上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

SJTU SUMMER RESEARCH INTERNSHIP PROGRAM

2023

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

S J T U

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Shanghai Jiao Tong University (SJTU) is a higher education institute in China, which enjoys a long history and a world-renowned reputation. Through 127 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 through lectures with topics such as "How to Write a Research Essay"and "How to Cooperate in a Project". Participants will also learn about Chinese language and culture, which will enhance their intercultural awareness and communication.

What will Participants receive?

> Knowledge of the top research projects in China
> The opportunity to work with top Chinese professors, fellows, and students
> A strong 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 for different llaboratory.

Duration

27 June, 2023 - 9 August, 2023

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

Create ID and password

Complete Online Application (By April 30)

Receive the result on the website (In 2 weeks after application)

Confirmation of Admission on the website (By 15 May)

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

[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, 2023

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 by September, 2023. 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, 2023
Notification of the application result	February to May, 2023
Registration	27 June, 2023
Opening Ceremony	28 June, 2023
Internship	27 June - 9 August, 2023
Finishing the program survey of issuing of certificates	30 August, 2023
Transcript delivery	September, 2023

Contact

Email: isc.mobility@sjtu.edu.cn

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

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PROJECT LIST

PROJECT LIST

MECHANICAL ENGINEERING

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 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:

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

Eligibility Requirements:

Interested students 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 design 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 instead of real motions, which can be utilized to implement human-machine interactions under different circumstances. Therefore, we propose to design 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 will also be investigated. Lastly, a demonstration based on motionless gesture recognition technique would be carried out, such as 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: fqi@sjtu.edu.cn

Project Description and Objectives:

Nowadays, combustion provides over 85% of global primary energy supply. Clean combustion is one of the important approaches to provide 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 theory in low-temperature combustion (LTC), which is a novel combustion concept to reduce both NOx and PM emissions in engine combustion, will be investigated with advanced experimental methods. The key elementary LTC reactions will be investigated with a newly designed shock tube at 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 also be utilized to understand the secrets in LTC engine-relevant conditions. Kinetic model of the investigated fuel will be proposed and validated through experimental findings. The outcome of this study will be used to explore further strategies to control combustion pollutant emissions in a more intelligent way.

Eligibility Requirements:

> Understanding of lab safety.
> Knowledge of physical chemistry is necessary.
> Students with laboratory experiences 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.
> Design 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: fqi@sjtu.edu.cn

Project Description and Objectives:
Combustion diagnostic techniques based on laser spectroscopy which are accurate and nonintrusive have become an important tool in combustion science field 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 loudspeaker built at the bottom of the setup provides acoustic excitation to the flame. Air and fuel are premixed and then being filled intothe 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 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 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 to measure flame temperature and concentrations of CO2/ H2O. A hot wire is equipped in the downstream of the swirler to measure the flow velocity change due to the acoustic excitation. Raman scattering techniques is also being 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.

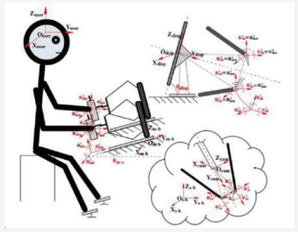
Website:
Lab: http://combustion.sjtu.edu.cn/home/
School: http://202.120.53.238/English/Default.aspx

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 in remote operation, that is, doctors use a handhled device to control the distal surgical robot to carry out operations with the assist of endoscopic images. This approach has a variety of advantages. Firstly, 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 certain orthopedic surgeries. More importantly, the isolation of doctors and patients by geographical location can accomplish genuine medical resource sharing. Excellent doctors can be shared with people around the world.
The hand-eye coordination algorithm proposed 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 robot, coordinate system transformation, etc. This is one of the core technologies that can tackle remote operation problems.

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://robolab.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 in accurate puncturing or drilling operations previously. In order to meet the requirement of surgical operations, the robotic system should possess the following features: 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 proposes a novel mechanical structure of medical robotic system to meet the abovementioned 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://sseme.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, thecurrent orthopedic robots are only applicable to traditional open surgery. Their working principles, operation modes, as well as the software and hardware systems simply do not apply to microscopic/endoscopic surgeries. In this project, several leading-edge algorithms based on artificial intelligence regarding multi-modal image registration, automatic segmentation, high quality visualization, and precise planning are proposed to adapt important anatomical structures of the musculoskeletal 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 to solve the soft tissue deformation and tracking problem. Finally, the comprehensive, light, and smart mechanical structures and control systems for surgical robots in endoscopic orthopedics are designed and integrated with our previous 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 in order to reach the goal of mass clinical application. Research findings of this project will advance the personalization, safety, accuracy, and minimal invasion of microscopic/endoscopic orthopedics, leading the direction in the international field of orthopedic robotics.

Eligibility Requirements:

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://sseme.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, limited intraoperative visibility, especially the anatomical intricacies, makes this kind of surgery a demanding procedure. Also, the accuracy and stability of these operations are hard to be guaranteed. In this project, with the integration of artificial intelligence, computer-assisted surgical planning, virtual reality, computer graphics, and 3D-printing technology, a methodology of designing and manufacturing 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 analysed. Therefore, those parameters can be optimized to achieve its accuracy, validity, and reliability. Ultimately, an integrated platform for digital design and manufacturing of customized templates will be formed to provide innovative technical methods for the personalization, digitalization, and minimal invasion of oral and maxillofacial surgery, which will greatly improve the general life quality of the patients.

Eligibility Requirements:

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://sseme.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 primary energy in the United States and Europe and nearly 30% in China. To reduce these buildings' dependence on the primary energy, several studies on energy-saving technologies have been done worldwide. On the other hand, renewable energy utilization is also considered as a reasonable solution to global warming, air pollution, and energy security. By combining 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:

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

Main Tasks:

> Get familiar with different building energy saving technologies, such as adsorption, absorption, dehumidification, etc.
> Can propose a new design, analyze it and optimize the design.
> 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

PROJECT 11

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. The debris significantly impairs the dimensional accuracy of a CMM, which is critical in measuring precision-engineered products. This project will investigate the impact of debris particles on the measurement accuracy of CMM. The phenomenon of particle adhesion on the CMM stylus will be modeled. Simulation of particle adhesion and deformation will be conducted. The findings of this project will help determine the significance of debris attachment during several CMM measurement tasks which is 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

PROJECT 12

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. The debris significantly impairs the dimensional accuracy of a CMM, which is critical inmeasuring precision-engineered products. This project will experimentally investigate the adhesion of debris particles on the CMM stylus. Debris of various materials and shapes in 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 findings of this project will help in determining the significance of debris attachment and assessing 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, using different methods for applying collected debris particles onto the workpiece surface with desired distribution,conducting CMM measurement experiments 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 vital part of next industrial revolution in precision manufacturing. On-machine metrology not only can 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. This 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:

Participants will carry out experimental investigation on on-machine metrology, including analysis of common measurement sensors, the design&installation &operation of an on-machine sensor on the machine tool, establishing communication between the sensor and machine tool, and performance evaluation 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:

> Interested in new energy.
> Have basic knowledge of electrochemistry.
> Have experience in chemical experiments in lab.
> Able 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 and new methodologies. This summer research program will focus on some 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 which includes a literature review and report drafting, as well as gaining hands-on experience from programming and image processing theories to recognize vehicles/pedestrian/signal lights from real images captured. The objective of this project is to help students build up ideas about how research projects and engineering projects are performed, as well as understand the fundamentals of 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 gaining increasing attention, traditional energy conversion scheme, such as gasoline internal combustion engine, is still playing significant roles nowadays. This course will offer a modern touch on optimizing the new generation of gasoline power using laser diagnostic means. Various laser diagnostic 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 inner situations 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/

ELECTRONIC INFORMATION AND ELECTRICAL ENGINEERING

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 JAVA and Web application development.

