>

PROJECT
104

Cloning and Functional Characterization of Rice Male Sterile Genes

Contact Information:

Prof. Dabing Zhang
Email: zhangdb@sjtu.edu.cn

Project Description and Objectives:

The life cycle of flowering plants alternates between diploid sporophyte and haploid gametophyte generations. Male gametophytes develop in the anther compartment of the stamen within the flower which requires cooperative functional interactions between gametophytic and sporophytic tissues. The male reproductive development is highly complicated, involving numerous biological events, including cell division, differentiation and degeneration of somatic tissues consisting of four concentric cell layers surrounding and supporting reproductive cells as they form mature pollen grains through meiosis and mitosis. To understand the mechanism of plant male reproduction, we are combining systematic biology (genomics, transcriptomics, proteomics, metabonomics) with other approaches such as genetics, cell biology, biochemistry, and structural biology to elucidate the molecular mechanisms underlying each biological event of male reproduction.

Eligibility Requirements:

- > Applicants should have basic knowledge of biology.
- > Experience in biological research would be an advantage.

Main Tasks:

The student will be involved in all stages of the project:

- > Design experimental scheme
- > Perform experiment
- > Analyze experimental results
- > Write the experiment report
- > Finish a research report
- > Give two presentations: one literature review and one on research progress.

Website:

Lab: <http://zhanglab.sjtu.edu.cn/Default.aspx>
School: <http://202.120.63.177:8884/english/>

PROJECT
105

Molecular Characterization of GMOs

Contact Information:

Prof. Dabing Zhang
Email: zhangdb@sjtu.edu.cn

Project Description and Objectives:

As more and more transgenic crops like transgenic maize and soybean have been approved and consumed as foods and feed, more and more people have become concerned about the safety of transgenic organisms. The molecular characterization of transgenic organisms is the basis for assessing the safety of transgenic organisms. We are developing new detection methods to identify changes that occur at the genomic, transcriptomics, proteomics, and metabolic levels. We are also currently comparing changes between transgenic lines and non-transgenic control lines, as well as between transgenic lines and conventional cultivated lines. This research will lay the foundation for the safety assessment of GMOs.

Eligibility Requirements:

- > Applicants should have basic knowledge of biology.
- > Experience in biological research would be preferred.

Main Tasks:

The student will be involved in all stages of the project:

- > Design experimental scheme.
- > Perform experiment.
- > Analyze experimental results.
- > Write the experiment report.
- > Finish a research report.
- > Give two presentations: one literature review and one on research progress.

Website:

Lab: <http://zhanglab.sjtu.edu.cn/Default.aspx>
School: <http://202.120.63.177:8884/english/>

PROJECT
106

Research of Genomics Analysis and Genetic Mechanism of Complex Diseases

Contact Information:

Prof. Yongyong Shi
Email: shiyongyong@vip.163.com

Project Description and Objectives:

This lab is focusing on developing new analytical tools for genetic studies, and discovering new genetic mechanisms of cancers, mental disorders, heart diseases and endocrine diseases. The major researching interests include: (1) development of new experimental methods and data analysis algorithms in molecular genetics; (2) Identification of common/rare variants associated with complex diseases such as schizophrenia by genome-wide association studies; (3) perform in vivo and in vitro functional studies for novel mutations to reveal their exact pathogenic mechanisms. (4) development of the correlated new drug and/or minimally invasive diagnosis for target therapies. Through the above works, we aim to identify risk genes, pathways and mechanisms of drug action for complex diseases and contribute to the precision medicine in the near future.

Eligibility Requirements:

- > Basic knowledge of genetics, statistics and molecular biology.

Main Tasks:

The student will be involved in all stages of the project:

- > Bioinformatics
- > Chip/sequencing data analysis
- > in vivo/vitro functional experiments

Website:

Lab: www.bio-x.cn
School: life.sjtu.edu.cn

PROJECT
107

Developmental regulation mechanism of female germline stem cells development

Contact Information:

Prof. Ji Wu
jiwu@sjtu.edu.cn

Project Description and Objectives:

In recent years, the global infertility has increased year by year, with an incidence rate of 10-15%. How to restore (or repair) ovarian function is the key to the treatment of ovarian dysfunctional infertility. The discovery of adult mammalian and human female germline stem cells has brought new opportunities for the repair of ovarian function and its mechanism. This project mainly takes female germline stem cells as the research object to study the regulatory mechanism of female germline stem cell development. This project will provide a basis for the diagnosis and treatment of oogenesis disorders and other related diseases.

Eligibility Requirements:

- > Theoretical analysis ability, logical thinking ability, teamwork ability.
- > Interested in reproductive biology and stem cell biology.

Main Tasks:

- > Midterm technical presentation.
- > Final project report.

Website:

Lab: <http://www.bio-x.cn/>
School: <http://www.bio-x.cn/>

PROJECT
108

The study on the pathogenesis of depression

Contact Information:

Asso.Prof. Weidong Li
Email: liwd@sjtu.edu.cn

Project Description and Objectives:

There is an increasing risk of mental disorders, such as acute stress disorder (ASD), post-traumatic stress disorder (PTSD) and depression among survivors who were trapped in rubble during earthquake. Such long-term impact of a single acute restraint stress has not been extensively explored. Our studies found subjected mice to 24-hour-restraint to simulate the trapping episode, and also we discovered a potential target gene LHPP which play a critical role in depression. Lateral habenula nucleus (LHb), the central of Amygdala (CeA) and anterior cingulate cortex (ACC) has been reported associated with depression. In this project, we will explore the neuron function in LHb, CeA and ACC of depressive-like mice induced by acute stress (24-hour-restraint) and LHPP knock-out using multi-channel recording, voltage sensitive detection imagine, Transcranial magnetic stimulation and whole cell recording. This project may provide a clue for the study of pathogenesis of depression.

Eligibility Requirements:

- > Understanding of lab safety.
- > Interested students should have basic knowledge of Neurophysiology and signal processing.

Main Tasks:

- > Finish a research report.
- > Give two research presentations.

Website:

Lab: <https://lwdlab.sjtu.edu.cn/>
School: <https://life.sjtu.edu.cn/bio-x.cn>



PROJECT

109

Characteristics of Air Pollutants in Plantation Stands along the Urban-Rural Gradient in Shanghai

Contact Information:

Prof. Chunjiang Liu
Email: chjliu@sjtu.edu.cn

Project Description and Objectives:

There are three observation sites for monitoring air pollutants (PM2.5, PM10, CO, NO₂, SO₂ and O₃) in plantation stands from the city center (Zhongshan Park), to the out-loop highway (Jinhai Park), and to the rural area (Chongming Island) in Shanghai. With this data, the concentrations of air pollutants and the variation along the urban-rural gradient will be analyzed and compared with those in other parts of Shanghai. The results would show what extent the concentrations of the air pollutants that are reduced to inside different plantation stands.

Eligibility Requirements:

- > Basic or brief knowledge of biology, environmental science, or ecology.
- > Basic statistics knowledge.
- > A Doubt-and-question mind.
- > Proper writing skills.

Main Tasks:

- > Checking the equipment and machines in the stations.
- > Analyzing the data of the air pollutants at the three monitoring sites.
- > Comparing the results with those obtained from the other parts of Shanghai.

Website:

Lab: <http://www.agri.sjtu.edu.cn/Data/View/3255>
School: <http://www.agri.sjtu.edu.cn/En/Default>

PROJECT

110

Particulate Coagulation Effect on Leaf Surface of the Typical Tree Species in Shanghai

Contact Information:

Asso. Prof. Shan Yin
Email: yinshan@sjtu.edu.cn

Project Description and Objectives:

Atmospheric particulate matter has become the primary air pollutant in China's cities and the use of urban greening tree species to absorb the particulate matter is one of the effective ways to alleviate urban air pollution. The study focuses on the assumptions of three coagulation effects on the leaf, including the wind coagulation, the vapor phase coagulation, and the thermal diffusion coagulation.

Through the above experiments, we will explore the law of condensation and deposition of particulate matters at the interface between the atmosphere and plant leaves under dry sedimentation conditions, filling the gap between vegetation and atmospheric research, and laying a foundation for the mechanism of plant-particle retention. The study will provide a scientific basis to build high efficiency and dust prevention of urban forests and green spaces.

Eligibility Requirements:

- > With basic or brief knowledge of Environment or Ecology.
- > With strong perseverance.
- > With doubt-and-question mind.
- > Punctuality.
- > Able to reflect from experiments and conclusions.
- > With proper writing skills.

Main Tasks:

- > Finish experiment assigned.
- > Give research presentations.
- > Compose one science paper.

