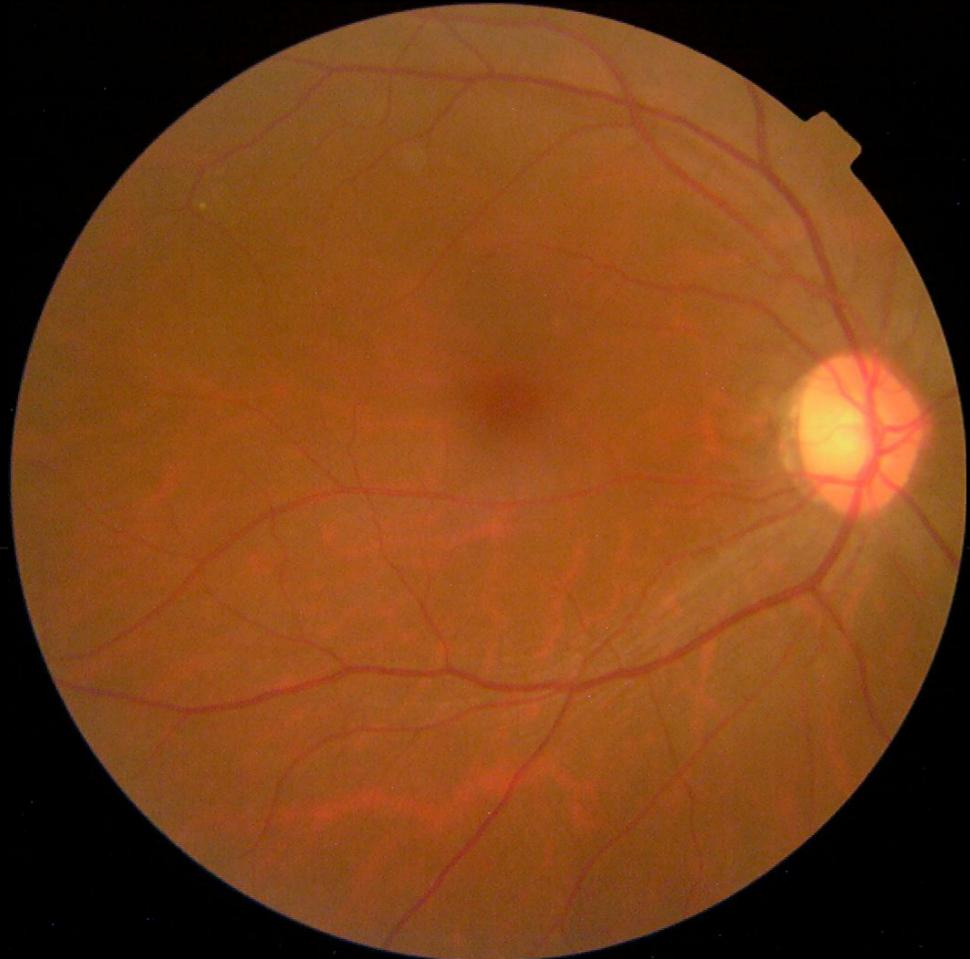
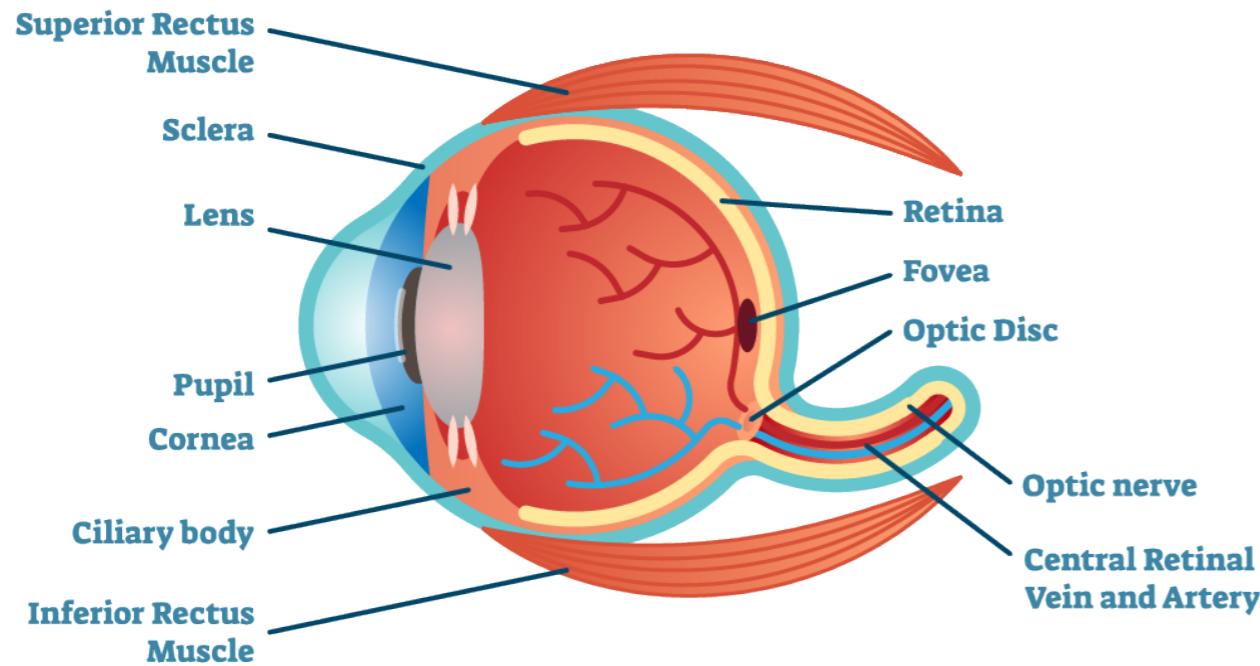


