MICKEY LI

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EDUCATION

PhD, Robotics and Autonomous Systems Sept 2018 - Present
University of Bristol, Bristol Robotics Laboratory & Toshiba Bristol Research and Innovation Laboratory.
FARSCOPE Centre for Doctoral Training in Future Autonomous and Robotic Systems
Thesis: (Submitted July 2023, est. completion date Oct 30th 2023)

Reliability-Aware Multi-UAV Coverage Path Planning

supervised by Prof. Arthur Richards & Prof. Mahesh Sooriyabandara

MEng Mathematics and Computer Science Oct 2014 - Jun 2018
Imperial College London. Graduated with First-Class Honours.
Dissertation project

Real Time Semantic Segmentation with SLAM for Gaze Intention Decoding from RGBD ego-centric video.

supervised by Dr Pavel Orlov and Dr Aldo Faisal, Imperial College Faisal Lab

Modules Included:

- Machine Learning, Data Science techniques, Reinforcement Learning.
- Computer Vision, (Advanced) Robotics, Logic Based Learning, Medical Image Computing
- Statistical modelling, Time Series, Game and Decision Theory
- Quantum Mechanics and Quantum Computing
- Applied Methods, Multivariable Calculus, Linear Algebra and Analysis
- Psychology of Music

Taunton School Aug 2009 - Jun 2014
A-levels: *Further Maths A*, Maths A*, Physics A, Music A, EPQ A*
GCSEs: *8A* incl. mathematics, 2A incl. english , 2B*

MAJOR PROJECTS AND PAST EXPERIENCES

Optimal Topologies for Drone Vertiports March 2023 - February 2023
Research Associate (under Prof. Arthur Richards) *University of Bristol Flight Laboratory*

· Investigate optimal topologies for fixed collision free approaches for deployable drone vertiports.
· Designing systems and user interfaces for safety-critical multi-drone operations in practice.
· Interaction and Collaboration with numerous industrial partners to achieve project goals.

Enhancing Plant Pollination with Micro-Drone Swarms Sept 2023 - Sept 2024
Researcher *University of Bristol, Cabot Institute*

· Involved in writing an accepted bid for seedcorn funding from the local Cabot institute for £4,620
· Working with an inter-disciplinary team of roboticists and ecologists in building, researching and implementing the pollination of rare plants in indoor botanic gardens with micro-drone swarms.

Reliability-Aware Multi-UAV Coverage Path Planning for 3D Environments April 2019 - Oct 2023
PhD Submitted, Supervised by Prof. Arthur Richards *Bristol Robotics Laboratory*

· Investigating how to optimally utilise failure prone agents to maximise the reliability of mission completion.

- Taking a probabilistic approach, I developed a novel reliability metric which quantifies the reliability of a multi-UAV coverage plan plan in general 3D environments, given individual UAV failure models.
- Investigated numerous optimisation methods including Integer Linear Programming and Genetic Algorithms in order to find reliability-optimal path plans. 3D environments required methods which were scalable and computational efficiency. Methods were evaluated in simulation and reality on a number of aircraft inspection scenarios
- Published and Presented the work at national and international conferences such as AAMAS and ICRA.

Project Starling - Implementing Cloud Inspired Flight Infrastructure for Multi-Drone Development, Deployment and Testing Jan 2021 - June 2023
Lead Project Manager and Developer *Bristol Robotics Laboratory, Flight Arena*

- Developing, designing and implementing a scalable and reusable flight controller development and deployment architecture for single and multi-drone research.
- Using cloud technologies such as Docker and Kubernetes with traditional Robotics and drone tools such as ROS2 and PX4 to allow for a simplified workflow to reduce the barrier to entry for researchers.
- Now used by others for MSc level teaching and various internal projects.
- https://github.com/StarlingUAS/ProjectStarling

Implementing real-time generation of 4pl motion trajectories for real drones Nov 2021 - Feb 2022
Research Associate (under Prof. Arthur Richards) *Bristol Robotics Laboratory, University of Bristol*

- Primary role of developing and implementing the 4pl fast motion planning algorithm for an experimental demonstration on real drones within Starling in collaboration with the original author.
- Re-implemented algorithm in Rust for speed, and real flight required development of augmented MPC formulation, as well as consideration of noise and practical demonstration of dynamic obstacle avoidance.

Real Time Semantic Segmentation with SLAM for Gaze Intention Decoding April 2018 - Aug 2018
MEng Dissertation, Supervised by Dr Aldo Faisal & Dr Stefan Leutenneger Imperial College London, Faisal Lab

- The aim was to develop a real time system which could label and position items which a user was gazing at.
- A novel real-time semantic segmentation network called YoloMask was developed and trained.
- Network was integrated into the SemanticFusion SLAM mapping system and integrated with Ego-Centric Glasses
- Dissertation: https://cloud.mickeyhl.li/index.php/s/ERZ8wT8jGrw8S8r

Researching and Developing a Scalable Model Based Recommendation System Jun 2017 - Sept 2017
4 Month Internship Project *Samsung Research UK*

- Created an extensible framework in Apache Spark with python Pandas to parse and manipulate the data
- Implemented Collaborative Deep Learning (CDL) Recommendation System (RS) in TensorFlow. The primary contribution was a method for improving training-times for CDL by using Distributed TensorFlow over Spark.
- Following the outcomes of this project, Samsung decided to create a new Research Group in the area of RS.

TEACHING AND SUPERVISION

Masters Thesis Supervision Roles Oct 2020 - Present

- Significant Supervision experience of total of nine robotics masters students on topics ranging from multi-vehicle path optimisation, vertiports, marsupial robotics control and implementing UAV applications. Requires good communication, teaching and interpersonal skills. Students were successful in submitting dissertations.