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: miaozhu@sjtu.edu.cn

Project Description and Objectives

With the development of energy and internet technologies, energy router has become an essential device for future energy internet. Energy internet is a novel concept that integrates the Internet with energy generation, transmission and consumption. Energy router is the centre of energy conversion and information interaction in energy internet, which is still developing and deepening with the ongoing 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. Afterward, typical energy internet scenarios of energy router will be summarized and presented . Then, key technologies, restraints and development trend of energy router will be studied respectively. A general report will be presented as final achievement.

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 wind farm keeps on increasing, 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 of 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 environment, 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 when in 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:

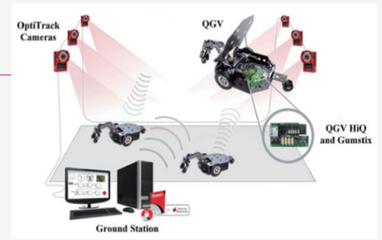
This project covers device modeling (kinematics and dynamics), synthesis and analysis of control systems, design and implementation of mechatronic devices, and human-machine interaction.

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 have focused on multi-robot cooperative control systems for their excellent abilities to finish complex tasks. However, the systems' safety is also at risk due to its highly distributed fashion and openness to outside world while operating in real environment.

In this research, we aim to design smart and efficient attack towards the multi-robot system via local information and learning-based methods 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 our proposed theory.

Eligibility Requirements:

Interested students should be proficient in python/C++ programming and have basic knowledge of robot control. Proficiency in writing and speaking is also 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 highspeed 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 computational complexity and transmission performance of the integrated optical interconnects by an in-depth understanding of the connection of 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 FMF overlap in space and time,causing 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 FMF's output light field, then each mode of FMF can be separated and reconstructed by calculation.

Eligibility Requirements:

Basic understanding of photonics and 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 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) is far from being real-time due to its high computational complexity. To avoid these weaknesses, one-dimensional (1D) Convolutional Neural Networks (CNNs) is 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 is 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 is more effective than from cross-cluster nodes. Therefore, differentiating the repair bandwidth from intra-cluster and cross-cluster is useful. For cluster DSSs, the tradeoff is considered with particular 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 and 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) due to long-term and chronic hyperglycemia, which seriously affects the life quality of the population. Complications screening is the main measure to prevent and cure related complications. The way to effectively improve the efficiency of diabetes complications screening and reduce the screening cost 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 diabetes complications in developing countries worldwide under the guidance of International Diabetes Federation (IDF).

Eligibility Requirements:

Applicants must have certain 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 rate of long-term complications of type 2 diabetes is high. One of the main reasons of this phenomenon is the contradiction between 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 of the linkage between hospitals and communities.This is to realize intelligent and accurate treatment guidance for diabetes patients 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 an 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 assist doctors in the image analysis of glomerular diseases. Moreover, the results can provide objective and quantitative analysis results to 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 field than can combine one image's artistic style with another image's content. The basic idea is to take the feature representations learned by a pre-trained deep convolutional neural network to obtain separate representations of 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 in style transfer to fasten training and inference as well as extend the style transfer technique from still images to videos and even game scenes.

Besides, one of the attractive research fields in computer vision is colorizing 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 many researches in this field. Image 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. Some teams have been working on presenting the robust colorization of cartoon black-white pictures. However, there are some bugs in the final results of previously proposed method such as the disability in showing a smooth background for some images and some special kind of reference colors.

In this project, our purpose is to present 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 from 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:

> Prepare a final report of the internship.
> Provide a presentation.
> Propose a new idea for converting a given a scene photo into the desired 2D style scene by an algorithm.
> Propose 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 has contributed in triggering the next technological revolution. Specifically, quantum computation is now widely used in machine learning design to speed up quantum hardware-based machine learning algorithms and 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 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 higher magnitude compared to current state-of-the-art. A typical application of massive access is a distributed sensor network which intelligently monitors and manages a large amount of devices. Normally, the activation of these devices is intermittent, i.e., each device is periodically active based on a random pattern and constitutes 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 designing active device detection algorithms for MIMO massive access communication based on compress sensing tools, estimation and detection theory, as well as matrix theory.

Eligibility Requirements:

Interested students should have basic knowledge on wireless communications and 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

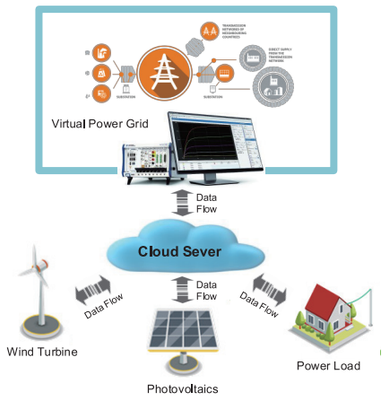
Project Description and Objectives:
In the power system research, hardware experiment is an accurate testing method at the cost of high expenditure and poor flexibility. The software simulation is flexible and efficient, yet its accuracy is limited by mathematic models. The hardware-in-the-loop (HIL)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

This modern power system is integrated with more renewable energy generations, which has a great impact on the dynamic characteristics of the power system. The internet-distributed hardware-in-the-loop simulation of 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 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 which are integrated with a large amount of converters are becoming recent research hotspots. This is because the dynamics of power system 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 HVDC and renewable energy, such as wind farms in China or Denmark.
(3) Study on the oscillation mechanism aroused by interactions between converters and AC grids. In order 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:

Machine learning tools are used to depict a nationwide map of power and energy supply and demand. The power system with uncountable devices that connects the power supply and demand has become the biggest and most complex artificial system of data of all time. The well-functioning of 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 both the system operation in short term and it's planning in the long run. Extracting useful information drives the application of machine learning tools in power systems, especially when the power system is being developed towards the ubiquitous Internet of Things and the data capacity consequently explodes. This program aims to apply machine learning tools to draw power maps which can 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 are required for a mark to be given.

Main Tasks:

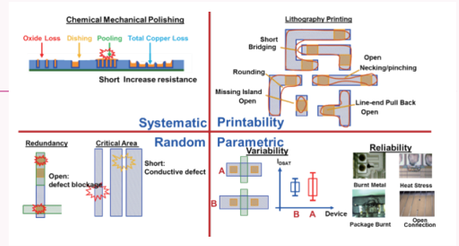
> Learning the background knowledge of power system: its history, the cutting-edge research topics with a focus on power system operation and planning.
> Reviewing machine learning tools: different algorithms, basic math it requires, typical problems it can solve.
> Implementing a machine learning tool, which can be either supervised or unsuper vised 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 such as automotive vehicles, computers/servers and mobile devices, it has been reported that the cost of producing new bleeding-edge chips with the latest technology now cost more than $500 million. In order to lower the barriers of designing 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 researchers 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 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 models and hyperparameter optimizations 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.
> Deliver 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 its broader applications. This project aims to devise a more generalizable deepfake detector based on DNN to apply on 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

AIoT Privacy Protection Scheme based on Dictionary Learning

Contact Information:

Prof. Yue Wu
Email: wuyue@sjtu.edu.cn

Project Description and Objectives:

The resources and computing power of AIoT device are limited, and traditional privacy protection and adversarial defense algorithms are difficult to implement on the device side. The way of realizing identification and protection of core privacy data under the condition of massive data has become a key scientific issue to implement privacy protection in AIoT environments. Traditional privacy protection methods often use differential privacy to add noise to the entire data, which not only causes a huge waste of resources and computing power of edge devices, but also adversely affects the performance of downstream tasks. By utilizing representation learning algorithm, the private feature and features corresponding to downstream tasks are extracted separately. Also, selective noise addition can be achieved. This project intends to propose algorithm based on dictionary learning to extract and identify the core privacy data features and apply differential privacy to protect user private data in AIoT conditions.

Eligibility Requirements:

> Basic knowledge of machine learning, matrix analysis and optimization theory.
> Mastering of Python and at least one deep learning framework, Pytorch preferred.

Main Tasks:

> Review literature on differential privacy.
> Achieve a prototype of dictionary learning model and differential privacy mechanism.

