Program Overview

1) Internship in Labs
As a student of the program, you take on a 3-month program where you participate in laboratory research at USTB’s state-of-the-art laboratories and benefit from our “Exploring China” course.

Available fields and topics include but not limited to:
- The Research and Applications of Industrial MIMO-SAR Digital Imaging Algorithms
- 2D Ear Recognition based on Deep Learning Method
- 2D & 3D Hybrid Ear Recognition from One Sample per Person
- Temperature Sensor Array for Breast Wellness Screening
- Making Smart Objects of Smart Home Smart
- Research on Synthesis and Characterization of Carbon Dots/TiO2 Photocatalyst
- Research on magnetic properties and magnetocaloric effect of novel magnetic materials

Please refer to the attachment for more details of the topics. You are also advised to contact a supervisor yourself if your preferred research topics are not listed above. Please browse USTB’s homepage to search a USTB faculty.

2) Exploring China ( * Available in July )
Our program offers a series of English-based lectures and field trips that allow you to experience time-honored Chinese history and culture, and explore specific environmental and socio-cultural aspects of China, including visits to historic sites, Chinese language course taught on primary level, Hand-on cultural experience, e.g. Taichi, Tea Art, Calligraphy, Han Chinese costume.

Application

1) Who can apply
- Students who are currently registered in a partner university
- English proficiency required to follow lectures

2) Number of Students
15 students

3) Program Duration
3 months, starting date as per different topics
4) How to apply
Send the following documents to the International Office, USTB.
- Application Form with photo
- Photocopy of passport
- Certificate of enrollment at home university
- Photocopy of insurance certificate
- Certificate of insurance

Applications should be submitted via the international office of the home university, and individual applications won’t be accepted.

5) Deadline
March 15 (Entry in May), or April 30 (Entry in June)

Payment
- Program fee: Exempted
- Accommodation fee: CNY 1500 per month (double-room housing), charged upon check-in
- Fees for Cultural events and Field trips: Exempted
- Costs for study materials and resources, meals, round-trip air ticket, local transportation, insurance and medical care not included

Accommodation
- Double room in campus dormitory
- Each room furnished with air-conditioner, desk, bed, closet and washroom and free internet access
- Limited single rooms are available based on a first apply first served principle on condition that the participant makes up the deficiency.

Contact
Tel.: +86-10-62332541
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Email: ustb_io@163.com
For more inquiry, please contact the International Office, USTB.
**2016 USTB Advanced Engineering Internship Program**

**Research Proposals**

### Topic 1

**The Research and Applications of Industrial MIMO-SAR Digital Imaging Algorithms**

**Supervisor**

Prof. and Dr. Chen Xianzhong  
- School of Automation  
- Tel: 0086-13601099984  
- E-mail: cxz@ustb.edu.cn

**Abstract**

The system include the MIMO antenna and measured object, the signal of target motion and imaging in the near-field was obtained from the Agilent network analyzer of 45GHz to simulation the industrial environment, and the intelligent and high-speed signal SAR processing with math imaging algorithms are needed to research. It's a little like a system of car/automobile radar safety position and a distance measure unit.

**Prerequisites**

A simple knowledge of higher mathematics and measurement instrumentation are needed.

### Topic 2

**Temperature Sensor Array for Breast Wellness Screening**

**Supervisor**

Rui WANG / wangrui@ustb.edu.cn

**Laboratory**

Early research results show that the abnormal temperature changes demonstrated an 87% correlation to a verified, clinical diagnosis of breast cancer including with those patients with dense breast tissue. A temperature sensor array can detect the tiniest circadian temperature changes within breast cells to predict early breast cancer.

**Prerequisites**

- Proficient in circuit design and embedded programming  
- Knowledge of data structures and algorithms  
- Knowledge of Computational Intelligence and Artificial Intelligence would be better
2D Ear Recognition based on Deep Learning Method

• **Supervisor**
  MU Zhichun

• **Laboratory**
  Computer Vision and Machine Intelligence Team

• **Internship period**
  From June till August 2016

• **Abstract**
  Ear based human recognition technology is a novel research field in biometric identification. Compared with other biometric methods such as fingerprint, face and iris, ear has its distinctive advantages. Ear has a stable and rich structure that is resistant to age change and does not suffer from changes in expressions as in facial recognition [1]. Moreover, the collection of ear images is considered to be easy and non-intrusive. So ear biometrics has recently received a growing attention. Researchers developed several approaches for ear recognition based on 2D ear images in the early years. Even though current ear recognition systems have reached a certain level of maturity, their success is limited to the controlled conditions, in which additional restrictions are imposed on the subjects and on the imaging conditions, e.g., the subject needs to be with small pose changes, the ear images to be without occlusion, and the lighting to be constant. In most ear recognition-related research works, ear recognition under partial occlusion or pose variation remains as an open challenging problem.