Teaching Oct 2020 - Present

- Developed and taught the Starling simulation environment and programming fundamentals for the Aerial MSc Group project course. Required the writing and delivery of several lectures in addition to running group tutorials. Materials: https://starlinguas.github.io/FenswoodScenario/

- Organised and delivered a two day workshop on an introduction to the Starling UAV system which aimed to bring students from software and drone basics of Python, PX4, ROS2, Docker and basic Kubernetes to flying real drones. Attended by 20 students and researchers within the department. Materials: https://starlinguas.github.io/starling_controller_templates/

Teaching Assistant 2019 - 2022

- Small group teaching of foundational mathematics, logic and programming to undergraduate and masters level engineering and computer science students. Requires good co-operation between TAs and the course leaders.

PUBLICATIONS

Starling: Containerisation Architecture for Scalable Local Development, Deployment and Testing of Multi-UAV Systems Robotic Science and Systems 2022 EMIRCATE Workshop
M. Li, R. Clarke, A. Richards, M

Asynchronous Reliability-Aware Multi-Agent Coverage Path Planning ICRA 2021
M. Li, A. Richards, M. Sooriyabandara

Reliability-Aware Multi-Agent Coverage Path Planning Using a Genetic Algorithm AAMAS 2021
Extended Abstract: M. Li, A. Richards, M. Sooriyabandara

Reliability-Aware Multi-Agent Coverage Path Planning Using Integer Linear Programming UK-RAS 2021
M. Li, A. Richards, M. Sooriyabandara

Towards an Embodied Semantic Fovea: Semantic 3D scene reconstruction from ego-centric eye-tracker videos ECCV 2018
Extended Abstract: M. Li, N.Songur, S Leutenegger, AA Faisal

SKILLS AND INTERESTS

Research Interests

- Control and Design of Multi-agent systems, Co-ordination, Path Planning and SLAM for Multi-drone systems.
- Optimisation, Statistics, Generative Methods, Reinforcement Learning and Machine Learning techniques

Programming and Systems Experience

- **Python** scripting and library building for robotics, data, control systems, optimisation, perception, planning algorithms and user interface creation and design. Mixed Python and C++ using **Cython**.
- **C++**, **C** and mixed C++ & C programming for robotics and control systems with extensive experience of data structures and algorithms theory and implementation, usage of standard and domain-specific libraries.
- Extensive usage of **ROS** and **ROS2** with understanding of underlying **DDS** middleware layer, writing software and documentation for researchers in C++ and Python. Extensive use of **mavros** and **mavlink** for autonomously controlling multiple **PX4** drones. Simulation with **Gazebo**. Experience with **VICON** motion capture.
- **Docker** and **Kubernetes** for the local development and deployment of ROS2 nodes onto drone edge compute. Includes **Continuous Integration**, testing pipelines and versioning using **Github Actions**.
- Websites and User interfaces **Qt**, **Dash**, **JavaScript**, **Angular**.
- Hardware interfacing with **Arduino** and **Raspberry Pis** and basic electronics.
- 3D Graphics processing and shader programming using C++, **OpenGL**, **OpenCV** and **PCL**.
- Game Engine Simulation using **AirSim** (**Unreal Engine**), Game Development in **Godot**, and **Unity**.
- Distributed Machine Learning using **TensorFlow** and Apache **Spark**.
- Statistical analysis using **R** and **MATLAB**.
- Dabbled in functional languages of **Haskell** and **Go**.
- Experience in **CAD** and **3D printing**.

Awards & Certifications Bristol PLUS Award, UK Drone License A2 CoC & GVC (2021-2026)
Languages English (Native),
Mandarin and Cantonese (Intermediate Spoken, Basic Comprehension)

OUTREACH

"The Forest" Art Installation June 2023
Project Manager and Engineer *Bristol Festival of Nature 2023*

- Member of a team of 5 creating an audio-visual installation exploring human activity in the urban-nature divide.
- Responsible for securing internal funding ($\approx$ £1000) from various programmes and projects.
- Participated in the design, and development of the software and hardware of the 2, 2 meter "sound pillars".

RoC-Ex: Robotics Cave Explorer Outreach Game Apr 2021
Lead Project Manager and Developer *UK-RAS Robotics Festival 2021*

- Developed an educational game accepted for the National UK-RAS 2021 Robotics Week, designed to teach school-aged children how a robot senses the world and its environment.
- Lead a team of 7 volunteer postgrad students through planning and development of the game.
- Lead the integration of the missions into the Godot game engine, and setup deployment and delivery of the game.
- Successfully released to the general public with currently over 1000 hits: https://farscope-outreach.co.uk/

OTHER ACTIVITIES

Attended IEEE Multi-Robot Systems Summer School, Czech Technical University Aug 2023

Attended IEEE Multi-Robot Systems Summer School (Virtual), Czech Technical University Aug 2020

Attended ICRA 2023, IROS 2022, MRS 2021, ICRA 2021, AAMAS 2020, ECCV 2018.

Attended Roche Continents Selective Arts+Science Summer School, Salzburg, Austria, Aug 2018

Chinese Language Course, Beijing Language and Culture University Aug 2014

Diploma (DipABRSM) in Piano Performance; Placed 3rd in EPTA Piano Competition 2013

REFERENCES

Professor Arthur Richards, University of Bristol, arthur.richards@bristol.ac.uk

Professor Mahesh Sooriyabandara, Toshiba R&D Ltd, mahesh.sooriyabandara@toshiba-bril.com

Dr Saurabh Upadhyay, Cranfield University, saurabh.upadhyay@cranfield.ac.uk

More references are available upon request.