Website:

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

PROJECT 39

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 increasing types and numbers of onboard terminals in intelligent and connected vehicle networks, security threats within internet of vehicles are also increasing. The information security of intelligent and connected vehicle networks has attracted more and more attention from 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 attack in the Internet of Vehicles environment, Sybil attack causes 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. Also, 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 in both simulation environment and real road test scenario.

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 utilized 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 they still suffer from a degraded reconstruction performance for multi-layer cases. This project aims to develop 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 displayed viewport as 4K (3840 X 2160), the resolution of the rectangular projection should be at least 12K (11520 X 6480), which indicates 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 conversely affects 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 of 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 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 coding efficiency and tile size, and the relationship between transmission efficiency and tile size.
> Solve the optimal tradeoff between coding efficiency and 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 to implement the tracking task, yet its performance might be affected by the distortion caused by video encoding. Therefore, it is interesting to explore 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 in 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 and 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 to 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 build 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 on planning the deployment and operation of energy storage and conversion devices in integrated energy systems to achieve an 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. Renewable 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, Python etc.).

Main Tasks:

> Identify the optimal combination and operation of energy supply, conversion and storage technologies at building or district level.

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 handled economically, either by adding power generation or implementing effective demand-side management techniques on 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 between EVs and power grid or other energy grid. It has important practical significance to further design and practice newer optimization scenarios on 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 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 possible illegal attacks for future networks.
> Combined with the artificial intelligence technologies, we will investigate a secure transmission in data transmission on 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 on introducing video information for multi-modal event detection and improving the robustness of event detection. However, with unparalleled data, it is critical to explore the fusion method based on 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 semantic understanding of structured information. This topic focuses on 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, the performance is still not ideal under non-cooperative conditions,. Data imbalance and sparsity are challenges 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 learning to effectively improve the speech recognition ability 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 deploy our design in practice in order to benefit 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 treated 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 datasets are mostly analyzed and used by data owners in the enterprise, resulting in large amount of data islands. Therefore, it is highly necessary to implement open data trading platforms to promote the circulation of big data within the Internet. In this way, we can further exploit the economic value of big data and discover potential applications of various kinds of data. In this project, we will investigate closely connected issues of data exchange including data collection, data pricing, and data protection. Firstly, we will study market demand-oriented data collection schemes to provide high quality and massive data resources to the market. Secondly, 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 data sellers's revenue. Lastly, 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 unique or dominant land cover regions 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 deep neural networks such as a fully convolutional network (FCN) and SegNet can outperform traditional segmentation methods if provided a large training dataset. This internship aims to realize the deep learning-based image classification methods and achieve 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 of extracting key features from human body movements and recognizing/classifying movement types using radar sensors. Techniques such as Deep Convoluted 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

Explicit Perception Meets Implicit Mapping: an Efficient and Dense Self-supervised SLAM System

Contact Information:

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

Project Description and Objectives:

Neural implicit representation has produced encouraging results in several areas including 3D scene reconstruction and simultaneous localization and mapping. The advantages of implicit scene representation by standard dense SLAM techniques include an efficient geometric representation with automatic detail control as well as smooth and reasonable filling of the unseen area. Existing methods still lag behind ORB-SLAM2 in tracking accuracy, meanwhile their scene reconstruction are too smooth and difficult to scale to large scenes. In this project, we will design deep-learning modules to realize efficient environment perception and 3D scene reconstruction. We hope to integrate unsupervised depth and estimation with implicit scene modeling to achieve a real-time monocular SLAM system, with high camera tracking accuracy as well as better scene reconstruction and rendering performance. In addition, the 3D information of the scene can be restored.

Eligibility Requirements:

> Basic knowledge of deep learning and SLAM.
> Good programming skills (Python & Pytorch).
> Good communication ability.

Main Tasks:

> Estimate the robot's ego-motion and build accurate esurrounding maps when the robot is moving in real time.

Website:

Lab: https://irmv.sjtu.edu.cn
School: http://english.seiee.sjtu.edu.cn/

PROJECT 55

Design, Modeling and Control of Task-oriented Bio-inspired Soft Robots

Contact Information:

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

Project Description and Objectives:

Robot applications in unstructured and complex scenes have gained increasing attentions. Due to the unique mechanical structure, better environmental adaptability and safer human-computer interaction ability of a soft robot, it is competent in such application scenarios. Up to now, a considerable number of soft robots have been successfully developed and applied on different tasks such as grasping objects with unknown shape, operating surgery in confined environment, tracking and observation of seabed biology, etc. In order to further enhance the application of soft robots, this study is proposed to guide students to learn the latest international scientific research progress in this field. In combination with the application requirements of soft robots in specific scenarios, an original soft robot prototype should be developed. Moreover, students are required to study the modeling methods and control algorithms, then complete the experimental validation on the prototype.

Eligibility Requirements:

> C, C++, Matlab, circuit design.

Main Tasks:

> Designing, modeling and controlling of bio-inspired soft robot.

Website:

Lab: https://irmv.sjtu.edu.cn/
School: http://english.seiee.sjtu.edu.cn/

PROJECT 56

Planning and Control of Unmanned Aerial Vehicles

Contact Information:

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

Project Description and Objectives:

For unmanned aerial vehicles (UAVs), the program mainly focuses on image-based control and trajectory planning. Since GPS can be unqualified in indoor and cluttered urban areas or at low altitudes, the program aims to control the UAV to perform regulation or tracking tasks by taking advantage of the visual information provided by a monocular camera only. On the other hand, the program also involves generating safe and dynamically feasible trajectories for UAVs in the obstacle-cluttered environment. The program consists of image-based visual servoing, image-based visual tracking and real-time trajectory generation.

Eligibility Requirements:

> C, C++, Matlab, ROS

Main Tasks:

> Modelling, controlling and planning of unmanned aerial vehicles.

Website:

Lab: https://irmv.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:

In recent years, computer-aided diagnosis has become more and more important as the great demands of clinical practice drive the remarkable development of artificial intelligence. Advances in artificial intelligence and medical imaging technology will greatly contribute to the diagnosis of many diseases. Especially, computer-aided diagnoses can reduce the disequilibrium of medical resources in China, where there is a significant difference between the main top hospitals located in big cities, such as Shanghai and Beijing, and smaller localized hospitals.

In this project, a number of important and typical problems will be investigated, and close collaboration with hospitals and foreign institutes 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 include:

1) Study medical image processing methods and artificial intelligence techniques for one particular disease.

2) Experiment with the developed techniques on clinical data.

3) Interpretive analysis of neural networks 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. The success of deep learning in recent years implies that enhanced flexibility supported by big data promises to improve machine learning performance. This route is also applicable to advancing kernel methods, which have traditionally been restricted to shallow structures.

In this project, we will investigate several key issues of advanced kernel methods. First, it is necessary to design a deeper structure, with several nonlinear layers and develop corresponding training methods. Second, making kernels flexible usually violates positive definiteness condition, which is usually required for classical kernels, so 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 include:

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, especially in the fields of computer vision and machine translation. Neural network has also come into the view of optical communities with more layers and more intrinsic inter-layer relationships. An even more powerful tool, convolutional neural network (CNN), is now widely used in computer vision and 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 signal performance distortion in optical fiber transmission, including intersymbol interference caused by dispersion, nonlinearities and bandwidth limitation. 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, way of thinking and many other aspects. Humans all over the world may have different emotional patterns or possess similar emotional characteristics. Recently, multicultural research on emotion recognition has provided explanations for cross-cultural differences as well as similarities.

This project mainly investigates emotional neural patterns across cultures using EEG and eye movement signals. It is known that facial expressions for different emotions are similar around 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 about the mechanisms of human emotions.

Eligibility Requirements:

> Interested students should have basic knowledge of machine learning and programming skills in Python.
> Experience on TensorFlow or PyTorch is preferred.

Main Tasks:

> Finish a research report.
> Analyze EEG and eye tracking data of different cultures 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:

Assoc. Prof. Wei-Long Zheng
Email: weilong@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 the training data and testing data come from different subjects. Recently, transfer learning has attracted the attention of many researchers, which has high potential for 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 mechanisms about human emotions.

