

# Qingbiao Li

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## Biography

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I am a PhD student at ProrokLab at the University of Cambridge, supervised by Dr Amanda Prorok. During my PhD, I focus on developing a **communication-aware decentralized multi-agent path planning** framework, where **Graph Neural Networks (GNNs)** are under active investigation to build communication channels for multi-agent systems so that agents can learn how to communicate between each other explicitly. This research can be applied in mobility-on-demand, automated warehouses, and smart cities.

I have delivered multiple research projects with demonstrable and solid results in computer vision (SLAM for Flexible Endoscopy), bipedal walking of a humanoid robot, and mechanical design of the industrial robot. I have the experience and practical skills in applying ML to cope with real-world challenges, including multi-robot path planning and medical imaging (non-invasive StO<sub>2</sub> estimation).

## Education

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### University of Cambridge

PHD IN COMPUTER SCIENCE

Cambridge, UK

Oct 2018 - Present

- **Research Interest:** Robot Learning, Multi-robot Path Planning, On-device Learning, Graph Neural Networks (GNNs), Imitation Learning, Reinforcement Learning and Computer Vision (Medical Imaging).

### Imperial College London

MRES MEDICAL ROBOTICS AND IMAGE GUIDED INTERVENTION (DISTINCTION)

London, UK

Oct 2017 - Sep 2018

- **Individual Project:** Developed tissue oxygenation saturation monitoring technique based on optical imaging (RGB and Hyperspectral Imaging) by conditional generative adversarial networks (cGAN).

### The University of Edinburgh

M. ENG (HONS) MECHANICAL ENGINEERING

Edinburgh, UK

Sep 2013 - June 2016

- **Individual Project:** Missile impact on snow inspired by a project from British Antarctic Survey.

### South China University of Technology

B. ENG. MECHANICAL ENGINEERING AND AUTOMATION

Guangzhou, China

Sep 2011 - July 2013

## Work Experience

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### Research Assistant in Bipedal Walking of Humanoid Robot

SLMC, SCHOOL OF INFORMATICS, THE UNIVERSITY OF EDINBURGH

Edinburgh, UK

Sep 2016 - June 2017

- Theoretical proof and simulation validation of online parameter estimation based on Tikhonov regularisation to obtain robust control of bipedal walking.

### Research Assistant in Industrial Robotics (Funded by Erasmus+)

THE INSTITUTE OF PRODUCTION ENGINEERING AND MACHINE TOOLS (IFW), LEIBNIZ UNIVERSITY OF HANOVER

Hannover, Germany

March 2015 - Aug 2015

- Mechanism design for industrial robot for industrial-level milling process, includes CAD modelling transmission device and robot arm. Kinematic simulation to analyse torque distribution during operation.

## Academic Projects

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### Vision-based Navigation in Flexible Endoscopy

IMPERIAL COLLEGE LONDON, SUPERVISED BY DR GEORGE MYLONAS

London, UK

Sep 2017 - Dec 2017

- This project aimed to track the endoscope pose in real time during flexible endoscopy and generate a 3D point cloud and a map within the human colon simultaneously. We investigated available visual SLAM methods (ORB-SLAM) and visual-inertial SLAM methods (VINS-Mono, OKVIS), and customize them for small scale, near focus.

### Missile Impact on Snow (MEng thesis with distinction)

UNIVERSITY OF EDINBURGH, SUPERVISED BY DR FILIPE TEIXEIRA-DIAS

Edinburgh, UK

Oct 2015 - Apr 2016

- This study aimed to optimize the design of the impactor developed by British Antarctic survey for long-term tracking on the motion of the glaciers. I investigated the characteristics of the impact dynamics of the impactor and its interaction with different types of snow, covering a range of impact energies.