Website:

Lab: <http://www.agri.sjtu.edu.cn/Data/View/3255>
School: <http://www.agri.sjtu.edu.cn/En/Default>

PROJECT

111

Phyllo Sphere Microbial Communities in Shanghai Region: Responses to Typical Tree Species and Urban-rural Gradient

Contact Information:

Asso. Prof. Nan Hui

Email: nan.hui@sjtu.edu.cn

Project Description and Objectives:

Tree phyllo sphere serves as an independent micro-environment, providing habitat for microorganisms such as bacteria, fungi, and archaea. In the field of urban ecology, phyllo sphere microbial community diversity and composition draw increasing attention. These microorganisms not only contribute to plant growth, metabolism, and protect their hosts from pathogenies, but also are responsible for many ecosystem services and functions in an urban environment, such as degrading and adsorbing atmosphere pollutants, maintaining biodiversity, etc. However, our current understanding of phyllo sphere microbes among different tree species remains relatively poor in urban areas. To screen phyllo sphere bacterial and fungal communities in high resolution, we will employ high-throughput DNA sequencing and characterize 16s (bacteria) and ITS (fungi) ribosomal rRNA gene. We will also quantify microbial population based on the same ribosomal gene utilizing qPCR. Our results will provide city managers with insights in tree selection in urban green space development which may improve the efficiency of atmosphere pollutant degradation.

Eligibility Requirements:

- > Interests in academic works.
- > Basics in molecular technology, ecology and statistics.
- > Good communication skills in English.

Main Tasks:

- > Tree leaf sampling and physical-chemical analyses.
- > Total DNA extraction, ribosomal rRNA gene amplification, qPCR and Illumina Miseq sequencing.
- > Bioinformatics and statistical analysis – introduction to R, mothur and JMP.

Website:

Lab: <http://www.agri.sjtu.edu.cn/Data/View/3255>

School: <http://www.agri.sjtu.edu.cn/En/Default>

PROJECT

112

Plant Synthetic Biology Techniques for Natural Products from Medical Plants

Contact Information:

Prof. Kexuan Tang

Email: kxtang@sjtu.edu.cn or kxtang1@163.com

Asso. Prof. Qifang Pan

Email: panqf@sjtu.edu.cn

Project Description and Objectives:

Plant synthetic biology uses enabling approaches from engineering and plants as platforms to produce self-sustaining and photosynthetic driven traits and bio-production of natural products. Chinese traditional medical plants produce a rich and diverse array of natural products, such as artemisinin from *Artemisia annua*, paclitaxel from *Taxus chinensis*, santalol from *Santalum album*, and so on. Our project aims to develop plant synthetic biology techniques for natural products, including the design and construction of new biological parts, devices, and systems and the re-design of existing natural biological systems.

Eligibility Requirements:

- > Basic knowledge of molecular biology.
- > Preferred: Experience in plant biotechnology.

Main Tasks:

- > Clone a functional structural gene, construct the vector and express in plant or yeast system.
- > Finish a research report.
- > Give one presentation (Experiment Design, Progress & Results).

Website:

Lab: N/A

School: <http://www.agri.sjtu.edu.cn/eng/>

PROJECT
113

Viticulture and Enology

Contact Information:

Dr. Yu Gao
Email: yugao@sjtu.edu.cn

Project Description and Objectives:

This project includes all the processes in the standard winemaking procedure, the students who joined the project will participate each step to gain the experiences, including the viticultural practice, grapevine physiology and electrophysiology, ripening analysis before the harvest, berry harvest, selection and crushing, yeast inoculation and start of fermentation, wine stabilization and clarification, etc. Furthermore, the students will also be trained how to taste the wine professionally.

Eligibility Requirements:

Basic knowledge of plant science and food science.

Main Tasks:

Complete a small scale wine fermentation process, learn the necessary analytical skills of wine chemistry and wine sensory evaluation.

Website:

Lab: cve.sjtu.edu.cn
School: <http://www.agri.sjtu.edu.cn/En>

PROJECT
114

Functional analysis of proteins interacting with the key factor of light signaling pathway

Contact Information:

Asso. Prof. Ruohe Yin
Email: ruohe.yin@sjtu.edu.cn

Project Description and Objectives:

Light is a key environmental factor affecting plant growth and development. Photoreceptor can sense light signals, triggers downstream signal transduction pathways, which regulate many physiological processes in plants. The objective of this project is to screening the interacting protein of the important factor in light signal transduction pathway, and investigate the function of the interacting proteins. The results will contribute to our further understanding in light regulating plant growth and development.

Eligibility Requirements:

- > Applicants should have basic knowledge of genetics, molecular biology and basic biochemistry.
- > Experience in biological research would be preferred.
- > Able to document experimental results and draw conclusions.

Main Tasks:

- > To perform protein-protein interaction assays with Y2H, BiFC etc..
- > To grow and verify the transgenic plant lines and mutants by genomic PCR, RT-PCR and western-blot.
- > To observe and document the phenotypes of the transgenic lines and mutants.
- > To analyze protein subcellular localization by confocal microscope.

Website:

Lab: <https://rhyin.sjtu.edu.cn/>
<http://www.agri.sjtu.edu.cn/En/Data/View/4091>
School: <http://www.agri.sjtu.edu.cn/En/Default>



PHARMACY

PROJECT

115

Xanthomonas Effectors for Plant Immunity

Contact Information:

Prof. Gongyou Chen

Email: gyouchen@sjtu.edu.cn

Project Description and Objectives:

To know how Xanthomonas effectors trigger plant immunity (ETI) and susceptibility (ETS) via their targets in plants and then to generate durable broad-spectrum resistant plants against Xanthomonas infection. Our working systems include not only Xanthomonas-rice pathosystems, but also other Xanthomonas-plant pathosystems as well. Currently we have generated a effector-free strain of a model race PXO99A which may elucidate PTI, ETI and ETS.

Eligibility Requirements:

> Graduates for Master or Ph D degrees, who take similar research projects, are welcome.

Main Tasks:

- > Try to understand what is (are) the core effector(s) of Xanthomonas oryzae for water-soaking in rice
- > Try to understand what are the core effectors of Xanthomonas oryzae for basic pathogenicity in rice
- > Try to understand what Xanthomonas core effectors and their targets in rice.

Website:

Lab: <https://researchgate.net/profile/Gongyou-Chen>

School: www.agri.sjtu.edu.cn/Data/View/2270

PROJECT

116

Introduction to Biotechnology and Antibody Medicine

Contact Information:

Prof. Dawei Li

Email: daweili@sjtu.edu.cn

Project Description and Objectives:

This general project aims at familiarizing students with basic theory and genetic engineering trend in biomedicine using up-to-date techniques.

Eligibility Requirements:

Level 1: Students must have passed basic biology classes.

Level 2: Student must have passed basic molecular cell biology.

Level 3: Students must have biology laboratory experience.

Main Tasks:

(Recommended for level 1 or level2 students)

- > Understand the goals of your projects (dry-lab)
 - This general project aims at familiarizing students with basic theory and genetic engineering trend in biomedicine using up-to-date techniques. Classes will be conducted with a brief lecture of related therapeutic theory and key notes in practice before each laboratory section.
- > Hands-on experimental training (wet-lab)
 - This project includes basic gene design, cloning and testing to finish a basic but complete hands-on project to produce recombinant antibodies and proteins with techniques commonly used in R&D of biomedicine.
- > Report-Analyze-Present your data in PPT format.

Website:

Lab: <http://lilab-pharmacy.sjtu.edu.cn/EN/Default.aspx>

School: <http://pharm.sjtu.edu.cn/>

PROJECT
117

R&D in Basic Antibody Medicine and Antibody Engineering

Contact Information:

Prof. Dawei Li
Email: daweilisjtu.edu.cn

Project Description and Objectives:

The experience in this specialized project is in hot demand- from biotech startups, research institutes and established biopharmaceutical companies alike.

Eligibility Requirements:

- Level 1: Students must have passed basic biology classes.
- Level 2: student must have passed basic molecular cell biology.
- Level 3: Students must have biology laboratory experience.

Main Tasks:

- > Understand goals of your projects (dry-lab)
The experience in this specialized project is in hot demand from biotech startups, research institutes and established biopharmaceutical companies alike. This project will focus on various current aspects in the research and development of antibody medicine, including engineering designs.
- > Hands-on experimental training (wet-lab)
This project focuses on the monoclonal or bi-specific antibody generation and manipulation as well as tumor cell culture and antitumor testing.
- > Report-Analyze-Present your data in PPT format.

Website:

Lab: <http://lilab-pharmacy.sjtu.edu.cn/EN/Default.aspx>
School: <http://pharm.sjtu.edu.cn/>

PROJECT
118

Practice and Training Base for Biopharmaceuticals

Contact Information:

Prof. Jianwei Zhu
Email: jianweiz@sjtu.edu.cn

Project Description and Objectives:

Antibodies have been a rapidly growing field as it has demonstrated an outstanding outcome in clinical treatment for cancer therapy. We have developed a novel platform 'Bispecific Antibody by Protein Trans-splicing, BAPTS' in our lab. In this project, we will apply this technology platform to construct novel bispecific antibodies and bispecific antibody drug conjugates (bsADCs) and bispecific immunotoxins. This research will provide promising biopharmaceutics for clinical drugs.

Eligibility Requirements:

Basic knowledge and experience in molecular biology and cell culture.

Main Tasks:

- > Construct bispecific antibodies, bsADCs and bispecific immunotoxins.
- > Finish a research report.