  Recently, deep learning models such as ConvNets have been proved effective for extracting high-level visual features and are used for face verification in unconstrained conditions [2, 3, 4]. These methods achieve 99.63% face verification accuracy on LFW dataset using only weakly aligned faces, which is encouragingly better than 97.53% that human manually can achieve. Inspired by these works, we are going to set a project to see how well the deep learning could do on 2D ear recognition, and develop the corresponding algorithm and program to exam their performance against unconstrained scenarios of pose variation, partial occlusion and varying lighting conditions, and address to their limitations.

• **References**

• **Prerequisites**
  - Matlab programming
  - Image processing
  - C/C++ programming
Biometrics has the advantages of efficiency and convenience in identity authentication [1]. As one of the biometric traits, the ear has certain advantages over the others. It has uniform color and its shape does not change under expressions. Clinical observation has proven that the shape of the ear is very stable during the age of 8 years and 70 years. Ear recognition can be done non-intrusively, sometimes even without the knowledge of the users. Besides, as the ear is located next to the face, it can provide valuable additional information to supplement the facial image. Automatic ear recognition has promising applications in human computer interaction, law enforcement, access control and many other fields where personal identification at distance is essential.

Previous studies have achieved remarkable performance with multiple samples per person (MSPP) in the gallery. However, most conventional methods are insufficient when there is only one sample per person (OSPP) available in the gallery [2]. The aim of this project is to design a hybrid ear recognition system to solve the OSPP problem by maximizing the use of a single sample. Because most 3D sensors capture 3D data accessorizing the corresponding 2D data, it is sensible to use both types of information. Currently, methods dealing with OSPP problem fall into four categories [3]: generic learning, virtual sample generation, image partitioning, and local feature representation. It is the valleys and hills of the ear that can be used for identification. Therefore, local feature representation is the better choice than the other three for OSPP ear recognition. This project will be expected to propose a hybrid ear recognition algorithm using local features to solve the OSPP problem.

**References**


**Prerequisites**

- Matlab programming
- Image processing
- C/C++ programming
**Making Smart Objects of Smart Home Smart**

- **Supervisor**
  Huansheng NING / ninghuansheng@ustb.edu.cn

- **Abstract**
  Smart home is a currently hot topic in both academic and industrial communities. In smart homes of the future, rooms heating can be adapted to our preferences and to the weather; TV can automatically present us our favorite shows. In this study, we are focusing on approaches that make smart objects understand what people want in a certain context, and then act automatically.

- **Prerequisites**
  - Proficient in at least one programming language
  - Knowledge of data structures and algorithms
  - Knowledge of Computational Intelligence and Artificial Intelligence would be better

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**Research on Synthesis and Characterization of Carbon Dots/TiO2 Photocatalyst**

- **Supervisor**
  Wenbin CAO / +86 13691526308 / wbcao@ustb.edu.cn

- **Abstract**
  With the increasing problem of world fossil energy shortage and environmental pollution, renewable and clean energy, such as the use of solar energy has become one of the current research focuses. In which semiconductor photocatalysis has being considered as one of the effective ways as it can convert solar energy into chemical energy. Among all the semiconductors, TiO2 is the most widely studied photocatalyst due to its chemical stability, non-toxicity, and low cost etc. However, TiO2 can only absorb UV light of solar spectra, which accounts for only around 4% of solar light. In order to extend the optical absorption of TiO2 to the visible light region, carbon dots/TiO2 complex photocatalyst will be prepared due to the broadband light-absorption ability of carbon dots (CDs). The phase composition, morphology, spectral response and photocatalytic properties of the synthesized photocatalyst will be characterized systematically.

- **References**

- **Prerequisites**
  The following courses should be completed before one who plans to participate in this program:
  - Physical Chemistry
  - Physics of Semiconductors or related
  - Principles of XRD, SEM, TEM, and XPS
Research on magnetic properties and magnetocaloric effect of novel magnetic materials

• **Supervisor**
  Hu Zhang / +86-15210637268 / zhanghu@ustb.edu.cn

• **Abstract**
  Nowadays, magnetic materials have been widely used and impact almost every aspect in our society from household appliances to aerospace sciences. Especially, the functional magnetic materials, such as permanent magnets, soft magnets, and magnetic shape memory alloys, etc, have played an essential role in the development of modern society. In recent years, magnetic refrigeration based on magnetocaloric effect (MCE) has been demonstrated to be a novel application of functional magnetic materials. Compared with conventional gas compression-expansion refrigeration, magnetic refrigeration technique has attracted considerable attention due to its great advantages in many aspects such as energy saving and environmental friendly. As the core part of magnetic refrigeration technique, the magnetocaloric properties of magnetic materials greatly affect the performance of magnetic refrigerator, and thus, it is of importance to develop magnetic refrigerants with large MCE. In this project, we will exploit novel magnetic materials, and investigate the crystallographic, magnetic, and magnetocaloric properties. Consequently, the intrinsic origin of large MCE will be discussed based on the experimental and theoretical analysis.

• **References**

• **Prerequisites**
  The following courses should be completed before one who plans to participate in this program:
  - Fundamentals of Material Science
  - Material Physics
  - Physics of Ferromagnetism or related