## Publications

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### JOURNAL ARTICLES

**Qingbiao Li**, Weizhe Lin, Zhe Liu, Amanda Prorok. "Focused Aggregation Graph Neural Networks for Large Scale Multi-Robot Path Planning," *IEEE Robotics and Automation Letters (Work in Progress)*. 2020

Weizhe Lin, Indigo Orton, **Qingbiao Li**, Gabriela Pavarini, Marwa Mahmoud. "Looking At The Body: Automatic Analysis of Body Gestures and Self-Adaptors in Psychological Distress," *IEEE Transactions on Affective Computing (Under Review)*. Springer, 2020. **PDF**

Binyu Wang, Zhe Liu, **Qingbiao Li**, Amanda Prorok. "Mobile Robot Path Planning in Dynamic Environments through Globally Guided Reinforcement Learning," *IEEE Robotics and Automation Letters* pp. 6932–6939. 2020. **PDF**

**Qingbiao Li**, Jianyu Lin, Neil T Clancy, Daniel S Elson. "Estimation of Tissue Oxygen Saturation from RGB Images and Sparse Hyperspectral Signals based on Conditional Generative Adversarial Network," *International Journal of Computer Assisted Radiology and Surgery* pp. 987–995. Springer, 2019. **PDF**

### CONFERENCE PROCEEDINGS

Ruoxi Wang, Dandan Zhang, **Qingbiao Li**, Xiao-Yun Zhou, Benny Lo. "Real-time Surgical Environment Enhancement for Robot-Assisted Minimally Invasive Surgery Based on Super-Resolution," *IEEE International Conference on Robotics and Automation (Under Review)*, 2021, **PDF**

**Qingbiao Li**, Fernando Gama, Alejandro Ribeiro, Amanda Prorok. "Graph Neural Networks for Decentralized Multi-robot Path Planning," *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2020, **PDF**

**Qingbiao Li**, Fernando Gama, Alejandro Ribeiro, Amanda Prorok. "Graph Neural Networks for Decentralized Path Planning," *International Conference on Autonomous Agents and MultiAgent Systems*, 2020, **PDF**

**Qingbiao Li**, Xiao-Yun Zhou, Jianyu Lin, Jian-Qing Zheng, Neil T Clancy, Daniel S Elson. "Estimation of Tissue Oxygen Saturation from RGB Images based on Pixel-level Image Translation," *The Hamlyn Symposium on Medical Robotics*, 2018, **PDF**

Jian-Qing Zheng, Xiao-Yun Zhou, **Qingbiao Li**, Celia Riga, Guang-Zhong Yang. "Abdominal Aortic Aneurysm Segmentation with a Small Number of Training Subjects," *The Hamlyn Symposium on Medical Robotics*, 2018, **PDF**

**Qingbiao Li**, Iordanis Chatzinikolaïdis, Yiming Yang, Sethu Vijayakumar, Zhibin Li. "Robust Foot Placement Control for Dynamic Walking using Online Parameter Estimation," *IEEE-RAS 17th International Conference on Humanoid Robotics (Humanoids)*, 2017, **PDF**

## Honors & Awards

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### Wiseman Prize

Department of Computer Science and Technology, University of Cambridge

2020

### PhD Studentship

Department of Computer Science and Technology, University of Cambridge

2018 - Present

### Subsystem Excellence Award at Hyperloop Pod Competition

Space Exploration Technologies Corporation

2016

### International Student Scholarship

The University of Edinburgh

2013-2016

### First Prize - "ThyssenKrupp" Elevator Cab Design Competition

School of Automation Science and Engineering, South China University of Technology

2012

## Skills

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### MOOC Certificate

Artificial Intelligence Planning; Introduction to Robotics; Machine Learning Techniques; An introduction to Interactive Programming in Python.

**Programming Skills** Python, Pytorch, Pytorch Geometric, Deep Graph Library (DGL), MATLAB,  $\LaTeX$ , NumPy

## Language Proficiency

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**English** Fluent

**German** Basic (Passed A2)

**Chinese** Mandarin (Native), Cantonese (Intermediate)