Application number/Title: 20609 - Development of a deep neural network for computer aided retinal disease detection and analysis

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Keywords provided by the Applicant PI to describe the research project:

ConvNets, epidemiology, retinal disease, detection, analysis

Application Lay Summary:

1a: The primary aspect of the study will be to develop a means for tracking disease states and progression (if longitudinal data is available) related to blindness via computer vision of fundus and OCT images.

The main aims are to develop a set of algorithms able to:
1) Interpret and verify the quality of the images across modalities
2) Develop epidemiological models to track and potentially forecast disease progression, including:
a. Automatic image analysis for generating quantitative measures from retinal morphology, including vessels, optic disk and malignancies of the retina.
b. Distil epidemiological indicators, based on quantitative measures following correction for image quality

1b: This work aligns with the UK Biobank's purpose with the goal of improving the prevention, diagnosis and treatment of blindness, as well as other acute and chronic diseases of the eye.

1c: The research will be conducted at the University of Waterloo, faculty of Systems Design Engineering. The CPUs and GPUs of one or more computers will be used in parallel to train deep learning algorithms called Convolutional Neural Networks.

These networks are modelled after biological neurons and can take a lot of time

to train and refine. Essentially, we train the algorithm using curated images with accompanying descriptions of the patients' conditions and it extracts the morphological similarities from the images.

This project will be completed by Henry Leopold under the supervision of John Zelek and Vasudevan Lakshminarayanan.

1d: The subset of the full cohort we are seeking are those which include data fields: 21015, 21016.

We will subset the data into healthy and non-healthy populations. Non-healthy populations will be further sub-categorized by disease type and severity. Patients may also be bulked into demographic factors before or after the aforementioned subsetting.