Jeffrey Li

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Personal Profile

Currently, I am enrolled in the MSc Robotics and Computation program at University College London. My academic focus centres on mathematics and computer science, particularly with a keen interest in intelligent mobile robotics and automation.

I am extensively engaged in Artificial Intelligence research, with a primary focus on delving into the practical application of state-of-the-art and cutting-edge advancements in machine learning algorithms for controlling robotic systems characterized by intricate kinematics and dynamics.

Education

University College London — *London*

MSc Robotics and Computation — *Sept 2023 - Oct 2024*

- Expecting First Class Honours
- **Relevant Modules:** Robotic Control Theory and Systems (**LQR, MPC**), Robotic Vision and Navigation (**SLAM, Kalman filters, Particle filters**), Robotic Sensing, Manipulation and Interaction, Computer Vision, Multiagent Intelligence, Bayesian Deep Learning

University College London — *London*

BSc Computer Science — *Sept 2020 - Jun 2023*

- First Class Honours
- **Relevant Modules:** Robotic Systems, Machine Learning and Neural Computing, Machine Learning for Visual Computing, Intelligent Systems

Epsom College — *Epsom, Surrey*

A-Levels — *Oct 2017 - Jul 2020*

- Mathematics (A*), Further Mathematics (A*), Computer science (A*), Physics (A*)

Research Experience

University College London — *London*

Do As I say! — *April 2023 - Sep 2024*

- The goal of the project is to create an adaptable, reinforcement learning-based interface that translates unstructured natural language commands into low-level actions for quadruped robots to execute accordingly. This aims to address the limitations of current research, which primarily targets high-level quadruped APIs that are platform-specific and challenging to integrate with other robotic systems.
- This project, overseen by Professor Dimitrios Kanoulas, is currently implementing the suggested method in **Isaac Sim**. We aim to incorporate this into the **Boston Dynamics Spot** by early June and are preparing to be published in ICRA and IROS next year.

University College London — *London*

Learning to Communicate under Noise — *Oct 2022 - Jun 2023*

- The objective of the project is to create a Multi-agent Reinforcement Learning algorithm that enables agents to acquire communication protocols for effective interaction over noisy discrete channels. This aims to facilitate cooperation and coordination among agents within specific fully cooperative Multi-Particle Environments.
- This project was supervised by Professor Mirco Musolesi. The algorithm designed was successfully implemented in Python using **PyTorch** and was thoroughly tested with self-designed environments.

UCL Centre for Artificial Intelligence — *London*

Multi-agent traffic prediction Research Internship — *Dec 2021 - Feb 2022*

- Conducted research on the critical aspect of traffic motion forecasting, serving as a fundamental component in the autonomous driving vehicles pipeline. This work was carried out under the supervision of Dr. Haitham Bou Ammar and Professor Jun Wang.
- Performed an in-depth literature review focusing on state-of-the-art algorithms and frameworks addressing similar challenges. Explored prominent methodologies like Social LSTM, Social GAN, DESIRE, DENSETNT, CASPERNet, among others, to analyze and comprehend existing approaches in the field.
- Established a connection with Thomas Gilles and his research team, known for proposing the top-scoring THOMAS framework in UC Berkeley's INTERPRET Challenge. Actively participated in weekly meetings throughout the internship, engaging in discussions on potential adaptations to enhance the existing framework. Explored the integration of successful elements from other state-of-the-art methods into the project.

Vision and Imaging Science Group, UCL — *London*

Invariant scattering networks Research Internship — *Oct 2021 - Nov 2021*

- Conducted research on the integration of Invariant Scattering Networks into Deep Reinforcement Learning for the purpose of achieving comparable agent performances with a reduction of 5% in required training samples. This work was conducted under the supervision of Professor Lewis Griffin and Augustine Mavor-Parker.
- Developed a deep reinforcement agent with Pytorch that includes invariant scattering layers as integral components within the policy neural network. The agent was subsequently deployed and tested in various environments provided by OpenAI Gym.

Key Projects

Robot Arm Manipulation and Sensing *London*

University College London *Mar 2024 - Apr 2024*

- Developed robot manipulator control system for achieving pick and place tasks on the Pandas manipulator using **C++, ROS, Gazebo, MoveIt!, OpenCV** and **Point Cloud Library**
- The system can achieve real-time shape identification and differentiation as well as perform pick and place tasks under cluttered environments while doing collision avoidance.

Drone Simulation and Control *London*

University College London *Nov 2023 - Dec 2023*

- Developed a simplified environment for simulating quadcopter kinematics and dynamics in **MATLAB**
- Successfully implemented a full-state feedback controller with **Linear Quadratic Regulator and Observer** for the quadcopter in completing the desired trajectory under turbulent conditions

Model Match: NHS and Data Scientist Collaboration Tool *London*

CarefulAI & NHS *Sep 2021 - Apr 2022*

- Developed a web-based platform for the exchange of clinical data and classification models, facilitating collaboration between data scientists and NHS clinicians. This initiative resulted in a notable reduction of time spent on data and model collection.
- Responsible for frontend development using **React.js** and coordinating backend development with **FastAPI** and **PostgreSQL**.
- Successfully containerized the application using Docker and accomplished a seamless deployment onto the client's Linode server.

Playing Super Mario With Deep Reinforcement Learning *London*

University College London *Jun 2020 - Apr 2021*

- Investigated Dynamic Programming algorithms, Model-Free algorithms and non-linear function approximations with neural networks in Reinforcement Learning.
- Developed and trained a DQN agent with PyTorch in Python to play games of Super Mario Bros using the gym-super-mario-bros environment.

Certification

IBM Data Science Professional Certificate *Online*

Coursera

- Applied foundational knowledge of SQL on the IBM Cloud using real-life data, as well as various data science and machine learning toolkits including **Scikit-learn**, **TensorFlow**, **pandas** and **seaborn**
- Led a capstone project to analyze data from SpaceX Falcon 9 rockets to predict the probability of successful first-stage landings, ultimately determining the corresponding launch cost. Presented the results to fellow course participants, receiving commendation and positive feedback.

Competitions

UKSEDS Olympus Rover Trials Competition *London*

Software Lead *October 2023-Ongoing*

- Collaborating within a team of 10 students from diverse engineering faculties, our assignment involves the design, construction, and operation of a fully autonomous rover for a simulated Mars sample return mission. We face the challenge of complex systems engineering, compelled to meet authentic space mission requirements.
- In my role as the team's software lead, my team and I are responsible for converting the robot's CAD design from Fusion 360 to URDF for the simulation of the robot in **Gazebo** using **ROS2** and **RViz**. We also incorporated a complete **SLAM** system and developed path-planning algorithms for navigating terrains similar to Mars, as well as for controlling the onboard robotic arm to perform pick-and-place operations using **MoveIt!**.

Southampton University Robotics Competition *Southampton, Hamshire*

1st Place Participant, Team Lead *Jul 2019 - Aug 2019*

- Engineered a carrier robot from the ground up and programmed it using Arduino to autonomously execute a series of challenging path-planning and navigation tasks.
- Securing the top position, the robot demonstrated its capabilities by effectively collecting and depositing items at specified locations, all while operating with a restricted set of sensors.

Skills

Programming	Python (More than 8 years of experience), C++ (4 years of experience), MatLab, Java, Haskell, C, HTML, CSS, JavaScript and SQL.
Robotics	ROS1, ROS2, Gazebo, RViz, Isaac Sim, MoveIt! ...
Soft Skills	Problem-solving, Independent thinking, Quick and Keen Learner, Leadership, Time-management, Perseverance
Languages	English, Mandarin, French