Francis Xiatian Zhang

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Education

Durham University, UK — *Oct. 2021 – May 2025*
- PhD in Computer Science. Research: geometric representations for clinical video analysis, surgical workflow anticipation, and endoscopic video understanding.
- Supervisors: Dr Hubert P. H. Shum and Dr Noura Al Moubayed.

King's College London, UK — *Sep. 2020 – Sep. 2021*
- MRes in Healthcare Technologies — Distinction.
- Project: Extracting Novel Cardiovascular Risk Factors from Routine CT Volumes.

University of Southampton, UK — *Sep. 2019 – Sep. 2020*
- MSc in Statistics with Applications in Medicine — Distinction.

Beijing University of Chinese Medicine, China — *Sep. 2014 – Jul. 2019*
- Bachelor of Medicine — Upper Second-Class Honours.

Research Statement

My research focuses on robot vision, particularly 3D perception, motion estimation, and visual navigation. I combine geometric modelling and deep learning, with recent work on depth estimation, visual odometry, and segmentation for medical robotics. I am interested in how robots recover structure and motion from images and use this information to understand and navigate their surroundings.

Relevant Experience

Research Associate, University of Edinburgh, UK — *Nov. 2024 – Present*
- Robot vision for bronchoscopic navigation: depth estimation, airway segmentation, visual odometry, and failure diagnosis. Research supervisor: Dr Mohsen Khadem.
- Collaborative work on continuum robot simulation and objective bronchoscopy skill assessment.

Research Assistant, Durham University, UK — *Oct.–Nov. 2023; Jul.–Sep. 2024*
- Edge Computing and Analytics 2.0: teaching model training, ONNX export, and deployment through Python APIs. PI: Dr Anish Jindal.

Demonstrator, Durham University, UK — *Nov. 2021 – Jun. 2024*
- Laboratory teaching in robotics, data science, programming, and text mining; instruction with Python, MATLAB, NVIDIA Jetson, and Puzzlebot.

Research Assistant, Northumbria University, UK — *Apr. 2022 – Jul. 2022*
- Pose-based assessment of CPR skills; multi-camera data collection with nursing students and staff. PI: Dr Merryn Constable.

Awards

2026: ICRA Best Paper Award in Medical Robotics, for Geometry-Aware Visual Odometry for Bronchoscopic Navigation via High-Gain Observer Fusion (co-author).

2020: Dean's List Award for Outstanding Achievement, University of Southampton.

Main Publications

Selected publications in robotics, computer vision, and biomedical engineering. Full list: Google Scholar.

- **Francis Xiatian Zhang**, Kevin Dhaliwal and Mohsen Khadem (2026). FDRAS: Failure Diagnosis and Repair for Airway Segmentation. *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*. paper | code.
- Mohammadreza Kasaei, **Francis Xiatian Zhang**, Feng Li, Farshid Alambeigi, Kevin Dhaliwal and Mohsen Khadem (2026). Geometry-Aware Visual Odometry for Bronchoscopic Navigation via High-Gain Observer Fusion. *IEEE International Conference on Robotics and Automation (ICRA)*. paper | arXiv. **Best Paper Award in Medical Robotics.**
- Zhaoxing Deng, David Hanley, **Francis Xiatian Zhang**, Kevin Dhaliwal and Mohsen Khadem (2026). A Model-Based Framework for Assessing Operator Performance in Navigational Bronchoscopy. *IEEE International Conference on Robotics and Automation (ICRA)*. paper.

- Salvatore Esposito, Matías Mattamala, Daniel Rebain, **Francis Xiatian Zhang**, Kevin Dhaliwal, Mohsen Khadem and Subramanian Ramamoorthy (2026). ROOM: A Physics-Based Continuum Robot Simulator for Photorealistic Medical Datasets Generation. *IEEE International Conference on Robotics and Automation (ICRA)*. paper | arXiv.
- **Francis Xiatian Zhang**, Hao Yao, Shengxuan Chen, Hong Zhu, Hongxiao Jia, Sisi Zheng and Hubert P. H. Shum (2026). Cross-view Multimodal Vision-Based Assessment Framework for Traditional Chinese Medicine Rehabilitation Training. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*. paper | arXiv | code.
- Emile Mackute, **Francis Xiatian Zhang**, Kevin Dhaliwal and Mohsen Khadem (2025). Navigational Bronchoscopy in Critical Care via End-to-End Pose Regression. *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*. paper.
- **Francis Xiatian Zhang**, Emile Mackute, Mohammadreza Kasaei, Kevin Dhaliwal, Robert Thomson and Mohsen Khadem (2025). BREA-Depth: Bronchoscopy Realistic Airway-geometric Depth Estimation. *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*. paper | arXiv | code.
- **Francis Xiatian Zhang**, Shuang Chen, Xianghua Xie and Hubert P. H. Shum (2024). Depth-Aware Endoscopic Video Inpainting. *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*. paper | arXiv | code.
- **Francis Xiatian Zhang**, Jingjing Deng, Robert Lieck and Hubert P. H. Shum (2024). Adaptive Anticipation: Adaptive Graph Learning From Spatial Information for Surgical Workflow Anticipation. *IEEE Transactions on Medical Robotics and Bionics*. paper | arXiv | code.
- Haozheng Zhang, Edmond S. L. Ho, **Francis Xiatian Zhang** and Hubert P. H. Shum (2022). Pose-Based Tremor Classification for Parkinson's Disease Diagnosis from Video. *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*. paper | arXiv | code.

Skills

- **Programming:** Python, MATLAB, and R; PyTorch and TensorFlow.
- **Computer vision:** Depth estimation, visual odometry, segmentation, pose estimation, video analysis, and graph-based modelling.
- **Medical imaging:** CT, MRI, and fMRI processing; SPM12 and FreeSurfer.
- **Statistical modelling:** Bayesian statistics, general linear models, survival analysis, and clinical trial design.

Talks and Conference Presentations

- Application of Graph Network Analysis in the Interpretation of Medical Data and Support of Clinical Decision-Making. *Beijing Integrated Medicine Committee Annual Conference, Psychiatry Workshop*, Beijing, China, November 2023.
- Correlation-Distance Graph Learning for Treatment Response Prediction from rs-fMRI. *ICONIP 2023*, Hunan, China.
- Towards Graph Representation Learning-Based Surgical Workflow Anticipation. *IEEE-EMBS BHI 2022*, Ioannina, Greece.

Service

Research Champion, National Institute for Health and Care Research (NIHR). Appointed December 2023. Contributions to inclusive trial recruitment and discussions of AI-assisted, privacy-preserving recruitment.

Peer review: International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI); IEEE International Conference on Robotics and Automation (ICRA); IEEE International Symposium on Biomedical Imaging (ISBI); IEEE Transactions on Image Processing (TIP); IEEE Robotics and Automation Letters (RA-L); IEEE Transactions on Medical Imaging (TMI); and IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE).

Training

- **BMVA Computer Vision Summer School 2022**, University of East Anglia, UK, July 2022. Computer vision lectures and laboratory sessions.
- **Clinical Clerkship**, Dongfang Hospital, Beijing University of Chinese Medicine, China, July 2018 – June 2019. Supervised experience in outpatient and inpatient departments.