Eligibility Requirements:

> Interested students should have basic knowledge of machine learning and programming skills in 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

Multimodal Emotion Recognition in Response to Oil Paintings

Contact Information

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

Project Description and Objectives:

Most artworks are created to raise strong emotional responses and emotions in aesthetics are contained within the narrative. Artworks could be another potential approach to study how our brain perceives and processes affective information. Could we develop computational models to recognize human emotions in response to oil paintings? Based on our previous work in the lab, we have collected multimodal data including EEG and eye tracking while watching the oil paintings. We use oil paintings as stimuli to evoke three types of emotions, namely, negative, neutral, and positive, in affective brain-computer interfaces.

This project mainly analyzes the multimodal data to classify different emotions using multimodal deep neural networks and explores critical EEG and eye movement features in different emotions

Eligibility Requirements:

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

Main Tasks:

> Finish a research report.
> Develop multimodal deep learning methods to analyze multimodal data.

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, as they can offer a low-cost alternative to rigid risers conventionally used on floating platforms and provide economic riser design solutions for fixed platforms. When placed within ocean currents, Vortex-induced vibrations (VIV) will be excited for such a long flexible structure with bluff cross-sections, and possible fatigue damage caused by VIV on these structures requires 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 in a flexible catenary riser under laminar flow regime. This will be a first step towards understanding the complex response of long flexible risers under 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.
> Deliver 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 is to study the liquefaction of soils and evaluate the destructive effects on buildings using a shaking table, and to study the destructive effects of traffic loads and sea wave loads.

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

Main Tasks:
> Understand basic theory.
> Learn 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 into the oceans over the past decade. Particularly, tidal energy and wave energy are regarded as the two most promising types of marine renewable energy. 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 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 time monitoring traffic pollution, collecting raw 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 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, demolition and construction wastes will be recycled and utilized to replace new materials (mainly in the form of recycled aggregates) in new construction. To compensate for the loss of strength, the recycled aggregates will be strengthened in advance. Meanwhile, scrap tire rubber will also be used as fine aggregate to replace sand. The methods of enhancing 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 microstructure and composition of the material. The objective of this project is to familiarize students with the production of recycled concrete used in modern construction, such as precast concrete for modular construction and the top layer for smart motorway. The possibility of using this material for 3D printing will also be investigated.

Eligibility Requirements:
> Interested students should have a basic knowledge of building materials.

Main Tasks:
> Become familiar with the production of recycled materials in modern construction.
> Complete a research report.
> Deliver two research presentations, being a reference review and a technical presentation.
> Submitt 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, productivity in the construction industry has been declining over the past 30 years. Automated construction systems provide a modern and efficient way to build high-rise buildings in urban city. The favorite benefits of such systemsinclude significant waste reduction, improved site safety, and a more controllable quality of construction projects. This project aims to develop a virtual control system for automated construction equipment utilizing digital innovations (including BIM, 3D laser scanning and multi-sensor technology). The system should be able to update the building information model in real time through the use of 3D laser scanning and robotic survey technology. Multi-sensor technology should also be used to provide a synchronized monitoring system for equipment during operation.

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/

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 it with great potential in cryogenic extremes such as in aerospace and petrochemical industries. In this project, we will use selective laser melting and one of the laser additive manufacturing technologies to fabricate 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 the biomedical industry. Friction stir welding (FSW) has advantages in the joining of 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 metal-polymer joining process. The welding temperature (Tw) and axial load (Fz) evolution will be measured during welding to study the temperature-force coupling process. Emphasis will be placed on bonding mechanisms (including macroscopic interlocking mechanism and microscopic bonding mechanism), and their effects on the mechanical properties of the joints will be studied through Transmission Electron Microscope (TEM), X-ray Photoelectron Spectroscopy (XPS), Fourier Transform Infrared Spectroscopy (FTIR) and Electron Energy Loss Spectroscopy (EELS). The obtained results will meet the urgent need 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.
> Deliver 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:

> Finish a research thesis.
> Deliver 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:

Asso. Prof.Yao Li
Email: liyaosjtu@sjtu.edu.cn

Project Description and Objectives:

Moisture in the air has drawn great concerns from various industries, including food preservation and processing, chemical and petrochemical industry, microelectronics, architecture materials, pharmaceuticals, cosmetics, and papermaking. Due to the limited amount of fresh water in the world (approximately 3% of the world's water), atmospheric moisture is a potential alternative renewable water resource, as the earth is surrounded by over 12.9*1012 m3 of atmospheric moisture. This could 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 with effective adsorption–desorption characteristics will be designed and investigated for water harvesting application.

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:

Asso. Prof.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 recently attracted extensive 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 promise a sustainable future. In this project, we utilize the unique structure of wood to fabricate wood-derived monolithic porous carbon materials by varying the experimental conditions to cater for different practical applications.

Eligibility Requirements:

> Experience in materials preparation.
> Familiar 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 to better meet 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:

Asso. Prof.Yao Li
Email: liyaosjtu@sjtu.edu.cn

Project Description and Objectives:

Stimuli-responsive photonic crystals have many potential applications in physical, chemical and biological detections. Stimuli-responsive photonic crystalsare a kind of smart color shifting materials whose color can be tuned by external stimuli, such as temperature, pH, ions, or electric fields. When external conditions change, the physical or chemical properties of these materials will change accordingly, leading to changes in their period length or refractive index, and eventually changes in their structural color. Thus, the external stimuli signals will be converted 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 intuitive mean for the detectionof stimuli signals.
Over billions of years' evolution, nature has formed diverse kinds of tiny structures that match 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 stimuli-responsive photonic crystals using biomaterials as templates and investigation of their 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 muti-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

Numerical Simulation Aided Manufacturing System Optimization for Single-crystal Blade

Contact Information:

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

Project Description and Objectives:

Single-crystal blade with perfect high-temperature mechanical properties is one of the important components in gas turbine. Due to the complex geometry of the blade, castings are prone to defects. In order to avoid these defects, we should gain insight into the directional solidification of single-crystal blade. In this project, we will utilize the numerical model to simulate the directional solidification of single-crystal blade in a Bridgman furnace. The characteristics of the heat transfer and solidification sequence will be discussed based on the simulation results. The optimization of the process design (including but not limited to furnace and shell mold) and selection of operating parameters will be proposed according to the analysis, and then estimated using further simulations. The obtained results will extend the understanding of the radiative heat transfer patterns in the furnace and improve the furnace design and parameter control in the fabrication of single-crystal blade.

Eligibility Requirements:

> Interested students should have a basic knowledge of directional solidification.
> Interested students should be familiar with ANSYS FLUENT software.

Main Tasks:

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

Website:

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

ENVIRONMENTAL SCIENCE AND ENGINEERING

PROJECT 77

Coupled Solar Driven Electro-catalytic Purification of Natural Gas via Simultaneous CO_2 and H_2S 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, most of the natural gas produced from gas fields contains about 15% hydrogen sulfide and 10% carbon dioxide, which must be removed before use. It is difficult to remove CO_2 and H_2S simultaneously by traditional separation methods. This is because apart from consuming lots of chemical reagents, the separated CO_2 and H_2S require complicated and expensive subsequent processing . Hence, if CO_2 and H_2S can be separated and converted into CO and S respectively, 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 combines solar energy conversion technology with CO_2 and H_2S 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 H_2O_2 on Modified C_3N_4 under Simultaneous Sunlight

Contact Information:

Prof. Mingce Long
Email: long_mc@sjtu.edu.cn

Project Description and Objectives:

H_2O_2 is one of the fastest growing industrial chemicals in the world. Over the last ten years, it has been widely used as a multi-purpose environmentally friendly oxidant in biological processes, water purification and chemical industry since it only emits water as final byproduct. Industrial production of H_2O_2 through anthraquinone oxidation is limited by the high energy input and tedious steps for multiple hydrogenation and oxidation reactions. It is stillchallenging but highly demanding to produce H_2O_2 in a facile, clean, and safe way. Photocatalytic production of hydrogen peroxide (H_2O_2) 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 H_2O_2 formation and the simultaneous decomposition of H_2O_2. C_3N_4 is a promising visible light driven photocatalyst for H_2O_2 production. In this study, we plan to synthesize highly active C_3N_4 by improving crystallinity and doping single atoms. The prepared catalysts will be fully characterized. The performance for H_2O_2 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 Containments

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, chemicals are increasingly synthesized and released into the environment. Many evidences have shown that the exposure to environmental contaminants is one of the important factors affecting both human and ecological health. In recent years, the contamination of emerging organic pollutants in our environment has attracted people's attention. Normally, several μg/L of organic pollutants is found in surface and ground waters. In the influent andeffluent flow of waste-water treatment plants, up to hundreds of μg/L of organic pollutants are found However, their potential reproductive and developmental effects on aquatic organisms are largely unknown. Therefore, the objective of this study is to investigate the developmental effectsand, 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 precise membrane separation process under low pressure condition. 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 Layer-by-Layer (LBL) method and spin-LBL method on PES membranes. The membranes prepared by spin-LBL method has showed higher rejections to dyes and water permeability than those of LBL method. However, mechanism of the difference in separation and rejection performance between the two membranes still need to be investigated.

Eligibility Requirements:

> Major in environmental Environmental Engineering, Chemical Engineering, Polymeror other related areas.
> Motivation to work.
> Students who are familiar with the computational method of the molecular modeling are 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

Biomechanical Mechanism of Balance Dysfunction in Patients with Sarcopenia

Contact Information:

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

Project Description and Objectives:

Sarcopenia is one of the most common diseases among the elderly. Falls caused by loss of balance have severe complications on the quality of life of sarcopenic patients. However, the mechanism of imbalance in sarcopenia has not been clearly understood till now. The nervous and muscular systems are the two central systems responsible for the motor coordination of our body. Hence, this project aims to explore the mechanism of imbalance in patients with sarcopenia from the perspective of nervous and muscular systems with biomechanical technologies. An understanding of imbalance in sarcopenia would help to improve the diagnosis, prevention and treatment of sarcopenia.

Eligibility Requirements:

The students should be interested 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 projects above. The students are required to attend regular lab meetings and write weekly reports for their mentor(s). By the end of the internship, a project report should be submitted.

Website:

Lab: https://bmct.sjtu.edu.cn/
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 functional capacity have been observed in post-operative patients, the adverse effects of reduced range of motion, asymmetric gait pattern, and inability to restore their normal joint kinematics, are 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 some adverse in-vivo dynamic phenomena,including edge loading, wearing, impingement and dislocation. Accurate knowledge of in-vivo joint dynamics is crucial for further improvement of arthroplasty. This project willconsist of investigations into the bone geometry of Asian people. Statistical shape modelling 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 modelling and inverse dynamics will enable joint forces and moments estimations. 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 no economical and efficient way to measure 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 the relationship between shear wave velocity on TCL and carpal tunnel pressure. The investigation will have a clinical influence on CTS prevention, diagnosis and treatment.

Eligibility Requirements:

The students should desire to use 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 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

Development of Myelinated and Vascularized Human Brain Organoid

Contact Information:

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

Project Description and Objectives:

Animal models are inherently challenging to translate to human physiology and pathophysiology of the central nervous system. The brain of a living organism is too complex and tightly integrated for detailed studies of metabolic interactions. Contributions of specific structures such as vasculature or perivasculature cannot be disentangled, let alone contributions by distinct cell types. Thus, it is quite challenging to develop treatments for brain diseases including stroke, due to the lack of established methods for generating relevant human data. This proposal aims to develop a vascularized brain organoid with myelin sheath structure and explore the interaction between myelin and blood vessel based on this brain organoid. The students will join a team of graduate students and research faculty members. Techniques used in this project will include but not limited to stem cell culture, brain organoid culture, staining and data analysis.

Eligibility Requirements:

> Must be at least in their sophomore year.

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

In Vitro Brain Modeling with 3D Bioprinting

Contact Information:

Asso.Prof. Wanlu Li
Email: liwanlu-0424@sjtu.edu.cn

Project Description and Objectives:

Establishing the in vitro brain model to simulate the physiological and pathological state of the brain is crucial for translational medicine. However, the applications of in vitro brain models are limited because of the difficulty in accurately reproducing the specific structure of the brain. 3D bioprinting, as an advanced technique, favors the biofabrication of tissues with improved structural complexity. This projectaims to develop a 3D bioprinting method to construct physiological-relevant brain tissue models. 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 cell culture, biomaterial synthesizing, 3D bioprinting, and data analysis.

Eligibility Requirements:

> Must be at least in their sophomore year.
> Basic knowledgeof biology, enthusiasm for cutting-edge 3D bioprinting techniques and their applications.

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 86

Developing Biomaterials to Recreate Physiological-Relevant Brain Signalling Cues

Contact Information:

Asso.Prof. Wanlu Li
Email: liwanlu-0424@sjtu.edu.cn

Project Description and Objectives:

The neural extracellular matrix (ECM) influences cellular proliferation, differentiation, migration and maturation throughout brain development. Although the neural ECM shapes key developmental processes, 2D and 3D culture approaches rely mostly on heterogeneous and insufficiently manipulatable ECMinspired materials (such as Matrigel). 2D and 3D culture approaches are also cultured as free-floating cell aggregates devoid of exogenous. Therefore, introducing biomaterials that better emulate endogenous neural ECM'scomposition or downstream signalling effects may yield cell culture models with more biomimetic neural proliferation, differentiation, ⊠migration⊠ and maturation. In this project, we aim to develop biomaterials to mimic the physiological-relevant brain signalling cues. 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 cell culture, biomaterial synthesizing, and data analysis.

Eligibility Requirements:

> Must be at least in their sophomore year.
> Basic knowledge of biology and biomaterials.

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. Lichi Zhang
Email: lichizhang@sjtu.edu.cn

Project Description and Objectives:

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. Deep learning-based image synthesis has recently 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 image synthesis technique. 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 for cutting-edge artificial intelligence techniques and their applications 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. The most advanced technology in this field is single cell protein detection. Mass Cytometry (CyTOF) is a multi-parameter detection technique for single cell using mass spectrometry. It inherits the characteristics of high-speed analysis of traditional flow cytometry and has a high resolution of mass spectrometry, 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 cell in highly multiple fashions.

Eligibility Requirements:

The students should have an interest in personalized disease diagnostics and personalized disease therapeutics and 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 projects above. 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 Metabolomics and Disease Early Diagnosis

Contact Information:

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

Project Description and Objectives:

Early disease diagnosis is of great concern in clinics and will benefit the patients. In addition to nucleic acid and proteins, metabolites are important disease biomarkers for disease-related physiological status. Therefore, it has recently attracted a lot of attention from scientists. However, metabolites are typically detected via the mass spectrometer but show few clinical potentials due to the high cost of the equipment and time-consuming pre-treatment process.

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. With the targeting of the biomarkers, SERS technique, as the non-targeting, non-invasive and efficient technique, will pave a new accurate way for 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 for 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 and bioinformatics
> 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 improve survival, and early diagnosis is particularly crucial. Diseases initiate from changes in tissue and intracellular structure and chemical composition. Raman spectroscopy is a non-invasive technique that can specifically detect chemical and structural information of molecules. The signature Raman spectra of genomic DNA, nuclei, and tissue of normal gastric mucosa and gastric cancerhave been proven different. This project aims to investigate the spectral difference between normal gastric tissue and cancers. It involves the usage of machine learning algorithms for the clustering or classification of Raman spectra that collected from cancer patients. The goal is to develop a model 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/

AERONAUTICS AND ASTRONAUTICS

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 who are interested in GNSS to develop high-precision GNSS positioning on smartphones and exploit every qualified state-of-the-art technique to fuse data from an inertial measurement unit (IMU) and GNSS. The developed algorithms will be a universal package with a slight modification of incoming sensor data stream to perform 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, graduate 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. The missing definitionintroduces an inherent limitation to classical theory. An alternative approach for simulation failures and damages in advanced composite materials is crucial to improve the shortcomings in classical mechanics. In this project, PeriDynamic(PD), a new continuum mechanics theory, will be applied to analyze progressive failures in advanced composite structures. Students will have fundamental and practical knowledgeof the numerical implementation of peridynamics. Moreover, students can perform experimental investigations of composite materials to verify their observation in numerical simulation.

