

List of IC@N Research Projects and Supervisors

School of Mechanical & Aerospace Engineering (MAE)	
Name of Supervisor	Research Project Description
Assoc Prof Cai Yiyu myycail@ntu.edu.sg	<p>AI for Tumour Diagnosis based on Multiplex immunofluorescence (mIF) and Hematoxylin and Eosin (H&E) Images</p> <p>Artificial Intelligence is playing an increasingly important role in various areas including healthcare. This project is a continuation of the research with our project team including FYP and PhD projects. This project is a collaboration between NTU and Singapore General Hospital. More specifically, this project is to further develop our efforts for intelligent computing using pathological images and biomarkers. The project has an IRB approved with a good number of data available for training and validation purpose. Bright-field images of hematoxylin and eosin (H&E) can be conveniently collected for basic information of tumors and other nuclei. An emerging technology, multiplex immunofluorescence (mIF), which enables quantifying multiple protein markers in the same tissue slides allows deep immune phenotyping. Of clinical importance, mIF enables the identification of cytotoxic T cells from H&E-identified tumor infiltrating lymphocytes (TILs) can better inform patient selection for immunotherapy such as PD-1 or PD-L1 inhibitors.</p> <p>The student will do a literature review first. H&E and serial mIF images of the same biopsy specimen, and higher order features correlated with both of these images will then be used to obtain information usually found in mIF images directly on H&E images. As proof-of-principle, Generative Adversarial Networks model (Pix2Pix) will be adopted to train on H&E-mIF image pairs to predict CD3 expression in H&E images, without the need of serial mIF images.</p>
Asst Prof Hortense Le Ferrand Hortense@ntu.edu.sg	<p>Orientation and aggregation of anisotropic microparticles under magnetic fields</p> <p>Biocomposites often display outstanding properties (mechanical, optical, functional) that result from their internal microstructures. Using synthetic chemistry, however, allows exploring a wider range of properties and functions. In particular, ferromagnetic anisotropic particles distributed in a polymer could be a means for magnetically-triggered morphing composites with superior mechanics and electrical conductivity. To this aim, one should first understand how to build hierarchical microstructures with such elements. In this project, the student will study how ferromagnetic microparticles suspended in a viscous matrix respond to magnetic fields in terms of orientation and distribution. The tools will be optical microscope, rheometer, and magnetic fields.</p>

School of Mechanical & Aerospace Engineering (MAE)

Name of Supervisor

Research Project Description

Asst Prof Li King Ho Holden
HoldenLi@ntu.edu.sg

Development of RF Communication System for Nanosatellite

Small scale satellite has been received much attention from both industrial and academia since its development in 1999. The small physical size and standardized cubic structure of the CubeSat reduce the design complexity, development cost, lead time and launch cost. Our team is currently developing a CubeSat platform and ground-based sensor terminals for space-based Internet-of-Things applications. The student will work closely with a research team on development and testing of the RF communication module for ground-based sensor terminals. The student is expected to have good understanding in RF communications, data communication protocol and programming.

Project Duration: 6 months

Dr Chow Chee Lap of Temasek Laboratories will be the co-supervisor.

RF Communication Design for CubeSat

In this project, a Cube Satellite (CubeSat) will be developed and launch into orbit for experimental study of cosmic effect on timing device. The CubeSat will continuously transmit useful information to ground station throughout its flight mission. The candidate will help in the design and development of the UHF transceiver module for data communication between the CubeSat and ground station. The candidate is expected to have strong understanding on RF communications system principles, especially Satellite communication.

Assoc Prof Huang Wei Min
MWMHuang@ntu.edu.sg

Shape memory polymer/alloy composite for enhanced stiffness

Shape memory alloy and shape memory polymer are two typical shape memory materials with great potential in many applications. One of the most popular stimuli to activate shape memory is heat. Both shape memory alloy and polymer change stiffness upon thermal cycling, but in an opposite way. While shape memory alloy becomes harder upon heating, shape memory polymer becomes softer upon heating. The problem in many real engineering applications is that in the soft state, the material might be not stiff enough even to support its self-weight.

