



Title of PhD project	AI methodology for investigating age-related cognitive changes and retinal imaging	
Supervisor	Dr Alex Lewin	LSHTM
Co-Supervisor	Professor Alicja Rudnicka	SGUL
Co-Supervisor	Professor Chris Owen	SGUL
Brief description of project	<p>This project will use AI/machine learning methods to investigate the association between age-related cognitive changes and age-related changes in retinal vessels.</p> <p>Morphological features of vessels from high-dimensional retinal images have been found to be strongly related to age. The object of this project is to use these morphological features in machine learning models for cognitive changes over time, investigating relations between cognitive measures, retinal imaging data and age. Cognitive change will be quantified using multivariate observations (prospective memory, numeric and verbal reasoning), measured at repeated time points in around 55,000 UK Biobank participants. Morphological features derived from retinal images are available at baseline for the same sample.</p> <p>Examples of research questions include:</p> <ul style="list-style-type: none"> • Are age-related changes in retinal images predictive of poorer cognition in later life? • Can we detect particular areas of the retinal vessels which drive associations between age and cognition? • Are cognitive changes with age mediated through changes in the retinal vessels? <p>These questions will require the use of high-dimensional supervised learning models. These will be extended to incorporate spatially-dependent predictors for finding which parts of the vessels are important, and to mediation approaches for investigating the three-way dependence between retinal images, age and cognition.</p> <p>The student will join an established team of investigators, including statisticians, epidemiologists, image scientists, and clinicians, working at Moorfields/UCL, LSHTM, St George's and Kingston Universities.</p>	

Skills we expect a student to develop/acquire whilst pursuing this project	Statistical/machine learning methods, data management/harmonisation, computational skills.
Particular <u>prior</u> educational requirements for a student undertaking this project	Strong quantitative background.
Project key words	Big data Bayesian modelling Machine learning Spatial modelling
Possible under 1+4 route? Master's options identified.	Yes LSHTM – MSc Health Data Science LSHTM – MSc Medical Statistics
MRC Core Skills developed through this project	Quantitative skills Interdisciplinary skills
MRC LID themes	Health Data Science