DR Problem Statement (Hypothesis Formation)

What is the best deep learning algorithm to detect the level of retinopathy in a diabetic retinal screen so that the grade can be artificially diagnosed with at least 80% of accuracy by using only a retinography image TIFF file?

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1 Context

Diabetes has reached impressive numbers by 2017, having almost 425 million people facing the disease and estimating almost 629 million by 2045. According The American Society of Retina Specialists, half of the patients with diabetes suffer from retinopathy and is the number one cause of irreversible blindness in working-age people. However, there is substantial scientific evidence that early detection and timely treatment can prevent vision loss.

In recent years, there have been programs based on the analysis of fundus photographs by specially trained ophthalmologists (mostly remote graders). However, although great eyes are behind the analysis, the **diagnostic accuracy achieved may not be optimal, and scaling and sustaining such programs has been found to be challenging**. Additionally, the costs of those type of services could be quite high even for developed countries. Therefore, to develop technology for making proper diagnosis based on computer vision is an actual trend of paramount importance.

Deep learning, a machine learning (ML) technique, has shown promising diagnostic performance in several applications, such as in image recognition and computer vision tasks. These technologies have been widely adopted in many domains including healthcare and medicine. For medical imaging analysis in general, it has achieved robust results in various medical specialties such as radiology; for ophthalmology in particular, deep learning (DL) continues the tradition of **autonomous and assisted analysis of retinal photographs**. Such **artificial intelligence (AI) systems** have been demonstrated to lower cost, improve diagnostic accuracy, and increase patient access to Diabetic Retinopathy screening. Recent works on DL in ophthalmology showcase its potential to at least partially replace human graders, while providing a similar level of accuracy. Nonetheless, being more adopted as a medical-aid systems than a replacement itself.

2 Criteria for success

- Develop a deep learning algorithm capable **of detecting retinopathy grade** in patients' retinography images with at least 80% of accuracy

- Being able to train the model using **standard computer resources** and enabling scaling for a cloud environment

- Create a data **pipeline transferable to a production environment** for a successful model deployment

- Develop a deep learning algorithm capable of **detecting risk of macular edema** in patients' retinography images with at least 80% of accuracy

3 Scope of solution space

The analysis and modeling will be made using **10 zip files containing 100 retinography images each** in .tiff file format These images were provided by the Messindor Database Project (Methods to evaluate Segmentation and Indexing Techniques in the Field of Retinal Ophthalmology within the Scope od diabetic Retinopathy).

It is planned to load and read the images from those files and use the labels to classify the images by using a machine learning algorithm (deep learning) transferable to software APIs or other platforms for use in the field of ophthalmology or for research and statistical analysis purposes.

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Problem Statement Worksheet (Hypothesis Formation)

<What is the business problem you are investigating? (Use SMART principles)>

4 Constraints within solution space

<What constraints exist that may prevent this business initiative from succeeding?>

5 Stakeholders to provide key insight

<Who are the key stakeholders that need to be involved in this project? Where will you source your data from and who will you present your recommendation to once you have identified a solution?>

6 Key data sources

<What are the key pieces of data you need to answer the questions related to the problem you are trying to solve?>