**Joint PhD Program Description**

The description for the Joint PhD program will be posted online as a sub-page to

Joint PhD Programmes | Graduate College | NTU Singapore.

| | |
|---|---|
| Name of Partner University | Indian Institute of Technology, Madras |
| Country | India |
| Year of JPP Establishment | 2018 |
| Program | ☒ Joint Degree<br>☐ Joint Supervision |
| Description of the Program (150-250 words) | The Joint PhD programmes are conducted on a full-time basis. Students in the programmes are registered at both NTU and the partner university. Upon successful completion of the programme, NTU and the partner university will jointly confer the PhD degree. |
| Disciplines | <ul><li>Science</li><li>Engineering</li><li>Management</li><li>Computing</li><li>Social Sciences</li></ul> |
| PMC Names and Emails | NTU:<br><ul><li>Assoc Prof Sunil Chandrakant Joshi (mscjoshi@ntu.edu.sg)</li><li>Assoc Prof Yusuf Ali (yusuf.ali@ntu.edu.sg)</li></ul>IITM:<br><ul><li>Prof Raghunathan Rengasamy (deange@iitm.ac.in)</li><li>Prof Mahesh Panchagnula (mvp@iitm.ac.in)</li></ul> |

**NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE** | Graduate College

## Joint Projects

## 1. Chiral Ion Pair Catalysts with Organometallic Anions

| Date Posted | 10 June 2024 | |
|---|---|---|
| Home University | Nanyang Technological University | |
| Partner University | Indian Institute of Technology, Madras | |
| **Supervisors** | **Home** | **Partner** |
| Name | Tan Choon Hong | Govindasamy Sekar |
| School | Chemistry, Chemical Engineering and Biotechnology | Chemistry |
| Email | choonhong@ntu.edu.sg | gsekar@iitm.ac.in |
| Website | https://tanchoonhong.wixsite.com/tchlab/about | https://chem.iitm.ac.in/faculty/sekar/ |
| **Project Description** (200-300 words) | The project aims to investigate the ion pair catalysts derived from chiral cations such as pentanidium and bisguanidiniums. They will be paired with transition metals containing anionic ligands. Enantioselective reactions using these catalysts will be investigated. At NTU, the student will prepare the pentanidium and bisguanidinium catalyst and attempt to pair them with transition metal anions. The student will also survey possible reactions to investigate. At IITM, the student will study enantioselective reactions using the ion pair catalysts developed in NTU. The student will also attempt to use the catalyst to make valuable active pharmaceutical intermediates. | |
| Program/Center Website(s) | NA | |
| Additional Information (e.g., files with project details) | NA | |

## 2. Hardware-Efficient Deep Learning based Visual SLAM for UAVs

| | | |
|---|---|---|
| Date Posted | 14 April 2023 | |
| Home University | Nanyang Technological University | |
| Partner University | Indian Institute of Technology, Madras | |
| **Supervisors** | **Home** | **Partner** |
| Name | Lam Siew Kei | Krishnamurthy Sridharan |
| School | College of Computing and Data Science | Department of Electrical Engineering |
| Email | assklam@ntu.edu.sg | sridhara@iitm.ac.in |
| Website | https://siewkeilam.github.io/ei-research-group/index.htmls | https://www.ee.iitm.ac.in/sridhara/ |
| **Project Description** (200-300 words) | Unmanned Aerial Vehicles (UAVs) are expected to play a significant role in surveillance, mapping, and monitoring weather and traffic conditions. Simultaneous Localization and Mapping (SLAM) is an essential technology used by UAVs to jointly perform localization and mapping especially in environments where GPS or GNSS are not available or are unreliable. Visual SLAM (vSLAM) has gained wide popularity with the advances in AI methods. However, existing embedded computing platforms, e.g., CPU and GPU, are unable to meet the real-time requirement especially when deep learning methods are infused into the vSLAM pipeline. In addition, existing AI based visual SLAM algorithms are not well suited for long-term (lifelong) operations where the scenes change over time. The research will first explore new hardware-efficient AI based vSLAM algorithms for UAVs that can continuously acquire new knowledge in a self (semi)-supervised manner to enable the UAV to learn unfamiliar objects and new environmental conditions different from the ones present during training. An FPGA design methodology will be developed to optimize latency and energy consumption of the AI based vSLAM algorithm, while meeting the accuracy requirements of the UAV scenario. It is envisioned that the proposed methodology can synthesize FPGA efficient implementations of lifelong SLAM algorithms for UAVs operating under challenging scenarios. | |
| Program/Center Website(s) | https://www.ntu.edu.sg/hesl | |
| Additional Information (e.g., files with project details) | NA | |