Using a Convolutional Neural Network to Identify Diabetic Retinopathy

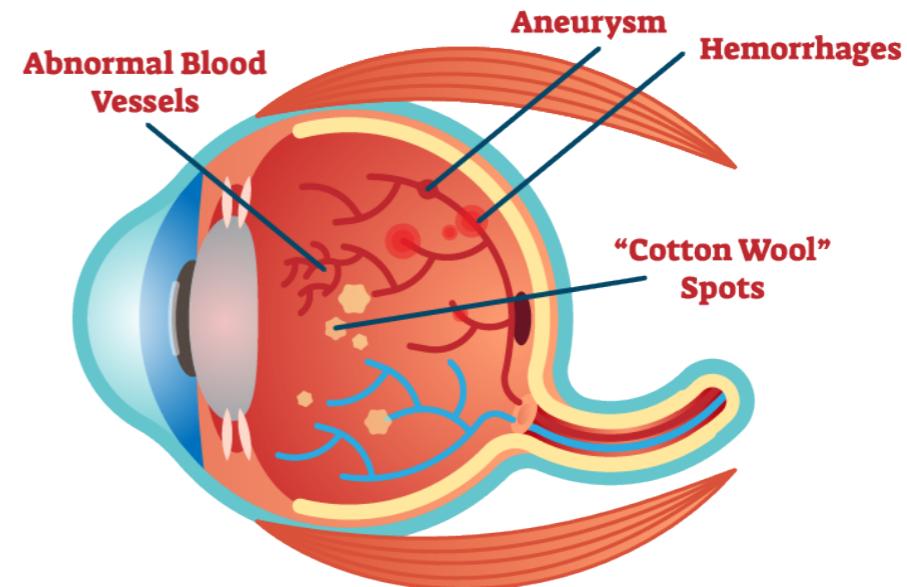


Giovanni Rosati
August 26, 2019

Diabetic Retinopathy



Healthy Eye



Diabetic Eye

❖ The Problem:

- Diabetic retinopathy is the most common cause of vision loss among people with diabetes and a leading cause of blindness among working-age adults.
- Diabetic retinopathy involves changes to retinal blood vessels that can cause them to bleed or leak fluid, distorting vision

