

## Project 4: Microultrasound imaging for disease diagnosis in the gut using a robotically-positioned capsule

### Supervisory Team

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### Background and motivation

Ultrasound imaging is a safe, inexpensive technique used in approximately 25% of all diagnostic medical scans. Some systems aim for particularly high resolution images using microultrasound, that is, ultrasound at frequencies that are higher than normal. In C-MIU, we have a prestigious project funded by the European Union to explore how this may be used, not in a conventional way from outside the body but with an ingestible capsule positioned within the gastrointestinal (GI) system using a robot. The aim is for the capsule to image the few millimetres thickness of the gut wall in a particular location in exquisite detail to better understand disease and treatment.

### What will you do?

This project will explore improvements in the imaging process that will be used in the capsule. Your first responsibility will be to take data obtained from a research ultrasound system used to image sections of porcine GI tract *ex vivo*. The device that generates ultrasound can be used in different ways, depending on the imaging algorithm of interest and you will need to take this into account in your work.

Once you have obtained the data, you will apply different imaging approaches and create images for comparison with the multi-layered tissue that comprises the gut. Ideally, you will work with tissue from different parts of the gut, such as the oesophagus, the stomach, and sections of the small bowel, and determine if a single algorithm can generate excellent images from them all, or if bespoke algorithms will be necessary. As the capsule will be positioned robotically, a bespoke approach will be possible.

You will learn many useful research techniques, including reviewing relevant literature, operating and programming a research ultrasound system, complex data acquisition from *ex vivo* tissue samples, and data processing and image display. You will work within a lively, curious research team, reporting and presenting your work regularly throughout the project.

### Required skills and experience

Candidates should have an interest in medical imaging, clinical procedures, and imaging algorithms. An enthusiastic approach to healthcare technology development will be beneficial. Candidates can come from degree backgrounds including biomedical engineering, electronic engineering, and different types of mechanical engineering. Candidates should have strong interpersonal skills and enjoy working as part of a team.

### Adjustments to the project if lab access is restricted

If lab access is restricted and/or we are required to work from home then we will adjust the project to be more heavily focussed on the image formation aspects of the proposed research.