Eligibility Requirements:
> Knowledge of 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 Microscopycan visualize atoms on a crystal surface and thus becomes a top priority for the scientists who work in either atomic-scale physics, chemistry or material science. Topology, a special kind of advanced mathematics, was introduced into solid-state physics and bred 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 and etc.

Eligibility Requirements:
> Good 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.
> Deliver 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, Bi_2Te_3.

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.
> Deliver two research presentations (1. References review; 2. Technical presentation).

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

CHEMISTRY AND CHEMICAL ENGINEERING

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 forge chemical bonds accurately in modern organic synthesis. Organocatalysis, a biomimetic catalyst that usually catalyzes with metal-free small organic molecules, is a relatively young research area that flourished 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. The reaction will result in successive multiple bond-forming events, further formation useful building blocks and extensive existence 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: https://tuyq.sjtu.edu.cn/
School: http://scce.sjtu.edu.cn/en/

PROJECT 96

Symmetry Breaking During Hierarchial Self-Assembly of Organic Cages

Contact Information:

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

Project Description and Objectives:

Symmetry breaking is a universal phenomenon which has attracted considerable attention to the communities of physics, chemistry, biology, and philosophy. The relativity of the break of symmetry is valid only if the time and/or space scale of the system of interest is defined. Thus, we use the self-assembly of organic cages and their catenated analogues to illustrate the relativity, which demonstrates that the erstwhile symmetry of racemic (i.e., symmetric) mixture is only considered broken within specific temporal, spatial and logical levels. Besides, we explore the intrinsic driving forces that lead to spontaneous chiral resolution during the self-assembly of cage racemates. Our research group emphasizes the importance of liberal education, which is a pivotal source of inspiration for the creativity and elegance of scientific endeavour.

Eligibility Requirements:

Candidates should be fluent in English and have the passion to explore the fantasy of the chemical world.

Main Tasks:

Synthesis and characterization of organic cages, exploration of physiochemical properties of their self-assembled structures in nano- and mesoscales. All works are conducted under the guidance of the postdocs and/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 from an ALS-related protein superoxide dismutase 1 (SOD1) (PNAS, 2017, 114, 33). This five-month intern project will be focused on understanding the formation of the corkscrew-like structure. The student is expected to use fluorescence spectroscopy to monitor the tryptophan fluorescence during the aggregation process to unveil 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 a 3,4-fused ring, which natural or semi-synthetic ones were approved for treatment or relief of neurodegenerative diseases. Due to their unique structure and beneficial biological activities, these natural products' biosynthetic and total syntheses were widely studied. The development of transitional-metal-catalyzed reactions, such as the Heck reaction, allylic reaction and C-H activation, has provided new synthetic strategies for the total syntheses. In this project, we proposed the biomimetic strategy using the C-H activation and decarboxylative reaction. We will investigate the key steps of synthesis of lysergic acid, including indole C4-H olefination and intramolecular decarboxylative Giese reaction, a chiral route by asymmetric decarboxylative allylic reaction. Similarly, indole C4-H alkynylation followed by intramolecular decarboxylative coupling with alkyne provided the key precursor of agroclavine. This project aims not only to provide another efficient route of ergot alkaloids in a biomimetic way, but also to prepare lots of ergot alkaloids for further medicinal chemistry studies.

Eligibility Requirements:

> Major in chemistry, including chemistry& biochemistry and 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

OCEANOGRAPHY

PROJECT 99

Microalgae and Ecosystem Sustainability

Contact Information:

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

Project Description and Objectives:

Marine biology internships offer 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 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

LIFE SCIENCES AND BIOTECHNOLOGY

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 regulate organ size negatively. Our lab had previously characterized the Arabidopsis protein kinase SIK1 and its scaffold protein MOB1 as the Hippo-Mats signalling 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. This project aims to verify the genetic interactions between SIK1 and some of these candidates by generating double mutants and 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:

> Generate double knock-out mutants by crossing or targeted genome editing (CRISPR-Cas).
> Grow the mutants and verify the double mutants by genomic PCR and RT-PCR.
> Observe and document the phenotypes of the double mutants.

Website:

Lab: https://www.researchgate.net/profile/Qingqiu_Gong?ev=prf_highl
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 proposed project aims 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 from this project might aid both neurologists and researchers studying the 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 are accumulated 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 or lysosome system. This project aims to produce autophagy regulating peptides by budding yeast. Our research will help society to provide safe and economical peptide-based medicine.

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. Expression and purification of the peptides will be performed based on initial results and further optimization of the design.

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 their safety of transgenic organisms. We are developing new detection methods to identify changes at the genomic, transcriptomics, proteomics, and metabolic levels. We are also currently comparing differencesbetween 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 focuses on developing new analytical tools for genetic studies and discovering new genetic mechanisms of cancers, mental disorders, heart diseases and endocrine diseases. The major research 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) performing 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 soon.

Eligibility Requirements:

> Basic knowledge of genetics, statistics and molecular biology.

Main Tasks:

> Bioinformatics
> Chip/sequencing data analysis
> In vivo/vitro functional experiments

Website:

Lab: https://bio-x.sjtu.edu.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, global infertility has increased yearly, with an incidence rate of 10-15%. Method to restoreor 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:
> Deliver midterm technical presentation.
> Complete final project report.

Website:
Lab: http://www.bio-x.cn/
School: https://bio-x.sjtu.edu.cn/

PROJECT
108

The Mechanisms of Depression and Memory Process

Contact Information:
Prof. Weidong Li
Email: liwd@sjtu.edu.cn

Project Description and Objectives:
Depression has become one of the major challenges of mankind. My lab works on the mechanisms and treatments of depression by using stress-induced depression mouse model, LHPP knock-out depression mouse model and depressive population. In this project, we will explore the neuron function of depressive-like mice with multiple technologies such as behavioural analysis, multi-channel recording, voltage-sensitive dye imaging, transcranial magnetic stimulation and whole-cell recording. The mechanism of learning and memory is one of the fundamental questions in brain science. Thus, we will also investigate the extinction mechanisms of traumatic memories by TRAP, DREADDs and optogenetics strategies. These projects may provide important clues for the mechanisms of depression and memory processes.

Eligibility Requirements:
> Understanding of lab safety.
> Basic knowledge of neuroscience.

Main Tasks:
> Discussions and presentations.
> Final research report.

Website:
Lab: https://lwdlab.sjtu.edu.cn/
School: https://bio-x.sjtu.edu.cn/

AGRICULTURE AND BIOLOGY

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, NO_2, SO_2 and O_3) in plantation stands from the city center (Zhongshan Park) to the out-loop highway (Jinhai Park) and the rural area (Chongming Island) in Shanghai. With these data, the concentrations of air pollutants and the variation along the urban-rural gradient will be analyzed and compared with other parts of Shanghai. The results would show to what extent the concentrations of the air pollutants are reduced 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.The usage of urban greening tree species to absorb 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 wind coagulation, vapor phase coagulation, and thermal diffusion coagulation.
Through the above experiments, we will explore the law of condensation and deposition of particulate matter at the interface between the atmosphere and plant leaves under dry sedimentation conditions. The exploration will fill the gap between vegetation and atmospheric research and lay a foundation for the mechanism of plant-particle retention. The study will provide a scientific basis for building high-efficiency and dust-prevention 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 into 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 Ilumina 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.
> Experience in plant biotechnology is preferred.

