APTOS Blindness Detection Proposal

Problem and Goal

In this project, the objective is to use a machine learning model to speed up diabetic retinopathy detection and classify 5 different severity levels of the disease. Millions of people suffer from diabetic retinopathy, which is the leading cause of blindness among working-age adults. Especially, patients living in rural areas have a higher risk of developing blindness because fundus screening is difficult to conduct under poor medical conditions. Even if screening is conduct successfully, the screen images are required professional doctors to review one by one and then provide the diagnosis. Such that, the whole diagnosis process becomes difficult and inefficient.

To avoid more people missing the optimal treatment time, Aravind Eye Hospital in India captured screen images from rural areas, and hoped to leverage technology to screen images automatically and gain information on the severity of the condition. Therefore, the project will end up with a machine learning model that is not only able to identify diabetic retinopathy from healthy eyes but also tells how severe the disease may be. In the future, we can develop a model to detect other sorts of diseases like glaucoma and macular degeneration.

Data

As mentioned above, the data are the images captured by Aravind Eye Hospital. The total number of the images is 5590. Each image is rated on a scale of 0 to 4 by a clinician, based on the severity of diabetic retinopathy (0 – No DR, 1 – Mild, 2 – Moderate, 3 – Severe, 4 – Proliferative DR). The data can be retrieved on the Kaggle platform.

Constraints

Images may contain artifacts, be out of focus, underexposed, or overexposed. The images were gathered from multiple clinics using a variety of cameras over an extended period, which will introduce further variation.

Another problem is that the severity of the disease might be subjective since the ratings more or less come with the clinician's personal opinion. Whether an image has diabetic retinopathy is a 'Yes' or 'No' question, but the degree of illness is hard to measure. There is no extract scale telling if it is mild, moderate, or severe.

Approaches

To deal with the problem of large variation, I will first detect abnormal images such as those with low contrast or low brightness. Then apply image augmentation techniques according to their needs so the machine can capture important information more easily. After the data is ready to train, leverage the Convolutional Neural Network to classify the images. Macro Average F1-score will be the metric to evaluate the model performance since I want to treat each class equally and balance the recall and precision scores.