Website:

Lab: <http://www.sjtumabcenter.org/>
School: <http://pharm.sjtu.edu.cn/>

PROJECT
119

Discovery, Synthesis and Biological Evaluation of Mitochondrial Targeting Drugs

Contact Information:

Prof. Lei Fu
Email: leifu@sjtu.edu.cn

Project Description and Objectives:

Mitochondria are essential organelle in the cells. The research on mitochondria-targeting drugs is one of the hottest study fields. In our previous research, we discovered a lead compound, TPP-thiazole, which can target Mitochondria and mitigate metabolic syndrome of aging. In this project, we will discover mitochondria-targeting drugs from traditional Chinese medicine or through chemical synthesis, and then evaluate their biological activities.

Eligibility Requirements:

Basic knowledge on biology or chemistry.

Main Tasks:

Extraction of active components form traditional Chinese medicine; Chemical synthesis of compounds; Cellular biological experiments.

Website:

Lab: N/A
School: <http://pharm.sjtu.edu.cn/en>

PROJECT
120

Chemical Synthesis and Bioactivity Investigation of Glycosylated Protein hG-CSF

Contact Information:

Dr. Dan Lv
Email: ludan@sjtu.edu.cn

Project Description and Objectives:

Human granulocyte colony-stimulating factor (hG-CSF) is an important glycoprotein cytokine. Chemical synthesis of glycoprotein takes great advantage over biological expression with precise glycosylation sites and glycan structures. This project will fully synthesize hG-CSF glycoproteins for biological evaluation.

Eligibility Requirements:

Basic knowledge on chemistry.

Main Tasks:

Chemical synthesis of peptides, carbohydrates and protein.

Website:

Lab: N/A
School: <http://pharm.sjtu.edu.cn/en>

PROJECT
121

Design, Synthesis and Biological Evaluation of KRAS-targeting Antitumor Drugs

Contact Information:

Asso. Prof. Faqin Jiang
Email: jfq2008@sjtu.edu.cn

Project Description and Objectives:

KRAS has emerged as a promising target in the treatment of solid tumors. However clinically viable inhibitors have yet to be identified. We will design and synthesize KRAS-targeting inhibitors based on the structure of this protein, and evaluate their antitumor activities.

Eligibility Requirements:

Basic knowledge on chemistry or biology.

Main Tasks:

Chemical synthesis of compounds; biological experiments.

Website:

Lab: N/A
School: <http://pharm.sjtu.edu.cn/en>

PROJECT
122

Practice and Training of Biotechnology and Antibody Medicine

Contact Information:

Asso. Prof. Feng Qian
Email: fengqian@sjtu.edu.cn

Project Description and Objectives:

Antibodies are ideal for therapeutic interventions in part owing to their high specificity, high tolerance, long half-life and amenability to manipulation and antibody-based therapeutics is at the center stage of drug discovery with antibodies being the fastest growing class of drugs. In this project, we will prepare detection antibodies and therapeutic antibodies using mouse hybridoma technology, phage display technology, antibody humanization technology and engineered cell expression antibody technology. We also plan to develop new antibody drugs that regulate inflammation and control tumors, and prepare new CAR-T cells to treat tumors and immune diseases.

Eligibility Requirements:

Basic biology and basic molecular cell biology.

Main Tasks:

- > Understand goals of the project.
- > Generate monoclonal or bi-specific antibody, manipulate tumor cell culture and do antitumor testing.
- > Report-Analyze-Present your data in PPT format.

Website:

Lab: <https://pharm.sjtu.edu.cn/ktz/2811.html>
School: <https://pharm.sjtu.edu.cn/>



PROJECT

123

Genetic Toxicity Evaluation of Human Induced Hepatocytes (hiHeps) Induced by Aristolochic Acid

Contact Information:

Asso. Prof. Yang Luan
Email: yluan@sjtu.edu.cn

Project Description and Objectives:

Be familiar with the lab, attend and pass the training of new staff, read and memorize the rules and regulations.

Read literature on aristolochic acid and human induced hepatocytes and be familiar with cell culture and passage methods.

Study the genetic toxicity evaluation method and routine combination experiment. It includes the principle, operation, observation and judgment of each experiment.

The cells were treated with aristolochic acid. According to the guiding principles and literatures, the appropriate toxic dose was found through preliminary experiments for the next formal experiment, so as to avoid false positive results caused by excessive toxicity.

According to the pre-experimental dose, a formal experiment was conducted. Get the results of all experiments, analyze the results through statistics and biology, write conclusions and write experimental reports and summaries.

Eligibility Requirements:

Fundamentals of chemistry and biology.

Main Tasks:

Understand the principle of genetic toxicity evaluation.

Website:

Lab: N/A
School: <https://www.shsmu.edu.cn/sph-en/>

PROJECT

124

Discovery of Relative Biomarkers Using Modern Analytical and Bioinformatics Methods

Contact Information:

Research Assistant Juanjuan Ren
E-mail: juanerren@126.com

Project Description and Objectives:

Schizophrenia and bipolar disorders are severe mental illnesses, which are often accompanied by high mortality rates, comorbidity and economic burdens that result from suicide and other syndromes. Currently, the diagnosis of severe mental illness remains subjective because of its complex spectrum of symptoms. It is urgent to identify biomarkers for their diagnosis. This program is mainly about the discovery of relative biomarkers using modern analytical and bioinformatics methods.

Eligibility Requirements:

If you know about Chinese society, culture, tradition and language, it would be preferred. It will help you grow faster and live a more interesting life during the training period in China. Simple Chinese is preferred, but not required.

Main Tasks:

- > Participate in a monthly group seminar.
- > Learn the operation of analytical instruments such as LC-MS and electrochemical analyzer.

Website:

Lab: <http://tsqs.cn>
School: <https://www.smhc.org.cn/English/channels/478.html>

PROJECT
125

Study on Pathogenic Genes of Bipolar Disorder in Two-phase Family of Chinese Han Population with the Large Sample Using a Family Cohort Study and Study in MDD Animals

Contact Information:

Research Assistant Hongmei Liu
E-mail: meijiok@163.com

Project Description and Objectives:

Our research focuses on bipolar disorders (BD) and major depressive disorders (MDD). At present, there are few reports of foreign bipolar disorder families and the results are not consistent. There is no research report on the large sample family of Chinese Han population in China. Therefore, it is necessary to expand the family sample size and combine with new genetic research methods in the Han population. Thus, we intend to find out the pathogenic genes of bipolar disorder by collecting the two-phase family of Chinese Han population with the large sample using a family cohort study design, combined with the new generation of high-throughput sequencing technology and Whole Genome Sequencing (WGS), Proteomics, bioinformatics analysis, etc., which is expected to be clarified at the genetic level.

Another research project is about MDD, which is a serious chronic mental disease with high morbidity, high recurrence rate, high suicide rate and high disability. We intend to research the role of transcription factor Nr4a2 played in the mechanism of impaired working memory in the brain and to explore the effective intervention for cognitive dysfunction of depression disorders by adopting male C57BL/6 mice to establish the chronic unpredictable mild stress animal model of depression.

Eligibility Requirements:

If you know about Chinese society, culture, tradition and language, it would be preferred. It will help you grow faster and live a more interesting life during the training period in China. Simple Chinese is preferred, but not required.

Main Tasks:

- > Help to understand the mechanism of MDD and BD.
- > Close contact and observation of clinical patients of MDD and BD.
- > Understanding the process and operation of clinical research.
- > Learning the model preparation, research methods and research steps for animal research.

Website:

Lab: <http://tsqs.cn>
School: <https://www.smhc.org.cn/English/channels/478.html>

PROJECT
126

Determination of Targeted Metabolomics of Amino Acid, Short-Chain Fatty Acid, Neurotransmitter and Determination of Psychoactive Drug Substance in Hair by LC-MS/MS

Contact Information

Research Assistant Xiujia Sun
Email: sxj013@163.com

Project Description and Objectives:

This research is about Chromatography analysis in biology. One direction that can be taken is through the determination of targeted metabolomics of amino acids, short-chain fatty acids, neurotransmitters, etc. Targeted metabolomics is a quantitative method for the characterization and quantitation analysis of targeted metabolic compounds in organisms. It offers relative or absolute quantitation results of targeted metabolomics. The absolute quantitation results are received through the use of an internal standard. The targeted metabolomics technology has an advantage of high specificity and accuracy. Thus, this method has been widely used to analyze and compare multiple targeted metabolites under different physiological states.

Another direction is the determination of psychoactive drug substance in hair by LC-MS/MS.

Eligibility Requirements:

If you know about Chinese society, culture, tradition and language, it would be best. It will help you grow faster and live a more interesting life during the training period in China. Simple Chinese is preferred, but not required.

Main Tasks:

- > Participate in the analyzation of biological samples of Amino acid by LC-MS/MS.
- > Participate in the analyzation of biological samples of Neurotransmitter by LC-MS/MS.
- > Participate in the analyzation of drugs in hair by LC-MS/MS.
- > Take part in weekly seminars and do some paperwork.

Website:

Lab: <http://tsqs.cn>
School: <https://www.smhc.org.cn/English/channels/478.html>

PROJECT
127

The Effect on Awareness Rate of Mental Health Knowledge in Shanghai Community Residents

Contact Information:

Research Assistant Ping Jiang
E-mail: jiangping413@126.com

Project Description and Objectives:

This research is about science communication in mental health and other medical fields. One program is the Effect on Awareness Rate of Mental Health Knowledge or other medical knowledge (regulating smoking, osteoporosis) in community residents and remote audiences online. Another program is Organizing Foreign Volunteers (from more than 5 countries: Russian, US, Turkey, Burma, Pakistan.....) to Participate in Community Science Communication Services in Shanghai with Talk Show. These new shows in Science Communication are welcomed by both foreign volunteers and resident. The research objective is improving the medical scientific literacy in Chinese with international cooperation. Papers in this field are being written in English and Chinese.

