Russel Frood

Short Biography:

Russell Frood is a Cancer Research UK Clinical Trial Fellow at the University of Leeds and Honorary Radiology Speciality Trainee at Leeds Teaching Hospitals NHS Trust. He was awarded a PhD from the University of Leeds in March 2023 focused on PET/CT based machine learning for outcome prediction in lymphoma. During this time he worked as a Clinical Research Fellow helping to deliver multi-centre imaging AI projects as part of the National Consortium of Intelligent Medical Imaging, a research collaboration consisting of NHS Trusts, Universities and Industry partners which was funded by Innovate UK. He is an Advisory Editor for Clinical Radiology, the Royal College of Radiologists' journal and manages radiology anatomy sessions for undergraduate medical students at the University of Leeds.

His current academic work focuses on the use of imaging biomarkers as part of prospective clinical trials in brain cancer (BRIOChe, APPROACH trials), anal carcinoma (PLATO study) and multiple myeloma (FiTNESS trial).

Abstract:

Lymphoma is a haematopoietic malignancy affecting lymphocytes and their progenitors with Hodgkin lymphoma (HL) being one of the main histological subtypes. Despite improvements in treatment-adaptation based on fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) response, relapse occurs in approximately 20% of patients. The majority of which will occur within 2 years of treatment. The work performed aimed to evaluate machine learning (ML) models based on pre-treatment FDG PET/CT for predicting 2-year event free survival (EFS) in a cohort of HL patients.

Two hundred and eighty-nine patients were retrospectively included from our large tertiary referral centre and split into training (80%) and test (20%) cohorts stratified around 2-year event free survival (EFS), age, sex, ethnicity, and disease stage. Radiomic features were extracted using PyRadiomics with ComBat harmonisation applied. Seven ML models were trained and hyperparameters tuned using stratified 5-fold cross validation and performance assessed using area under the curve (AUC) from receiver operator characteristic analysis.

A ridge regression model had the highest performance, with mean training, validation, and test AUC (+/- standard deviation) of 0.82 ± 0.002, 0.79 ± 0.01 and 0.81±0.12. However, there was no significant difference between this model and a clinical feature-based model.

Outcome prediction using pre-treatment FDG PET/CT-derived ML-models is feasible in HL patients. Further work is needed to determine optimum predictive thresholds for clinical use, as well as more detailed analysis into underrepresented patient groups within the study cohort.