Project title: SOMA-AI: Specimen intra-Operative Margin Assessment using Artificial Intelligence

Project Summary: SOMA-AI addresses a critical challenge in breast-conserving surgery (BCS) for breast cancer: ensuring complete removal of cancerous tissue while minimising unnecessary excision. During surgery, the goal is to remove the tumour with a small rim of healthy tissue - known as the "margin." If cancer cells are found at the edge, termed a "positive margin," patients often require a second operation or additional treatment, which delays adjuvant therapy, increases patient/carer stress, results in poorer cosmetic outcomes and increases NHS costs.

Currently, surgeons rely on intraoperative specimen X-rays to assess margins, but the signs are subtle, and decisions must be made quickly. The aim of this project is to determine whether AI analysis of intra-operative specimen X-rays can improve real-time margin assessment in BCS. We aim to enhance this process by developing an AI algorithm that analyses these X-rays in real time to help identify potential positive margins. The system will also generate a visual overlay to highlight areas of concern, supporting the surgeon's decision on whether further tissue removal is necessary - potentially sparing patients from repeat procedures.
To train and validate the model, we will use:

- 1,250 historical cases from The Royal Marsden, including specimen X-rays, pathology results, and clinicopathological data.
- An estimated 8,000 additional cases from the OPTIMAM database to further strengthen model performance.

The expected outcome is a tool that can be tested prospectively and integrates seamlessly into existing NHS workflows - requiring no new hardware, just enhancing information already available and collected at the right moment.

This work will provide novel AI-methods for medical imaging researchers and a clear answer on whether AI-optimised analysis of intra-operative specimen X-rays improves margin assessment or whether alternative imaging (e.g. higher resolution or 3D modalities) or non-imaging technologies should be explored. If effective it could be implemented into clinical practice and reduce re-operations thus improving recovery and quality of life for patients, support surgeons and reduce unwanted variation and costs for the NHS.

This project is led by a multidisciplinary team with expertise in AI development, clinical data access, and healthcare delivery—ensuring both innovation and implementation readiness.

Supervisory Team: Professor Ben Glocker, Ms Jennifer Rusby, Dr Richard Sidebottom, Ms Rachel O'Connell

Clinical Specialities: Breast Surgery, Radiology, Clinical Oncology, Health Informatics / AI in Healthcare