Eligibility Requirements:

If you know something about Chinese society, culture, tradition and language, it would be preferred. It will help you grow faster and live a more interesting life during the training period in China. Simple Chinese is preferred, but not needed.

Main Tasks:

- > Participate in 1-2 community popularization science activities with their mentor
- > Take part in weekly seminars and do some paperwork
- > Try to apply a small program in science popularization with the help of their mentor
- > Take part in weekly seminars and do some paper works.

Website:

Lab: <http://tsqs.cn>
School: <https://www.smhc.org.cn/English/channels/478.html>

PROJECT
128

A Histological Study for Acute Stress Affecting Sucrose Self-Administration

Contact Information:

Asso. Prof. Tifei Yuan
Email: ytf0707@126.com

Project Description and Objectives:

Acute stress-induced relapse has been widely verified in clinical studies and animal experiments, but it remains unclear that the effect of acute stress on reinstatement behavior after natural reward (sucrose solution) withdrawal, and its mechanism remains to be investigated. In our previous result, we found that acute stress may affect the sucrose reinstatement. In this project, we will conduct sucrose self-administration (SA) to establish a sucrose-seeking model in mice. We will focus on the differences between the two groups that received acute stress or not before reinstatement test and also search for regions that respond to this acute stress and thus have an impact on the reinstatement of sucrose SA.

Eligibility Requirements:

- > Fluent English writing and speaking.
- > Undergraduate student of biology, neuroscience, or medicine.
- > Animal behavior experiment experience.

Main Tasks:

- > Perform experiments, analyze experiments, and write a research report.
- > Give a research presentation: technical presentation.

Website:

Lab: <http://tfyuan-lab.strikingly.com>
School: Shanghai Jiao Tong University

PROJECT
129

The Neural Circuits for Reward and Aversive Neural Ensembles in the Nucleus Accumbens

Contact Information:

Asso. Prof. Tifei Yuan
Email: ytf0707@126.com

Project Description and Objectives:

The nucleus accumbens is the key brain structure for addiction. Exposure to addictive drugs causes an increase in dopamine release in the brain, leading to neuronal activation and changes in synaptic plasticity in the nucleus accumbens, which are considered as an important mechanism of addiction. However, due to the heterogeneity of the nucleus accumbens, different neural subpopulations respond to rewarding or aversive stimuli differently. It has not been tested whether these two subpopulations of neurons have a different neural circuit. This project intends to utilize retrograde tracer to label the subpopulation of neurons activated by morphine, investigate the neural circuit, and provide morphology evidence for the neural basis of drug addiction. This project is important for elaborating the circuit basis of addiction in the nucleus accumbens and it is also important for exploring new targets and approaches for addiction treatment.

Eligibility Requirements:

- > Fluency English writing and speaking.
- > Undergraduate student of biology, neuroscience, or medicine.
- > Animal behavior experiment experience.

Main Tasks:

- > Perform experiments, analyze experimental and write a research report.
- > Give a research presentation: technical presentation.

Website:

Lab: <http://tfyuan-lab.strikingly.com>
School: Shanghai Jiao Tong University

PROJECT
130

Quality Control Improvement Program of Clinical Laboratory

Contact Information:

Asso. Prof. Huiming Sheng
Email: SHM2783@shtrhospital.com

Project Description and Objectives:

The Clinical Laboratory is one of the key departments of Tongren Hospital. There are 7 sub-groups including immunology, biochemistry, microbiology, molecular biology, etc. More than 420 projects have been carried out. There is 1 master's supervisor, 1 post-doctor, and there are also 11 masters and doctors. There have been several Research projects hosted including the National Natural Science Foundation of China and more than 10 municipal-level or district-level projects. We have more than 100 papers in SCI or Chinese journals published, and one patent has been approved.

This program is going to promote international cooperation and communication as well as share experiences in improving quality control of the clinical laboratory. Through this program, students will have a deeper understanding of quality control and laboratory management.

Eligibility Requirements:

- > Willing to learn about quality control of the clinical laboratory.
- > Interested in experimental operations.

Main Tasks:

- > Learn about mechanism and protocols of various projects carried out by clinical laboratory.
- > Understand the concept of quality control and learn about operations and precautions.

Website:

Lab: <https://www.shtrhospital.com/index.aspx>
School: N/A

PROJECT
131

Application of IL-38 in Precise Target Therapy of Colorectal Cancer based on Single Cell Analysis and Clinicopathological Study

Contact Information:

Prof. Kun Tao
Email: taokun20119@163.com

Project Description and Objectives:

The application of IL-38 is the precise target therapy of colorectal cancer based on single cell analysis and clinic pathological study. In this study, we will start with the single cell analysis of colorectal cancer cells and tissue samples and explore the value of IL-38 in the target treatment of colorectal cancer by cell culture, RT-PCR, Western Blot and other methods.

Eligibility Requirements:

Students should master some experimental techniques such as cell culture, tissue preparation, immunohistochemistry, FISH, RT-PCR, Western blot and so on.

Main Tasks:

Starting with cell culture, protein extraction, gene isolation, purification and identification, protein localization and so on, we can help students master the commonly used experimental methods and skills in pathological research. Based on this, students will have an overall grasp of the application and significance of molecular biology methods. What's more, we will provide a variety of experimental materials for students to design and prepare experiments on their own, so as to cultivate independent scientific research ability.

Website:

Lab: <http://blk.shtrhospital.com>
School: <http://www.shtrhospital.com>

PROJECT
132

Mechanisms of Long Non-coding RNA FENDRR Affecting Metastasis of Colon Cancer by Regulating PBXIP1 Expression

Contact Information:

Prof. Kun Tao
Email: taokun20119@163.com

Project Description and Objectives:

Mechanisms of long non-coding RNA FENDRR affect the metastasis of colon cancer by regulating PBXIP1 expression. In this study, we will study the changes of FENDRR and PBXIP1 gene and protein expression in colon cancer cell lines and fresh tissues and the changes of invasiveness of colon cancer cell lines before and after gene knockout, so as to reveal the relationship between FENDRR and PBXIP1 and the mechanism of colon cancer metastasis.

Eligibility Requirements:

Students should master some experimental techniques such as cell culture, tissue preparation, immunohistochemistry, FISH, RT-PCR, Western blot and so on.

Main Tasks:

Starting with cell culture, protein extraction, gene isolation, purification and identification, protein localization and so on, we can help students master the commonly used experimental methods and skills in pathological research. Based on this, students will have an overall grasp of the application and significance of molecular biology methods. What's more, we will provide a variety of experimental materials for students to design and prepare experiments on their own, so as to cultivate independent scientific research ability.

Website:

Lab: <http://blk.shtrhospital.com>
School: <http://www.shtrhospital.com>

PROJECT
133

Application of IL-38 in Precise Target Therapy of Colorectal Cancer based on Single Cell Analysis and Clinicopathological Study

Contact Information:

Prof. Yongchun Yu
Email: yyc2166@sjtu.edu.cn

Project Description and Objectives:

Ferroptosis is a type of programmed cell death which is tightly associated with cell metabolism. Overload of lipid ROS would lead to cell ferroptosis. However, the ferroptosis status of cells and whether ferroptosis inducing could be used as a tumor treatment strategy in lung cancer remains to be further investigated. Our laboratory will search for target genes and target proteins related to ferroptosis through high-throughput combined bioinformatics methods and we will explore relevant mechanisms in cell lines and primary cells and finally verify the conclusions in tumor specimens and transgenic animals. We anticipate to find a series of target genes, target proteins and metabolites related to ferroptosis and understand the mechanism of ferroptosis promotion or inhibition in lung cancer. We also anticipate exploring whether ferroptosis might be used as a new type of treatment for lung cancer and find the relevant potential therapeutic targets. In this project, the participant will perform various types of molecular biology experiments, including Western Blotting, immunohistochemistry, immunofluorescence, real-time fluorescent quantitative PCR, molecular cloning, transgenic animal manipulation, and clinical specimen testing. In addition, the participant will understand the classical molecular mechanism of ferroptosis and have research ideas on ferroptosis studies and other basic research related to metabolism or signaling pathways.

Eligibility Requirements:

- > Basic knowledge of molecular biology.
- > Preferred: Experience in biology and medical research.

Main Tasks:

Gaining a proficiency in Western Blotting, real-time fluorescent quantitative PCR, animal experiments, immunohistochemistry, immunofluorescence and other molecular experiments, and basic research ideas for ferroptosis.

Website:

Lab: <http://www.shxkyy.com>
School: N/A

PROJECT
134

Construction of Primary Cell Lineage and Human Transplanted Tumor Model of Tumor Tissue

Contact Information:

Prof. Liming Lu
Email: lulunew2003@163.com

Project Description and Objectives:

Collect fresh lung cancer specimens, and carry out the following:

1. Primary cell culture and identify cell lines, including STR detection, phase contrast microscopy of tumor cells, identification of HE and immunohistochemical staining, plotting tumor cell growth curve, cell cycle analysis, and tumorigenic observation, karyotype analysis, etc.
2. Construction of human xenograft model: Humanized tumor models were constructed and transplanted into immunodeficient mice by patient-derived ones. These tumor models were used to deeply study the mechanism of tumorigenesis and to understand the pharmacology of drugs in tumor tissues of patients as well as pharmacodynamic response, guiding patients to clinical medication.