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: https://plantbiotech.sjtu.edu.cn/
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 experiences, including 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 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. Photoreceptors can sense light signals and trigger downstream signal transduction pathways, which regulate many physiological processes in plants. The objective of this project is to screen the interacting protein of the important factor in the light signal transduction pathway and investigate the function of the interacting proteins. The results will contribute to our further understanding of 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:

> Perform protein-protein interaction assays with Y2H, BiFC etc..
> Grow and verify the transgenic plant lines and mutants by genomic PCR, RT-PCR and western-blot.
> Observe and document the phenotypes of the transgenic lines and mutants.
> 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

PROJECT
115

Xanthomonas Effectors for Plant Immunity

Contact Information:

Prof. Gongyou Chen
Email: gyouchen@sjtu.edu.cn

Project Description and Objectives:

This project aims to know how Xanthomonas effectors trigger plant immunity (ETI) and susceptibility (ETS) via their targets in plants 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. We have currently generated an effector-free strain of a model race PXO99A which may elucidate PTI, ETI and ETS.

Eligibility Requirements:

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

Main Tasks:

> Understand the core effector(s) of Xanthomonas oryzae for water-soaking in rice
> Understand the core effectors of Xanthomonas oryzae for basic pathogenicity in rice
> Understand 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

PHARMACY

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 to familiarize students with basic theory and genetic engineering trends in biomedicine using up-to-date techniques.

Eligibility Requirements:

Level 1: Students must have passed basic biology classes.
Level 2: Students 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 trends in biomedicine using up-to-date techniques. Classes will be conducted with a brief lecture of related therapeutic theory and keynotes 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 and 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: daweili@sjtu.edu.cn

Project Description and Objectives:

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

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 knowledge and experience in this specialized projectis in hot demand from biotech startups, research institutes and established biopharmaceutical companies. This project will focus on various current aspects in the research and development including engineering designs, of antibody medicine.

> 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 outstanding outcomes 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 utilize this 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 organelles in cells. The research on mitochondria-targeting drugs is one of the currently 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 either 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 from 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 ofbiological 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 partly because of their high specificity, high tolerance, long half-life and amenability to manipulation .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 to prepare new CAR-T cells to treat tumors and increase immunity towards 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/

MEDICINE

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:

Familiarize yourself with the lab, attend and assist the training of new staff, read and memorize the rules and regulations.
Read literatures on aristolochic acid and human induced hepatocytes and familiarize yourself with cell culture and passage methods.
Study the genetic toxicity evaluation method and routine combination experiment. It includes the principle, operation, observation and evaluation 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, 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, 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 due to its complex spectrum of symptoms. It is important 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://www.smhc.org.cn/yixue/shsjswsyjs/info_606.aspx?itemid=747&id=215
School: http://www.smhc.org.cn/index_en.aspx

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 a large sample size 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://www.smhc.org.cn/yixue/shsjswsyjs/info_606.aspx?itemid=747&id=215
School: http://www.smhc.org.cn/index_en.aspx

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 quantitative 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, as it is 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://www.smhc.org.cn/yixue/shsjswsyjs/info_606.aspx?itemid=747&id=215
School: http://www.smhc.org.cn/index_en.aspx

PROJECT
127

Laughter Is the Best Medicine: The Effect of Innovative Health Science Popularization Models for Improving Health Awareness and Satisfaction in Shanghai Community

Contact Information:

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

Project Description and Objectives:

This research is about innovative health science popularization models, such as medical science talk show in mental health and other medical fields. One program is the effect on awareness of mental health knowledge or other medical knowledge in community residents. Another program is organizing foreign volunteers (Russia, America, Turkey, Burma, Pakistan……) to participate in community science popularization programs in Shanghai with medical science talk shows. This innovative science popularization model is welcomed by foreign volunteers and residents. Our objective is evaluating the effect of innovative health science popularization models on improving health awareness and satisfaction in Shanghai community. Laughter is the best medicine, and all that.

Eligibility Requirements:

If you have interesting in Chinese society, culture, tradition and language, it would be preferred. You will have happy and interesting time in this program 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 programs in science popularization with mentor's help

Website:

Lab: http://www.smhc.org.cn/yixue/shsjswsyjs/info_606.aspx?itemid=747&id=215
School: http://www.smhc.org.cn/index_en.aspx

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 associated to 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 is 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 tracers to label the subpopulation of neurons activated by morphine, investigate the neural circuit, and provide morphological evidence for the neural basis of drug addiction. This project is important for elaborating the circuit basis of addiction in the nucleus accumbens and also 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 clinical laboratories. 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 on the precise target therapy of colorectal cancer based on single cell analysis and clinic pathological study. In this study, we will start with single cell analysis of colorectal cancer cells and tissue samples and explore the value of IL-38 in the targeted 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 cultivation, 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 their ability to conduct scientific research independently.

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 are found to affect the metastasis of colon cancer by regulating PBXIP1 expression. In this study, we will study the changes of FENDRR and PBXIP1 gene and how it affects protein expression in colon cancer cell lines and fresh tissues, 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 cultivation, 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 their ability to conduct scientific research independently.

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 with bioinformatics methods .We will also 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 further 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 studies related to metabolism or signaling pathways.

Eligibility Requirements:

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

Main Tasks:

Increase 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. Cultivate 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, 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:

> Cultivate 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 collected during the last decade. The laboratory has three major researching interests, which include: (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 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 for 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

Neuro-immune Regulation of Skin Diseases

Contact Information:

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

Project Description and Objectives:

Psoriasis is a chronic immune-mediated skin disorder. The most common type of psoriasis is plaque psoriasis. Symptoms are dry patches of skinthat turns red, and covered in silver scales that usually appear on the elbows, knees, lower back, and scalp. Mounting evidence shows that the peripheral sensory nervous system plays an active part in the pathogenesis of skin diseases, which inspired us to explore the possibility of directly targeting the nervous system for psoriasis treatment and the detailed mechanism of neuroimmune crosstalk. We recently published an article entitled " Lidocaine Ameliorates Psoriasis by Obstructing Pathogenic CGRP Signaling-Mediated Sensory Neuron-Dendritic Cell Communication" in the Journal of Investigative Dermatology, reporting a proof-of-concept study using an epidural anesthetic injection of lidocaine to treat four patients with psoriasis. By the end of the study period, all patients achieved remarkable improvements, showing a 35%-70% reduction in Psoriasis Area and Severity Index (PASI) scores. Mechanistically, lidocaine acts on sensory neurons by downregulating disordered neurite growth and proinflammatory CGRP (calcium gene-related peptide) release. Concomitantly, restricted CGRP+ nerve density leads to reduced IL-23 production from dendritic cells, which express excessive CGRP receptors. In summary, our study demonstrates that manipulating the neuroimmune interplay may put a brake on neurogenic inflammation and downstream key inflammatory cytokine production, providing therapeutic prospects for sensory neuron-orchestrated inflammatory skin diseases. We intend to study neuron-immune regulatory mechanisms in skin diseases including psoriasis, atopic dermatitis, and vitiligo, as well as in skin aging, to identify novel therapeutic targets and invent targeted therapies.

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.
> Therapeutic effect assessment.
> Literature reading, sorting, and reviewing.
> Research report and presentation.

