**Early Detection of Diabetic Retinopathy using Personalised Longitudinal Discriminant Analysis.**

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Sight threating diabetic retinopathy (STDR) is a sight threatening condition screened for every year in all patients with diabetes in the UK. Based on various longitudinal measurements the aim is to classify patients according to their risk of developing STDR within the next year.

Only around 4% of patients with diabetes develop STDR each year, so testing all patients is very inefficient. Our aim is to accurately identify patients at high risk of developing STDR in order to screen them more regularly whilst being able to screen patients at low risk less frequently without reducing screening efficiency.

Our aims are to increase the accuracy of classification through the inclusion of covariate information and to identify the earliest time point at which correct classification can be achieved. Recent developments have been made in discriminant analysis where longitudinal trends are modelled using multivariate generalized linear mixed models.

We extend this existing discriminant analysis methodology for longitudinal data by allowing covariate information to be used as discriminators, and not just to influence the longitudinal trends. Furthermore, we extend the longitudinal profiles for a patient to allow for classification at future time points. The aim is to predict the individual risk of STDR at various future time points so as to inform a screening schedule.

We analyse data from a longitudinal study of over 12,000 patients diagnosed with diabetes and use our method to classify these patients into risk groups. We expect that this methodology will lead to better detection of sight threatening diabetic retinopathy, and hence improved patient care, whilst also significantly reducing the screening costs for the NHS.