Eligibility Requirements:

- > Basic knowledge of medicine or biology.

Main Tasks:

- > Primary cell culture and identify cell lines.
- > Construction of human xenograft model.

Website

Lab: <http://www.shxkyy.com>
School: N/A

PROJECT
135

Mapping New Causal Genes for Glomerulonephritis

Contact Information:

Prof. Jingyuan Xie
Email: nephroxie@163.com

Project Description and Objectives:

This lab is focusing on mapping new causal genes in patients with glomerulonephritis based on our large biobank for glomerulonephritis during the last decade. The laboratory has three major researching interests, including: (1) Identification of rare variants for glomerulonephritis including FSGS and IgA nephropathy (IgAN) by next-generation sequencing. (2) Identification of common variants associated with glomerulonephritis such as focal segmental glomerulosclerosis (FSGS) and Membranous nephropathy (MN) by genome-wide association studies. (3) In vivo (trans-genetic animal models) and in vitro functional studies (variant cultured cell lines) were performed for novel mutations to reveal their exact pathogenic mechanism. Through the above works, we aim to better understand the genetic basis of glomerulonephritis and contribute to the precision medicine in the near future for the patients.

Eligibility Requirements:

Basic knowledge of genetics, statistics and molecular biology.

Main Tasks:

The familial study, sequencing data analysis, and an in vitro functional study (cell experiment)

Website:

Lab: N/A
School: N/A

PROJECT
136

Molecular Biology of Leukemia and Targeted Cancer Therapies

Contact Information:

Prof. Ruibao Ren
Email: rbren@sjtu.edu.cn

Project Description and Objectives:

The laboratory is working to delineate the molecular mechanism in the pathogenesis of leukemia, create precision diagnostics of leukemia, as well as the develop novel targeted cancer therapies. The major research areas include: (1) Intergrading the whole genome deep sequencing hotspot panel sequencing, and with this aim to reveal the composition and evolution pattern of leukemia clones, to identify the molecular targets that drive drug resistance and disease relapse, and eventually to establish a novel molecular diagnostic system based on the leukemia clonal evolution patterns; (2) Identification of therapeutic targets and development of targeted therapies for RAS-related cancers. Hyperactivation of RAS is common in human cancers, including in hematological malignancies. However, RAS protein itself has been difficult to "target", making the cancers harboring RAS mutations the most difficult to treat. By using molecular biology and chemical biology approaches, we aim to identify therapeutic targets and develop novel targeted therapies for RAS related cancer; (3) Mechanisms of anti-tumor activity of innate immune system and novel drug discovery and development. We study the roles of Interferon Response Factors IRF4/8 in leukemogenesis and try to develop novel anti-tumor immunotherapies.

Eligibility Requirements:

Basic knowledge of genetics and molecular biology.

Main Tasks:

Bioinformatic analysis, identification and characterization of anti-cancer compounds.

Website:

Lab: N/A
School: <http://www.sih.org.cn>

PROJECT
137

Pre-clinical Investigation into an Endogenously Expressed Micropeptide MiRPEP155 with Immunomodulatory Functions

Contact Information:

Prof. Honglin Wang
Email: honglin.wang@sjtu.edu.cn

Project Description and Objectives:

Micro RNA precursors are generally considered to be non-coding. We recently published an article entitled "A Micropeptide Encoded by LncRNA MIR155HG Suppresses Autoimmune Inflammation via Modulating Antigen Presentation" in Science Advances, reporting that a previously annotated non-coding region of the human genome encodes a polypeptide named MIPEP155. MIPEP155 can regulate the antigen-presenting capacity of dendritic cells in the context of inflammation. MIPEP155 showed prominent therapeutic effects on two autoinflammatory disease models, namely imiquimod-induced mouse model of psoriasis and experimental autoimmune encephalomyelitis (EAE), highlighting the potential of miPEP155 to be a drug candidate of autoimmune diseases. In this project, we intend to study the dose-dependent therapeutic effects of miPEP155 on imiquimod-induced mouse model of psoriasis and a mouse model of inflammatory bowel diseases (IBD), taking antibody drugs including anti-TNF- α , anti-IL-17A and anti-IL-23p19 as positive controls. Moreover, we intend to study the pharmacokinetics of miPEP155 using mice, rats and rabbits. Overall, these results will help us evaluate the druggability of miPEP155 and assess the risk to continue the development of miPEP155 into a drug for autoinflammatory diseases.

Eligibility Requirements:

An eligible candidate should be self-motivated and have

- > An excellent team spirit.
- > Good English communication and writing skills.
- > Basic knowledge on cell biology and immunology.
- > Experience in working with animal models is preferred.

Main Tasks:

- > Animal model establishment.
- > Drug candidate application.
- > Disease score evaluation.
- > Druggability assessment.

Website

Lab: <http://sii.shsmu.edu.cn/DetailMemberInfo.php?pid=6&cid=22&num=22&id=11>
School: <http://daoshi.shsmu.edu.cn/Pages/TeacherInformationView.aspx?uid=CC9DAA19-8AE4-4DFB-82EE-1A1BC05E3BA3&from=s&pld=&tld=710>

PROJECT
138

Expression Pattern and Functional Study of A Novel Peptide Encoded by Pri-miR-31 on Clinical Sample and Murine Model of Psoriasis Pri-miR-31

Contact Information:

Prof. Honglin Wang
Email: honglin.wang@sjtu.edu.cn

Project Description and Objectives:

Recent evidence has revealed that small polypeptides (usually containing fewer than 100 amino acids) can be translated from noncoding RNA (ncRNA) which is usually defined an RNA molecule that does not encode a protein. We have discovered a peptide, which we termed MIPEP31, is encoded by pri-miRNA-31. Using CRISPR/Cas9, we introduced a point mutation leading to deficiency of MIPEP31 without affecting MIRNA processing. Mice with MIPEP31 deficiency result in decreased regulatory T cell (Treg) frequency and spontaneous colonic inflammation. Our work reveal indispensable roles of the peptide encoded by pri-miRNA on maintaining immune homeostasis by promoting Treg differentiation, and offers a potential means for modulating miRNA expression and treating autoimmune diseases. Psoriasis is a chronic inflammatory skin disorder affecting 2-3% of the general population. MIPEP31 could be promising candidate to treat psoriasis by promoting the differentiation of Treg. In this project, we intend to study the clinical relevance of MIPEP31 expression on clinical sample of psoriasis patient. Moreover, we intend to study the expression of MIPEP31 in different tissues and its therapeutic effect on mouse model of psoriasis. Our results will help us understand the pathogenesis of psoriasis and hopefully find a drug for psoriasis.

Eligibility Requirements:

An eligible candidate should be self-motivated and have

- > an excellent team spirit.
- > good English communication and writing skills.
- > basic knowledge on cell biology and immunology.
- > Experience in working with animal models is preferred.

Main Tasks

- > Animal model establishment.
- > Clinical sample collection.
- > MiPEP31 expression evaluation.
- > Therapeutic effect assessment.

Website

Lab: <http://sii.shsmu.edu.cn/DetailMemberInfo.php?pid=6&cid=22&num=22&id=11>
School: <http://daoshi.shsmu.edu.cn/Pages/TeacherInformationView.aspx?uid=CC9DAA19-8AE4-4DFB-82EE-1A1BC05E3BA3&from=s&pld=&tld=710>

PROJECT
139

Discovery and Preclinical Studies of Anti-Psoriasis Small Compounds

Contact Information:

Prof. Honglin Wang
Email: honglin.wang@sjtu.edu.cn

Project Description and Objectives:

Psoriasis is a chronic inflammatory skin disorder affecting 2-3% of the general population. Importantly, psoriasis is not fatal but incurable, which means patients must live with the annoying disease throughout their lifetime. Natural compounds have become an important source for new drug discovery, and there is growing international interest in lead compounds found in plants. Therefore, it is an effective way to screen active anti-psoriasis natural products derived from plants, and to derivatize natural, to determine their structures, to improve efficacy, specificity, and to reduce toxicity.

In this program, we also aim to perform preclinical studies. Deciding whether a drug is ready for clinical trials (the so-called move from bench to bedside) involves extensive preclinical studies that yield preliminary efficacy, toxicity, pharmacokinetics, and safety information. Wide doses of the drug are tested using in vitro (test tube or cell culture) and in vivo (animal) experiments, and it is also possible to perform in silico profiling using computer models of the drug-target interactions.

Eligibility Requirements:

An eligible candidate should be self-motivated and have

- > An excellent team spirit.
- > Good English communication and writing skills.
- > Basic knowledge of cell biology and immunology.
- > Experience in working with animal models is preferred.

Main Tasks:

- > Animal model establishment.
- > Small molecule screening.
- > Drug candidate application.
- > Disease score evaluation.
- > Druggability assessment.