Website

Lab: https://orcid.org/0000-0001-6302-6927
School: http://daoshi.shsmu.edu.cn/Pages/TeacherInformationView.aspx-?uid=CC9DAA19-8AE4-4DFB-82EE-1A1BC05E3BA3&from=s&pId=&tId=710

PROJECT
138

Targeted Therapy of Vitiligo and Its Mouse Models

Contact Information:

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

Project Description and Objectives:

Vitiligo is a common autoimmune disease that progressively destroys melanocytes in the skin, resulting in the appearance of patchy depigmentation. It affects ☒1% of the world's population without any significant difference in prevalence due to sex, ethnicity, or geographic region. Yet, targeted drugs for vitiligo are very scarce and off-label therapies have limited efficacy (Ruxolitinib cream is the only FDA–approved treatment for vitiligo repigmentation). Thus, developing a better understanding of vitiligo pathogenesis to explore more effective treatments would have an enormous impact on those who suffer from vitiligo. Vitiligo pathogenesis is very complex, and its initiation and regulation mechanisms remain unclear. Autoreactive cytotoxic CD8+ T cells engage melanocytes and promote disease progression through the local production of IFN-γ. However, the detailed mechanisms by which autoreactive T cell activation and infiltration remain largely unknown. In this project, we use single-cell RNA sequencing (scRNA-seq) to analyse all cell types present in patient skin, which implies a strong Sensory Neuron☒Dendritic Cell-Cytotoxic CD8+ T cells communication. Moreover, we developed a mouse model in which vitiligo was induced by inoculation with B16F10 melanoma coupled with depletion of regulatory T (Treg) cells, which recapitulated the pathologies of patients with vitiligo. Next, we intend to screen for small molecule drugs to interfere with pathogenic signaling pathways using in vitro (test tube or cell culture) and in vivo (animal) experiments. Our results will help us understand the pathogenesis of vitiligo and hopefully find targeted drugs for vitiligo.

Eligibility Requirements:

An eligible candidate should be self-motivated and have

> an excellent team spirit.
> good English communication and writing skills.
> Able to reflect from experiments and conclusions.
> Interested in neuroimmune interaction and autoimmune disease.
> Experience in working with animal models is preferred.

Main Tasks

> Animal model establishment.
> Complete experiment assigned.
> Give research presentations.
> Complete a research report.

Website

Lab: https://orcid.org/0000-0001-6302-6927
School: http://daoshi.shsmu.edu.cn/Pages/TeacherInformationView.aspx-?uid=CC9DAA19-8AE4-4DFB-82EE-1A1BC05E3BA3&from=s&pId=&tId=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 disease affecting 2-3% of the global population. Although current treatments provide multiple therapeutic options, psoriasis is still incurable, which means patients must live with the annoying disease throughout their lifetime. Thus, new druggable targets which improve treatment outcomes should be explored, and natural compounds with biological activities are suitable means to identify new druggable targets. We perform preclinical studies to screen therapeutic compound in multiple models of psoriasis. Moreover, we investigate the underlying mechanism of anti-psoriasis compound and modify their structure to enhance therapeutic effect and reduce toxicity.
Recently, we published an article entitled "Targeting the transcription factor HES1 by L-menthol restores protein phosphatase 6 in keratinocytes in models of psoriasis" in Nature Communications, reporting that a natural compound, L-menthol, for psoriasis therapy. L-menthol ameliorates psoriasis-like skin inflammation by increasing protein phosphatase 6 (PP6) in keratinocytes. Target identification approaches reveal an indispensable role for the transcription factor hairy and enhancer of split 1 (HES1) in governing the PP6-upregulating function of L-menthol in keratinocytes. HES1 is diminished in the epidermis of psoriasis patients and imiquimod-induced mouse model, while L-menthol upregulates HES1 by preventing its proteasomal degradation. Mechanistically, HES1 activates the expression of immunoglobulin-binding protein 1 (IGBP1) which promotes PP6 expression and inhibits its ubiquitination. Collectively, we discover a therapeutic compound, L-menthol, for psoriasis, and uncover the dysfunctional the HES1-IGBP1-PP6 axis that contributes to psoriasis pathology by using L-menthol as a probe. We now seek to discover and investigate other candidate compounds (either natural compounds or their derivatives) for their potential to treat skin immune diseases like psoriasis and explore the underlying working mechanisms.

Eligibility Requirements:
An eligible candidate should be self-motivated and have
> 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: https://orcid.org/0000-0001-6302-6927
School: http://daoshi.shsmu.edu.cn/Pages/TeacherInformationView.aspx-?uid=CC9DAA19-8AE4-4DFB-82EE-1A1BC05E3BA3&from=s&pId=&tId=710

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. Earlier works have indicated that AEP has a great effect on breast cancer metastasis. Thus, later work will focus on searching for small molecule inhibitors of AEP, antitumor prodrugs, and therapeutic antibodies. In addition, 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 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:
> Complete 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 it is closely associated 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 incidents 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 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: https://scsb.sjtu.edu.cn/

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 of knowledge as well as interdisciplinary and international vision. The project, "Construction of TCM Knowledge Graph", aims to cultivate professionals in internationally 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 on the integration of medicine, science and engineering knowledge, develop diversified thinking which comprises of Chinese and Western thinking horizons, 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.
> proficient at computer technology and 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 changes have greatly influenced urban planning and development. More and 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 the 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 are to be performed to analyze and summarize the root causes of urban problems. The ultimate goal is to explore and propose solutions usingurban planning in architectures. During this project research, students will rediscover 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 to 2D/3D urban landscape metrics. These metrics characterize, for instance, the urban morphology, the thermophysical properties of 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 energy conservation and emission reduction of sewage treatment. The goal is to understand the units of high energy consumption and high carbon emission of sewage treatment process, and learn how to realize energy-saving and carbon reduction technology in the optimal design of sewage treatment process. Such examples of new environmental processes are, 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 to teach participants on nature-based solutions and how to utilize nature-based solutions to solve problems, and to learn the skills to extract necessary information from remote sensing images and spatial analysis.

Eligibility Requirements:

Participants are required to have basic background of geography, ecology, and environmental science, and have basic skills to operate GIS, such as Arc Map, etc., and image processing software, such as ENVI, etc.

Main Tasks:

Main tasks include extracting information concerning 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 rate of population agingis the fastest as ever before. As the population grows older, we also see a decrease in young people that are prepared to take care of the elderly groups. This project is to develop and deploy an elderly care robot that can perform simple tasks 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 in modeling the temperature distribution in electronic devices. We already developed 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++.
> Having background knowledge in 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/

PROJECT
150

Research on the Coordinated Control of SOFC/GT Hybrid System Based on Safety Margin

Contact Information:
Asso. Prof. Xiaojing Lv
Email: lvxiaojing@sjtu.edu.cn

Project Description and Objectives:
Solid Oxide Fuel Cell/Gas Turbine (SOFC/GT) hybrid systems have the advantages of high efficiency, low emissions and high fuel flexibility. It is one of the most important development directions of power generation technology of the future.
However, the safe and stable operation and high-performance controls have always been a difficult technology question that has been restricting 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 a coordinated control method of performance indicators and multi-dimensional safety margin, and obtain a 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 database for the optimization of design andsafety warning settings, 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 theoretical 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://pmelab.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 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 wasted crab/shrimp shells or woody biomass such as wheat straws. Some tools may be applied to solve problems in the projects, mainly 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 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:

Develop a feasible process to transform waste shell-derived chitosan into biodegradable plastic bags with good qualities.

Website:

Lab: N/A
School: http://lcc.sjtu.edu.cn/En/Data/View/763

PROJECT 152

Design Thermal Functional Materials via Materials Informatics

Contact Information:

Asso. Prof. Shenghong Ju
Email: shenghong.ju@sjtu.edu.cn

Project Description and Objectives:

Designing functional 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 along with theory, simulation, and experiment, is now gaining attention in materials research. In this project, we will employ various intelligent optimization methods to solve the bottlenecks of material selection and structure design which limit the design efficiency in thermal functional materials.

Eligibility Requirements:

> Familiar with or interested in machine learning and data science.
> Understands 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
153

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 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 at specific times and places. 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 strong solar thermal energy stored in the summer. CHS works on the basis of reversible thermochemical reactions to store and release thermal energy.
What's more, adsorptive seawater desalination is a technology based on low-temperature evaporation under negative pressure and adsorption/desorption coupling of porous media. We hope to gain more insight on the matter in this project.

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 $Mg(OH)_2$.
> Obtain the supercooling phenomenon and the distribution of supercooling degree during solidification by heating and melting the PCM then cooling the PCM.
> 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
154

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 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 activity of waste recycling and at the same time, reduce energy reliance on traditional fossil fuel sources and its emission of pollutants.

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/

上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

SJTU Summer Research Internship Program

2023

Contact :
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