Patient-centric Machine Learning Approach to Improve Clinical Trial Efficiency and Effectiveness

**Type of award**  
PhD Research Studentship

**School**  
Engineering Mathematics and Technology

**Scholarship Details**  
Minimum £18,622 p.a. plus a £4,000 p.a. industrial top-up subject to eligibility status and confirmation of award.

**Duration**  
4 years

**Eligibility**  
Home/EU (UK settled status) with permanent UK residency / International

**Start Date**  
November 2023

PhD Topic Background/Description

This 4-year University of Bristol PhD scholarship is funded by Roche, a global biotech company, a leading provider of in-vitro diagnostics and a global supplier of transformative innovative solutions across major disease areas. It will be based in the School of Engineering Mathematics and Technology and supervised by a multi-disciplinary team from the Medical School, the School of Engineering Mathematics and Technology, and Roche.

Clinical trials play a crucial role in advancing medical research and improving patient care. However, one of the major challenges faced by the medical community is the efficient and accurate matching of eligible patients to appropriate clinical trials. This process traditionally relies on manual assessment, leading to significant delays, suboptimal patient enrolment, and inefficient allocation of resources. This project will harness the power of machine learning to develop a patient-centric approach to match patients with clinical trials more effectively, maximizing the potential benefits for patients, researchers, and oncologists.

Aims and objectives:

The primary aim of this research project is to develop a machine learning-based system that facilitates the precise matching of cancer patients with appropriate clinical trials. The specific objectives include:

1. Identify and extract relevant biomarkers from patient data to enhance the matching accuracy.
2. Develop a machine learning algorithm that can be used to match clinical trials with patients in a more personalised way than is currently possible considering the scarcity of training data.
3. Evaluate the performance of the algorithm on a dataset of real-world data.
4. Implement the algorithm in a software application that can be used by clinicians to match patients with clinical trials.

Methods:

To achieve the objectives outlined above, the following methodology is proposed:

- Extract meaningful and relevant features from the patient and trial data. This process will involve domain expertise and statistical analysis to identify informative biomarkers and clinical variables that influence patient-trial matching. Feature engineering will enhance the accuracy and interpretability of machine learning models.
Utilize explainable machine learning algorithms suitable for patient-trial matching. These models offer interpretability by providing clear decision rules or feature importance rankings. Multiple models will be developed and compared to identify the best-performing approach.

Given the scarcity of clinical trial data, appropriate techniques will be explored to address this challenge. Transfer learning methods will be investigated, where pre-trained models from related tasks or datasets will be fine-tuned using the available clinical trial data to improve generalization performance.

Evaluate the performance of the developed machine learning models. Apply model optimization techniques to enhance the performance and interpretability of the machine learning models. The optimization process will seek the right balance between model complexity and generalizability, with a focus on models that are both accurate and explainable.

Deploy the developed machine learning algorithm into a user-friendly software application. The application will provide an intuitive interface for clinicians, allowing them to input patient data and receive personalized clinical trial recommendations. The interface will also display model explanations, feature importance, and decision rules to enhance transparency and user trust.

Candidate Requirements
We strongly encourage applications from STEM and/or health disciplines with experience in computer / data science (e.g., mathematics, statistics, computer science, life or natural sciences, economics, social sciences or other related quantitative discipline). You will need to demonstrate your ability in conducting research using computational methods or a strong motivation in learning those methods.

Applications are sought from high performing individuals who have, or are expected to obtain, at least a 2.1 degree (or equivalent). Possession of a relevant Master’s degree or research experience would be advantageous but is not required.

We welcome applications from those with non-standard qualifications who can demonstrate knowledge, experience and skills developed in the workplace, or elsewhere, relevant to the programme of study Engineering Mathematics PhD.

Scholarship Details
The studentship is funded by Roche based on UKRI rates (£18,622 pa) with the addition of a £4,000 “uplift” (giving a total stipend of £22,622 per year). Roche will also cover the cost of student tuition (for home student applicants) and provide £1,000 for research training support.

International students may also apply but will need to cover the difference in tuition fees. An outstanding international candidates may be eligible for a fee waiver. Funding is subject to confirmation of eligibility and award.

For eligibility and residence requirements please check the UKRI UK Research and Innovation website.

Enquiries
For questions about the research topic please contact Dr. Zahraa S. Abdallah (zahraa.abdallah@bristol.ac.uk)
For questions about eligibility and the application process please contact PGR Engineering Admissions (admissions-engpgr@bristol.ac.uk)

Application Details
To apply for this studentship, submit a PhD application using our online application system [www.bristol.ac.uk/pg-howtoapply]. Select Engineering Mathematics (PhD) from the dropdown list.

When applying, candidates must enter supervisor names as listed under the project title for which they are applying. Full details on what to include in your application can be found in the Admissions Statement.

Personal statement: Please also provide a personal statement that describes your training and experience so far, your motivation for doing a PhD, your motivations for applying to the University of Bristol, and why you think we
should select you. We are keen to support applicants from minority and under-represented backgrounds (based on protected characteristics) and those who have experienced other challenges or disadvantages. We encourage you to use your personal statement to ensure we can take these factors into account.

Where it asks you to upload a research proposal, please use this space to explain your understanding of the science around the project, and why you find it interesting.