Website:

Lab: <http://sii.shsmu.edu.cn/DetailMemberInfo.php?pid=6&cid=22&num=22&id=11>
School: <http://daoshi.shsmu.edu.cn/Pages/TeacherInformationView.aspx?uid=CC9DAA19-8AE4-4DFB-82EE-1A1BC05E3BA3&from=s&pld=&tld=710>



SYSTEMS BIOMEDICINE

PROJECT
140

Mechanisms of New Targets in Tumor Metastasis and Development of Therapeutic Methods

Contact Information:

Prof. Fang Guo
Email: fguo@sjtu.edu.cn

Project Description and Objectives:

Our lab focuses on searching for drug targets which can inhibit tumor metastasis. The earlier work has indicated that AEP had a great effect on breast cancer metastasis. Thus, the later work will focus on searching for small molecule inhibitors of AEP, antitumor prodrugs, and therapeutic antibodies. In addition, the later work will provide depth on the mechanism of AEP in a tumor microenvironment and a tumor-associated macrophage.

This project mainly focuses on searching for the inhibitors of Bcl-2 (including natural products and derivatives) and setting up appropriate tumor animal models to study the efficacy and molecular mechanism of microwave hyperthermia chemotherapy and microwave hyperthermia immunotherapy. With clinical trials, our research will provide theoretical support for the new tumor therapy.

Eligibility Requirements:

The interested student should have a basic knowledge of Molecular biology technology.

Main Tasks:

- > Finish a research report.
- > Give two research presentations (1. References review; 2. Technical presentation).
- > Submit one paper to journal as a co-author.

Website:

Lab: N/A
School: <http://scsb.sjtu.edu.cn/xtswyx/homeen.do?method=getHomeList>

PROJECT
141

Developing New Glyco-Biomarkers for Immunotherapy Response in Lung Cancer

Contact Information:

Prof. Yan Zhang
Email: yanzhang2006@sjtu.edu.cn

Project Description and Objectives:

Glycosylation is one of the most important post-transcription modifications of proteins. Changes in glycosylation can significantly modulate the structure, stability and function of proteins and closely associates with pathogenesis and progression of cancer. It is found that the most routinely used cancer biomarkers, including CEA, AFP, PSA, CA125, and CA19-9 are all glycoproteins. Currently, glycosylation-based biomarkers have emerged as promising candidates for early diagnosis, prognosis and real-time follow-up of tumor dynamics. Lung cancer is the leading cause of cancer incidence and mortality worldwide. In recent years, the rise of immunotherapy has significantly improved the prognosis of lung cancer. However, only 25-30% of patients could benefit from this therapy. Thus, the discovery of the efficient biomarkers for immunotherapy response is of great importance for precise medicine. In this project, we are combining the advanced glycomics technologies with other approaches such as glycobiology and cell biology to find the new predictors of response to immunotherapy.

Eligibility Requirements:

- > Applicants should have basic knowledge of biology.
- > Experience in biological research would be an advantage.

Main Tasks:

- > Carry out experiments and analyze experimental results.
- > Give two research presentations, (one on previously published papers, one on research progress).
- > Finish a research report.

Website:

Lab: <http://glycolab.sjtu.edu.cn/Default.aspx>
School: <http://116.62.6.201:8086/>

PROJECT
142

Construction of TCM Knowledge Graph

Contact Information:

Prof. Hui LU
Email: huilu@sjtu.edu.cn

Project Description and Objectives:

Our center is committed to cultivating undergraduate and graduate students with high level as well as interdisciplinary and international vision. The project "Construction of TCM Knowledge Graph" aims to cultivate special professionals in international potential disciplines and China's dominant disciplines, strengthen students' basic knowledge in interdisciplinary fields, deepen students' scientific research ability in frontier fields, improve their comprehensive quality with integration of medicine, science and engineering knowledge, make them have both Chinese and Western horizons and develop diversified thinking, and promote the output of innovative achievements.

Eligibility Requirements:

- > Applicants must have the following academic background: medical background or computer background or biological background or the background of other related disciplines.
- > being good at computer technology and proficient in Chinese

Main Tasks:

- > Construction of TCM Knowledge Graph

Website:

Lab: N/A
School: <https://life.sjtu.edu.cn>

PROJECT
143

Climate Adaption in Architecture and Urban Research

Contact Information:

Prof. Wenjun Ma
Email: mwj@sjtu.edu.cn

Project Description and Objectives:

Urban climate and its change have great influence in urban planning and development. More attention has been attracted to architecture and city research along with urban climates. This project is aimed at present climate situation and problems, such as urban heat island effect, air pollution, and unsatisfactory atmospheric conditions. The goal is to integrate urban climate into urban data models. We are eager to visualize urban dynamic data from various government departments or commercial institutes and organizations. We want to evaluate the urban climate carrying capacity. Thus, tentative experiments should be performed to analyze and summarize the root causes of urban problems. The ultimate goal is to explore and propose solutions by urban planning in architectures. During this project research, students will rediscover an urban phenomenon and master the methods of problem analysis.

Eligibility Requirements:

- > Speaking and writing English fluently is essential.
- > Interested students should have basic knowledge of urban planning.
- > Experience in architecture and city research- especially in climate change research would be an advantage.

Main Tasks:

- > Literature reading, sorting and reviewing.
- > Participating in and conducting at least two experiments.
- > Writing a report or paper and presenting it.

Website:

Lab: N/A
School: <https://designschool.sjtu.edu.cn/>

PROJECT
144

Correlating Local Spatial Variability of Urban Warming and Pollution to 2D/3D Landscape Metrics Research field: Mesoscale Climate Simulation

Contact Information:

Prof. Shengquan Che
Email: chsq@sjtu.edu.cn

Project Description and Objectives:

With the intensification of global climate change and frequent occurrence of extreme climate disasters, the research on the theory and technology of resilient city planning and design under climate change is of great significance to ensure the safety of human life and property. This research is focused on the physical and empirical investigation of the intensity and spatial variability of urban warming/pollution and its correlation with the 2D/3D urban landscape metrics. These metrics characterize, for instance, the urban morphology, the thermophysical properties of the urban structures, the land cover/use, the vegetation, and the water bodies. During this project research, students will learn the software, methods and basic knowledge of urban climate research.

Eligibility Requirements:

- > Speaking and writing English fluently is essential.
- > Experience in landscape architecture and urban planning research- especially in using geographic information system would be an advantage.

Main Tasks:

- > Development of urban local climate zone map
- > Generation and analysis of urban surface temperature
- > Relationship model between urban surface temperature and local climate zone

Website:

Lab: <http://fpc.ud.sjtu.edu.cn>
School: <https://designschool.sjtu.edu.cn/>

PROJECT
145

Application of energy saving and carbon reduction technology in sewage treatment process design and R & D of new material.

Contact Information:

Prof. Shengquan Che
Email: chsq@sjtu.edu.cn

Project Description and Objectives:

Global climate changes and environmental degradations are two critical factors influencing our sustainable future. Carbon footprint analysis is an emerging strategy to evaluate the sustainability of WWTPs. The potential of greenhouse gas (GHG) emissions from sewage management of metropolis is a critical concern in the water-energy-nexus. It is desired for the project to achieve the energy conservation and emission reduction of sewage treatment. Understand the units of high energy consumption and high carbon emission of sewage treatment process, and learn the realization way of energy-saving and carbon reduction technology in the optimal design of sewage treatment process. The R & D process of making building materials such as cattail board and new environmental protection materials such as granular activated carbon from traditional biomass materials such as Acorus calamus. By studying these two typical examples, the students can preliminarily master the ways and research means of energy-saving and carbon reduction technology in their professional fields.

Eligibility Requirements:

- > Speaking and writing English fluently is essential.
- > Interested students should have basic knowledge of wastewater treatment plant, low-carbon technologies and functions of new materials.
- > Experience in science and engineering research, especially in low-carbon technologies research would be an advantage.

Main Tasks:

- > Literature reading, sorting and reviewing.
- > Participating in and conducting at least two experiments.
- > Writing a report or paper and presenting it.

Website:

Lab: <http://fpc.ud.sjtu.edu.cn>
School: <https://designschool.sjtu.edu.cn/>

PROJECT
146

Nature-based Solutions to Mitigate Urban Thermal Environment

Contact Information:

Dr. Junxiang LI/Caiyan WU
Email: junxiangli@sjtu.edu.cn; caiyanwu@sjtu.edu.cn.

Project Description and Objectives:

This project aims to explore the relationships between urban land surface temperature and urban green and blue infrastructure using remote sensing and GIS technologies, combining with field investigations. The objectives of the project are making participants to learn knowledges on nature-based solutions and how to use nature-based solution to solve problems, to learn the skills to extract necessary information from remote sensing images and spatial analysis.

Eligibility Requirements:

The participant needs to have basic background of geography, ecology, and environmental science, and have basic skills to operate GIS, such as Arc Map, etc., and image process software, such as ENVI, etc.

Main Tasks:

The main tasks including extract information of urban green and blue infrastructure (GI, BI), urban land surface temperature (LST), field investigation, GIS spatial analysis, modeling of LST and GI and BI .