This project aims to experimentally investigate a simple solution by means of combining shape memory alloy and polymer together, so that the resulted composite is always able to, at least, support itself to avoid collapsing during operation upon thermal cycling.

This project is under smart materials and is mainly experimental investigation.

The duration of this project is up to 6 months.

Good hands-on skill is required, and interest to explore new ideas is a big plus.

<p>Assoc Prof Xie Ming mmxie@ntu.edu.sg</p>	<p>Development of Vision System Using Robotics Operating Systems</p> <p>The aim of the small project is to learn how to use ROS (robotics operating systems) to implement a vision system with graphical user interface and a set of functions for image processing and vision computing.</p>
	<p>Development of Simulation System Using Robotics Operating Systems</p> <p>The aim of the small project is to learn how to use ROS (robotics operating systems) to implement a simulation system with graphical user interface and a set of models of industrial robots, mobile robots and intelligent vehicles.</p>
	<p>Development of Speech System Using Robotics Operating Systems</p> <p>The aim of the small project is to learn how to use ROS (robotics operating systems) to implement a speech system with graphical user interface and a set of functions for speech recognition and voice activated control of robot systems or intelligent machines.</p>
<p>Assoc Prof Huang Wei Min mwmhuang@ntu.edu.sg</p>	<p>Rubber-like Shape Memory Hybrid for Comfort Fitting</p> <p>This project aims to develop a new shape memory material for comfort fitting, such as shoes and insoles. This shape memory material should have a couple of unique features, which cannot be spotted in conventional shape memory polymers either individually or in a combined manner, namely highly elastic (as silicone rubber) at around body temperature, and fixing of the temporary at around body temperature.</p>
	<p>Self-Healing in a Novel Electrically Conductive Shape Memory Polymeric Composite</p> <p>This project aims to develop a novel electrical conductive shape memory polymeric composite, which can be activated for shape recovery via joule heating, while the built-in conductive network can be repaired easily for cyclic operation. The scope of this project includes two parts, fabrication of the polymeric composite, and characterization of its performance, namely the shape memory effect and healing effect of the conductive network for joule heating.</p>

<p>Prof Lye Sun Woh MSWLYE@ntu.edu.sg</p>	<p>Intern for Human Computer Interaction (HCI) applications programmer in the field of Air Traffic Control (ATC)</p> <p>Intern will be playing a key role in developing key applications for HCI in ATC. This is achieved by implementing the computation of monitoring behaviour from the captured eye tracking data, in the</p>
<p>Assoc Prof A. I Sivakumar msiva@ntu.edu.sg</p>	<p>Application of learning algorithm for dynamic scheduling of single machine</p> <p>Study single machine scheduling methods; understand the nature of N-P hard optimization problem. Study dynamic scheduling methodologies Develop simple scheduling algorithm for multiple dissimilar jobs on a single machine Review how to apply a simple concept of learning algorithm to dynamic scheduling Apply discrete event simulation to validate results.</p> <p>Duration: 3 months</p>
<p>Assoc Prof Shu Dong Wei mdshu@ntu.edu.sg</p>	<p>FEM investigation of Split Hopkinson Pressure Bar</p> <p>Split Hopkinson Pressure Bar requires high precision of the specimen, precise alignment of the bars, and strain gage positioning. This project investigate such influence with the help of ANSYS/LSDYNA licensed in the CAD laboratory in the school of MAE of NTU. The project students will interact with a group of Students comprising NTU undergraduate students and PhD students.</p> <p>Duration: 2 to 6 months</p>
<p>Assoc Prof Shu Jian-Jun mjjshu@ntu.edu.sg</p>	<p>Riemann zeta function</p> <p>The Riemann zeta function is central to number theory and also plays an important role in physics and engineering. The scope of this project is to investigate some important properties and applications of the Riemann zeta function, and to write a project report.</p> <p>Duration: 6 months</p>
	<p>Quantum entropy</p> <p>The concept of entropy plays a central role in classical information theory. The scope of this project is to develop an entropic measure of quantum information, and to write a project report.</p> <p>Duration: 6 months</p>

	<p>already available real time post-processing tool (Java) Intern will also be able to perform trial tests to test the feasibility of the improved system in ATC.</p>
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