iCase Project / AY 2023 -2024

Machine learning to understand the radiogenomics of resistance in ovarian cancer

Supervisor: Dr Mireia Crispin (mc973@cam.ac.uk)

Department/Institute: Oncology

Industrial Partner: Canon Medical Research Europe

Research area: Oncology, radiogenomics, image analysis, machine learning, biotechnology

Project outline:

High grade serous ovarian carcinoma (HGSOC) is the most lethal gynaecological malignancy. Most HGSOC patients now receive chemotherapy as their first treatment (neoadjuvant therapy), but ~40% do not respond and do not receive surgery.

We have developed genomic and radiomic biomarkers that can predict response to neoadjuvant therapy. The critical next step for clinical translation is to define the biology of radiomic features. Initial work will molecularly profile tissue samples that have been precisely coregistered with CT images during neoadjuvant therapy using methods we have developed for printing 3D moulds from radiological data. Tissue slides will be processed using multiplexed single-cell resolution imaging and analysed using computational pathology methods. Predictive radiomics models based on deep learning will be developed to infer the distributions of the different parameters of interest (tumour cellularity; immune activity; stromal distribution) across the entire volume of interest, and compared with genomic assays obtained from the samples. These results will have important clinical impact and will (1) enable the prediction of optimal biopsy locations for tumour monitoring during neoadjuvant treatment and (2) provide unprecedented insights into the micro- and macro-environmental biology of HGSOC. These data will further inform machine learning tools for clinical management.

The project will be supervised by Dr Mireia Crispin-Ortuzar (Dept. of Oncology and Integrated Cancer Medicine Programme) in close collaboration with interdisciplinary partners in the CRUK Cambridge Institute (Prof Brenton) and Canon Medical Research, one of the leading medical imaging companies worldwide with a state-of-the-art AI Research team with experience in multi-omic analysis.

BBSRC DTP main strategic theme: Transformative technologies

BBSRC DTP secondary strategic theme: Bioscience for an integrated understanding of health