

PhD Studentship in Multimodal AI for Context-Aware Surgical Robotics

An opportunity has arisen for a **3.5-year PhD studentship** within the **Hamlyn Centre for Robotic Surgery** and **Department of Surgery and Cancer** at Imperial College London, funded by the Multi-Scale Medical Robotics Centre.

Project Background

Surgical robots have revolutionised how surgeons operate, offering extraordinary precision and dexterity. However, in terms of information architecture, these robots remain isolated tools. They have limited awareness of the patient's medical history, the surgical plan, or the procedure's current phase. When a surgeon enters the robotic console, they are immersed in a 3D video feed but cut off from the wider clinical environment.

This PhD project will bridge this gap, transforming the surgical robotic console from a passive instrument into a **context-aware partner**. By integrating multimodal AI, the project aims to minimise the surgeon's cognitive load, ensuring the right information is presented at the right time during the procedure.

Recent advances in multimodal foundation models, real-time perception, and agentic AI make it timely and feasible to rethink the surgical console as an intelligent collaborator.

Project Outline

The successful candidate will work at the intersection of **Natural Language Processing (NLP)**, **Computer Vision**, and **Medical Robotics** to develop a data-enabled surgical environment. The core challenge of this PhD is to research an intelligent system capable of ingesting vast amounts of pre-operative and intra-operative data to support real-time clinical decision-making.

The project emphasises novel methods and publishable research contributions, alongside system-level validation in real surgical environments.

The project vision spans three key pillars. While we expect the successful candidate to touch upon all three, you will have the flexibility to tailor the depth of focus in each area according to your emerging expertise:

1. **Multimodal Information Extraction:** Utilising state-of-the-art AI (e.g., LLMs/VLMs/Knowledge graphs) to parse, structure, and semanticise complex patient health data, including pathology reports, imaging, and genomics.
2. **Context-Aware Surgical Intelligence:** Developing algorithms that can observe the surgery in real-time (using video analysis or robot kinematics) to understand the surgical phase and anticipate the surgeon's information needs.
3. **Intelligent Information Presentation:** Designing the logic and interface to seamlessly project relevant, retrieved data to the surgeon without causing distraction, effectively creating an augmented "cockpit" for robotic surgery.

Research Environment & Benefits

You will join a diverse, inclusive, vibrant, and collaborative research centre with access to world-class facilities, including clinical-grade surgical robots and high-performance computing resources.

The studentship includes a **dedicated travel budget** to support presenting your work at major international conferences (e.g., CVPR, MICCAI, ICRA) and collaborative workshops.

You will also work alongside leading clinicians and researchers from Imperial College NHS hospitals, gaining hands-on insights into surgical practice and benefiting from their mentorship throughout your research.

Graduates will be well positioned for academic careers in AI and robotics, as well as research roles in leading healthcare technology and medical AI companies.

Applicant Requirements

This is a highly technical, interdisciplinary project. We are looking for a candidate who is ready to build complex systems.

- **Academic:** Applicants should hold or expect to obtain a First or Upper-Second Class Honours degree (or equivalent) in Computer Science, Engineering, Maths, or Physics. A Master's degree in a relevant field is advantageous.
- **Technical (Essential):** Strong programming skills in **Python** and proficiency with deep learning frameworks (**PyTorch** or **TensorFlow**). You must be comfortable with software engineering best practices (e.g., Git version control).
- **Technical (Desirable):** Experience with RAG (Retrieval-Augmented Generation), LLMs, VLMs, and robotics.
- **Collaborative Communication:** The ability to translate complex technical concepts for clinical partners and translate surgical needs into engineering requirements.

Funding & Eligibility

- **Eligibility:** Applications are open to **UK and International candidates**. International applicants must be eligible to obtain a UK Student Visa.
- **Financials:** The studentship covers **full tuition fees** (Home and International) and provides a **tax-free stipend of approximately £22,780 per annum** for 3.5 years.

How to Apply: Applicants should express their interest by submitting their CV, including full contact details of two referees, to **Dr. Stuart Bowyer** via <https://forms.cloud.microsoft/e/9iUVK8LQx8>

Note: Imperial College PhD entry requirements must be met, and the successful applicant will subsequently need to apply via the online portal.

Closing Date: New applications will be reviewed on a rolling basis until a suitable pool of candidates is identified (expected review date: **28th February 2026**). Early application is strongly advised.