Website:

Lab: N/A
School: <https://designschool.sjtu.edu.cn/>



PROJECT
147

Elderly Care Robot Development and Deployment

Contact Information:

Asso. Prof. Gang Zheng
Email: gzheng@sjtu.edu.cn

Project Description and Objectives:

According to the latest reports, China has 15.8 million residents aged more than 65, and 24.1 million aged more than 60 (as of 2017). Its population aging speed is the fastest as before. As the populations grows older, we also see a decrease in young people prepared to take care of the elderly groups. This project is to develop and deploy an elderly care robot that can perform simple service like medicine delivery etc.

Eligibility Requirements:

Basic knowledge of:

- > Mechanical engineering
- > Programming language

Main Tasks:

- > To build a simple "elderly care" scenario using KT board etc.
- > To program and practice a brand new service robot.
- > Deploy the robot in "elderly care" scenario and perform medicine delivery task.

Website:

Lab: <http://umji.sjtu.edu.cn/about/administrative-offices/teaching-lab-service-office/>
School: <http://umji.sjtu.edu.cn/>

PROJECT
148

Numerical Solution of the Phonon Boltzmann Transport Equation: Algorithm Development and Optimization

Contact Information:

Asso. Prof. Bao Hua
Email: hua.bao@sjtu.edu.cn

Project Description and Objectives:

Boltzmann transport equation (BTE) is the fundamental equation for sub-continuum scale electron or heat transport, which is important to model the temperature distribution in electronic devices. We already developed a C++ code to solve BTE by discrete ordinate method and finite volume method. We are now in the phase of optimizing the code and implementing advanced algorithms.

Eligibility Requirements:

- > Basic knowledge of High Performance Computing.
- > Familiar with C/C++.
- > Previous knowledge in heat transfer, numerical analysis, numerical methods (e.g., finite volume method).

Main Tasks:

- > Develop highly efficient hybrid Fourier-BTE solver to handle large non-gray transport problem.
- > Implement and optimize advanced algorithms to optimize the code, including but not limited to sparse matrix solver, parallel computing (using MPI/OpenMP).
- > Assist graduate students to conduct some calculations.

Website:

Lab: <http://caces.sjtu.edu.cn/>
School: <http://umji.sjtu.edu.cn/>

PROJECT
149

Design of a fully integrated power management chip.

Contact Information:

Asst. Prof. Xuyang Lu
Email: Xuyang.Lu@sjtu.edu.cn

Project Description and Objectives:

Course material includes:

- > Basics of analog circuit design
- > Basics of digital circuit design
- > The design of a 3-to-8 multiplexer using Synopsys synthesis tools.
- > Analog circuit design practice: Bandgap reference design through cadence.
- > Analog amplifier design.
- > Optimization of analog and digital circuit.
- > The pre- and post simulation of power electronics circuits.
- > Design of IO circuits.

Eligibility Requirements:

- > ECE student with knowledge in analog and digital circuits

Main Tasks:

- > The design and optimization of a power controller chip in CMOS.

Website:

Lab: <https://sites.ji.sjtu.edu.cn/xuyang-lu/>
School: <http://umji.sjtu.edu.cn/>

CHINA-UK LOW CARBON

PROJECT
150

Research on the Coordinated Control of SOFC/GT Hybrid System Based on Safety Margin

Contact Information:

Asso. Prof. Xiaojing Lv
Email: lvxiaoqing@sjtu.edu.cn

Project Description and Objectives:

Solid Oxide Fuel Cell/Gas Turbine (SOFC/GT) hybrid system has the advantages of high efficiency, low emissions and fuel flexibility. It is one of the most important development directions of power generation technology for the future. However, the safe and stable operation and high-performance controls have always been the difficult technology question that restricts the development of hybrid systems because of its complexity. This project intends to establish a dynamic mathematical model of SOFC/GT hybrid systems with a safe boundary, reveal the coupling mechanism of safety margin, operation characteristics, electrochemical reaction characteristics, develop an coordinated control method of performance indicators and multi-dimensional safety margin, and obtain the safe and efficient operation trajectory of the hybrid system from start-up to load regulation to shut-down. The results will be beneficial for providing theoretical and experimental support and data base for the optimization design, safety warning setting, and efficient control strategy formulation of hybrid systems, which has vital theoretical significance and practical value for promoting the process development of hybrid system from theory research to actual application.

Eligibility Requirements:

- > Knowledge of laboratory safety should be mastered.
- > Basic knowledge/coursework in advanced energy systems, thermodynamics, or electrochemistry engineering.
- > Students who have experiences in labs is preferred.

Main Tasks:

- > Propose a new idea to improve the hybrid system performance based on the theory and experiment work.
- > Make a presentation of the simulation or experimental study.
- > Complete a final report of this program.

Website:

Lab: <http://pmlab.sjtu.edu.cn/index.asp>
School: <http://lcc.sjtu.edu.cn/>

PROJECT

151

Preparation of Biodegradable Plastics from Waste Shells

Contact Information:

Asso. Prof. Xi Chen
Email: chenxi-lcc@sjtu.edu.cn

Project Description and Objectives:

Waste resources utilization is a pivotal topic for the sustainable development of the society to promote carbon circulation and reduce carbon emission. "Waste-to-wealth" is the idea to transform the waste materials generated in industrial activities and daily life activities into valuable products such as chemicals, materials, etc. This internship program focuses on the manufacturing of biodegradable plastics and other value-added chemicals from waste crab/shrimp shells or woody biomass such as wheat straws. Some tools may be applied to solve problems in the projects mainly including catalytic techniques and simple machine learning skills to deal with the data. The objectives are to reinforce the awareness of the students on waste utilization, equip them with some frontier techniques to change the waste into useful products, and enable them to command basic skills in experimental design, data processing, and critical thinking so that they can contribute to relevant fields in the future to protect the environment and mitigate carbon emission.

Eligibility Requirements:

Have relevant backgrounds (Environment, Chemistry, Engineering, etc.).

Main Tasks:

Establish a feasible process to transform waste shell-derived chitosan into biodegradable plastic bags with good properties.

Website:

Lab: N/A
School: <http://lcc.sjtu.edu.cn/En/Data/View/763>

PROJECT

152

Performance Enhancement of a Novel CO₂ based Refrigerating System Using Nano-coated Heat Pipes

Contact Information:

Asso.Prof. Yanping Du
Email: yanping.du@sjtu.edu.cn

Project Description and Objectives:

Refrigerating systems in the current market suffer from restraints with a bottleneck of low coefficient of performance (COP) due to the inefficient heat transfer ability resulted from conventional cooling strategies adopted in the systems. Not only that, but the conventional refrigerants used have a severely negative influence on the ozonosphere (O₃) of the earth, which urgently needs to be substituted. In this regard, the research team led by Dr. Du developed a nano-coated heat pipe for an enhanced heat transfer and used carbon dioxide (CO₂) as the substitute, aiming to improve the cooling as well as the wicking in the condenser and the evaporator, respectively. Thermodynamic properties of different refrigerants including R22, R410a and CO₂ are to be tested. The cooling effect will be evaluated using the principle of energy conservation. The variation of the refrigerating capacity needs to be calculated in corresponding scenarios. A special focus will be given on the comparison of the systematic COP using dominant compressors that have a big difference in cost. Overall, the project is towards researching a highly-efficient, low-cost and environment-friendly product leading to a green and sustainable future.

Eligibility Requirements:

- > Proficient English skills.
- > Major in Energy and Power Engineering or relevant subjects.
- > Proactive, responsible and easy to work with.

Main Tasks:

- > Experimental system construction.
- > Experiments implementation to obtain the thermodynamic properties of different refrigerants including R22, R410a and CO₂.
- > Evaluation of the refrigerating capacity, power consumption and COP under different conditions.
- > Simulation using ANSYS should be done to compare with experiments
- > Final report to be submitted at the ending of the research program.

Website:

Lab:N/A
School: <http://lcc.sjtu.edu.cn/En/Default>

PROJECT
153

Design Thermal Functional Materials via Materials Informatics

Contact Information:

Asso. Prof. Shenghong Ju
Email: shenghong.ju@sjtu.edu.cn

Project Description and Objectives:

Designing functionalized materials with desired thermal property holds its critical importance in applications of thermal interfacial materials, thermoelectrics, thermal barrier coatings and thermal insulators. Materials informatics (MI), which has been considered as the fourth paradigm of science in addition to theory, simulation, and experiment, is now gaining a great attention in materials research. In this project, we will employ various intelligence optimization method to solve the bottlenecks of material selection and structure designing which limit the designing efficiency in thermal functional materials.

Eligibility Requirements:

- > Familiar with or interested in machine learning and data science.
- > Fundamental knowledge in heat transfer and materials science.

Main Tasks:

- > Screening material database to find materials with ultimate high/low thermal conductivity
- > Designing nanostructures to tune thermal transport via quantum annealing.

