POPULAR SCIENTIFIC ABSTRACT

Jakob Kristian Holm Andersen

Detection of Diabetic Eye Disease in a Danish Context using Deep Learning

Diabetes is a global epidemic with more than 460 million people affected across the world. This number is expected to rise dramatically in the coming decades, as people on average live longer into old age and our lifestyles become increasingly sedentary. Diabetes leads to high blood pressure which is the cause of many complications in organs such as the heart, kidneys and eyes.

Diabetic retinopathy (DR) is one of the most frequent complication in diabetes. It is a chronic and progressive disease in the eye where microvascular changes brought on by high blood pressure and blood glucose can lead to reduced vision and blindness, and it is a leading cause of preventable blindness in the working aged population.

The risk of DR related vision loss and blindness can be decreased by early detection of the disease. Diabetes patients in many countries attend regular screenings at hospitals or health-care clinics, where ophthalmologist or trained health professionals will examine their eyes using fundoscobic images and look for microvascular changes and abnormalities indicating disease.

As the incidence of diabetes continues to rise, the demand for expert healthcare professionals also increases, and there is a fear that healthcare systems will not be able to keep up with demand. Within the last five years the interest in and research into the use of computer assisted diagnostic methods have increased, in large part due to the performance of deep learning methods and specifically convolutional neural networks for automatic image recognition. Deep learning has been extensively studied for use in automated screening and diagnosis of DR and is currently on the level of human experts for detecting certain severity levels of the disease

Denmark has an established DR screening program that is tasked with regular screenings of the about 300,000 people in Denmark with diabetes. The Danish screening program is build on recommendations and guideline established by The Danish Ophthalmological Society. These guidelines propose the use of specific methods for identifying and stratifying DR disease severity and managing patients to reduce the risk of DR related vision loss.

The current methods for automatically detecting DR with deep learning do not comply with the recommendations and guidelines used in the Danish screening program due to differences in the types of images and disease stratification scale used. In addition, many of the methods so fare developed have used im-

ages from populations in India and South East Asia, and there is a concern that the methods may not perform with the same level of efficiency in the Danish population.

This thesis is concerned with developing a method for automatic detection of DR in the Danish population that complies with the guidelines and recommendations from The Danish Ophthalmological Society. This entails the use of images with a large field of view of the patient's retina and the ability to stratify DR disease severity into the five levels used to plan screeningi ntervals and treatment for diabetes patients. A focus will be on increasing the interpretabilityof the decisions made by the methods in order to make the potential adoption into the screening program more acceptable for clinicians as well as patients.