# Retinal Image Analysis using Deep Neural Networks

**Problem Statement:**

**To segment retinal landmarks (such as optic disk and blood vessels) and classify retinal images based on the severity of Diabetic retinopathy using Deep Neural Networks.**

Nowadays, many people are suffering from Diabetic Retinopathy, which is one of the commonest reasons among adults aged 20 –74 years for blind registration in the world. The development of retinopathy greatly depends upon how long a person is suffering from diabetes.

In DR patients lesions such as microaneurysms, haemorrhages, exudates, neovascularization etc may develop and it is necessary to detect them for early intervention.

DR is broadly classified as Non-proliferative diabetic retinopathy and Proliferative diabetic retinopathy. Non-proliferative DR can be further categorized as mild, moderate and severe stages. Mild non-proliferative diabetic retinopathy is characterized by microaneurysms, whereas moderate and severe stages are characterized by exudates. Non-proliferative diabetic retinopathy exhibits no distinctive symptoms and generally does not interfere with vision until a proliferative stage of diabetic retinopathy is reached. Proliferative diabetic retinopathy is characterized by neovascularization causing visual impairment or blindness. In addition, the treatment at the proliferative stage becomes less effective. It is therefore important to diagnose diabetic retinopathy at an earlier asymptomatic clinical stage [1].

According to ophthalmologists, the severity level of diabetic retinopathy is judged primarily based on the size, number and locations of exudates. In daily clinical practice, ophthalmologists using fundus photographs manually detect HEs. However, this method of detection is time-consuming and has the possibility for human error in a repetitive task. Additionally, the high demand for professional skills and expensive equipment makes it hard to conduct fundus examinations in local hospitals. Hence, automated HE detection is essential for the limited and possibly decreasing number of specialists and for timely treatment [2].

The challenges are: (1) The size of HEs varies dramatically; small exudates only occupy a few pixels and are as small as microaneurysms, while large ones can be the size of optic disc (see

Fig.). (2) HEs have diverse shapes, which makes them difficult to detect. (3) Some anatomical structures (e.g., vessels reflections and optical artifacts) share similar intensity or texture information to exudates. (4) Fundus images taken from patients usually have different colors, non-uniform illumination and low contrast variation etc.

To overcome the above said challenges, Juan et. al [3] proposed the cascaded deep residual networks to recognize DME wherein a fully connected convolutional residual network extracts multi-features to segment exudates accurately with a faster speed.

Moreover, the detection of exudates is not only useful for diagnosis but also for treatment planning. **The physicians determine the precise area of exudates to be exposed to laser for photocoagulation. Therefore, proper detection and segmentation of exudates is important for treatment decisions. Thus, a computer-aided detection and segmentation of exudates would offer fast and precise diagnosis of diabetic retinopathy.**

**References:**


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