Website:

Lab: <http://lcc.sjtu.edu.cn/En/Data/View/1158>
School: <http://lcc.sjtu.edu.cn/En>

PROJECT
154

Thermal Storage and Energy Conservation

Contact Information:

Asso. Prof. Huijin Xu
Email: xuhuijin@sjtu.edu.cn

Project Description and Objectives:

The increase in energy consumption has resulted in the increased demand of fossil fuels and the increased pollutant emissions. Efficient energy utilization and renewable energy provide solutions to these issues. Energy storage technology can feasibly recover industrial waste thermal energy, enhance the use of solar energy, and balance the demand and supply of energy in time and place. There are three categories of thermal energy-storage systems: sensible heat storage, latent heat storage, and chemical heat storage (CHS). Compared with the first two types, CHS systems show great advantages, such as high energy density and long-term storage with negligible energy loss. CHS is also called seasonal heat storage because of the possibility of satisfying the demand for thermal energy in winter with the strong solar thermal energy in the summer. CHS works on the basis of reversible thermochemical reactions to store and release thermal energy. What's more, adsorption seawater desalination is a technology based on low-temperature evaporation under negative pressure and adsorption/desorption coupling of porous media.

Eligibility Requirements:

Students should be in the major of Engineering, and have interests to exploring the knowledge of thermal energy storage for practical applications.

Main Tasks:

- > Test and analyze the curve of inorganic salt doped Mg(OH)₂.
- > By heating and melting the PCM then cooling the PCM, obtain the supercooling phenomenon and the distribution of supercooling degree during the solidification.
- > Prepare the composite heat storage materials with good thermal properties and stable properties.
- > Understand the seawater desalination system based on adsorptive materials.

Website:

Lab: N/A
School: <https://lcc.sjtu.edu.cn/En>

PROJECT

155

WASTE TO ENERGY: Biological Systems towards Energy and Environmental Sustainability

Contact Information:

Asso.Prof. Jingxin Zhang
Email: lcczjx@sjtu.edu.cn

Project Description and Objectives:

With the rapid urbanization and population explosion in the past decades, an increasing number of people are congregating in big cities, hence generating a massive amount of municipal solid waste (MSW) and consuming more energy than ever before. The major focus of this project is to develop a novel sustainable waste management and energy recovery solutions suitable for energy and environmental sustainability. This project will examine a coupled problem at the nexus of energy and waste, accelerate the waste recycling and reduce energy reliance on traditional fossil fuel sources and its emission of pollutants, at the same time.

Eligibility Requirements:

- > Proficient English skills.
- > Major in Environment, Biology, Chemistry, and other relevant subjects.

Main Tasks:

- > Propose a research plan to improve the performance of a biological system for the conversion of organic wastes into energy/resources.
- > Literature review and experimental works
- > Prepare a final report

Website:

Lab: <https://lcc.sjtu.edu.cn/En/Data/View/1165>
School: <https://lcc.sjtu.edu.cn/>

SJTU Online Summer Research Internship Program

2022





Application Instructions for Summer Program



上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

- Create an account by choosing “Register”
- Finish “send e-mail verification” before signing in
- Sign in with your e-mail address and password



The screenshot shows the registration page for the Shanghai Jiao Tong University Foreign Students Apply system. At the top, there is a navigation bar with the university's logo and name in Chinese and English, and the text "留学生在在线申请 SHANGHAI JIAO TONG UNIVERSITY Foreign Students Apply". Below this, there are two tabs: "注册 Register" and "登录 Sign In". The registration form includes fields for "电子邮件 e-mail", "密码 Password", and "验证码 Verification code". A "登录/Login" button is located below the form. There are also links for "找回密码 retrieve your password", "发送验证邮件 send e-mail verification", and "用学号登陆 student number login". A large image of a university building is visible in the background. At the bottom, there are instructions in Chinese and English regarding email usage and browser requirements, along with a link to "申请指南/Application Instructions: 下载/Download" and a button for "申请密西根学院请点击/Apply JI-SJTU : 申请/Apply". The logo for the "JOINT INSTITUTE 交大密西根学院" is also present.

- Choose “Application”



上海交通大学

SHANGHAI JIAO TONG UNIVERSITY

留学生在线申请

Foreign Students Apply

邮箱地址 Email: sjtujqzhu@foxmail.com

修改密码 Reset Password

退出 Logout

简体中文

English



Application



Application List



Contact Information



上海交通大学

SHANGHAI JIAO TONG UNIVERSITY



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Pre-university Student



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Master/Doctoral



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- Finish the procedure from Step 1 to 9

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操作提示 / Steps	
Step 1 Basic Info	
Step 2 Study Plan	
Step 3 Educational&Employment	
Step 4 Language Proficiency	
Step 5 Contact Info	
Step 6 Others Info	
Step 7 Upload Documents	
Step 8 Application Fee	
Step 9 Submit	

Basic Info	
* Family Name(as shown on passport):	<input type="text"/> <input type="checkbox"/> No Family Name
* Given Name(as shown on passport):	<input type="text"/>
Please complete your names including your middle name, which should be the same shown in your passport.	
Chinese Name:	<input type="text"/>
* Gender:	<input type="text"/>
* Marital Status:	<input type="text"/>
* Nationality:	<input type="text"/>
* Date of Birth:	<input type="text" value="1995-1-1"/>
* Country of Birth:	<input type="text"/>
Religion:	<input type="text"/>
Finally Educational:	<input type="text" value="High School Diploma"/>
* Passport No.:	<input type="text"/> <input type="checkbox"/> Under Applying
* Date of Expiry:	<input type="text" value="2016-12-5"/>
* Email:	<input type="text" value="sjtujqzhu@foxmail.com"/>
* Emergency Contact:	<input type="text"/>
* Emergency Contact Tel:	<input type="text"/>

[Save and Next](#)

- When you submit your application, you will get an email indicating that your application has been received.
- If your application is rejected or required for more information, you will receive an alert email and you need to go back to the application page for more information.
- If your application is accepted, you will get a congratulation letter.



The screenshot shows the 'SHANGHAI JIAO TONG UNIVERSITY Foreign Students Apply' website. It features a navigation bar with 'New Application' and 'Application List' buttons. Below the navigation bar is a table with the following data:

Application No.	Application Item	Study Duration	Teaching Language	College & Major	Application Status	Operate
20160630073	2016 International Summer Research Internship Program	2016/6/1 To 2016/8/30	English/French	School of Mechanical Engineering LAB-Biomechatronics and Biorobotics Laboratory	Submitted	View

Thanks !



上海交通大學

SHANGHAI JIAO TONG UNIVERSITY

交通大學





香港中文大學
學術交流處（國內事務）



CU in Mainland & Taiwan 學生交流活動報名須知

參加資格及報名須知：

1. 香港中文大學的全日制本科生及研究生均可報名。接待院校一般**優先**接受香港本地生及澳門學生申請。
2. 參加者須持有**有效**回鄉卡（往內地）、護照（如需前往台灣和外國）或其他相關簽證。
3. 參加者必須配合本處指示，跟隨團體指定的交通方式和行程班次前往目的地，並**完成整個活動**。
（不適用於線上活動）
4. 每位同學在每一學期可以選報多於一個活動，但名額分配全由本處負責，同學不得異議。
5. **請小心填妥網上報名表格**。任何因申請人填表時出錯以致未能收到本處信息，本處概不負責。
6. 本處所舉辦之交流活動供有興趣到內地（及海外）交流的同學可以自由選擇參與，所有活動並非任何學科之必修課程。
7. 報名參與線上或線下含學分的課程前請向所屬學系部門及註冊及考試組查詢有關轉移學分要求及準則；透過本處參與含學分的課程並不等於一定可以轉移相關學分。

行程費用：（不適用於線上活動）

除非個別標明，否則活動期間之住宿、膳食、團體活動及交通費用將由主辦單位承擔。參加者須支付來回當地機票及當地個人消費。為保障同學出遊安全，中大會為參加者購買旅遊保險，保單內容可參考中大財務處商務組網頁（http://www.cuhk.edu.hk/bursary/eng/public/purchase_guides/insurance.html，有關頁面需要學生登入中大帳戶）。我們亦鼓勵同學按個人需要，自行購買額外旅遊保險。

活動要求：

每位參加者均須：

1. 細閱及簽署承諾書（Letter of Undertaking）**（不適用於線上活動）**
2. 出席本處舉辦之行前簡介會**（不適用於線上活動）**
3. 活動完結後**一星期內**向本處遞交活動感想報告（不少於500字）、活動照片（每人5張）、活動短片（每10位同學最少2段）**（不適用於線上活動）**
4. 活動完結後填寫網上意見調查問卷
5. 符合其他主辦院校的活動要求

活動資助：（不適用於線上活動）

中大全日制本科生可經中大學術交流處(OAL)申請香港教育局推出之「免入息審查專上學生內地體驗先導計劃」，申請到內地參加短期實習或學習活動的資助。

活動報名及名額分配：

同學須於**本處網頁上標示之日期**完成網上報名手續。本處有權隨時更改報名截止時間，不作另行通知。活動名額盡量以**平均及先到先得**形式分配。如報名人數少於名額，同學有機會獲選參與多於一個活動。本處會於截止報名後兩星期內或盡快經電郵通知成功申請者（**敬請檢查垃圾郵件箱及雜件箱等**），獲通知的同學須於期限內確認參加活動，而未獲通知者將自動列入後備名單。最終錄取名單以本處公布為準。**如有任何爭議，本處保留最終決定權利。**

學術交流處（國內事務）聯絡人：

陳小姐 Kit 電話：39434412 電郵：kitkwchan@cuhk.edu.hk

辦公室地址：香港中文大學康本國際學術園1306室