❖ The Goal:

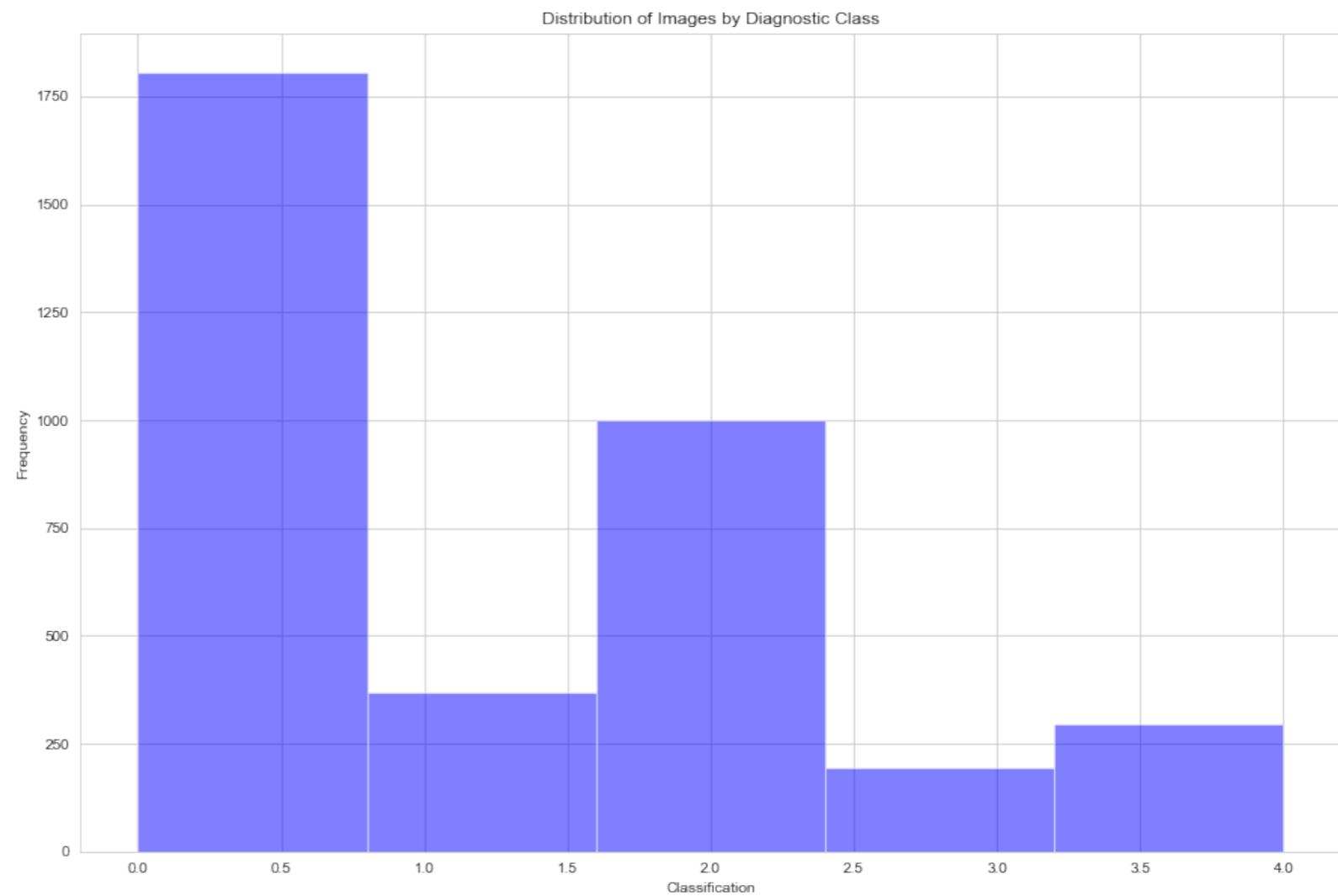
- Create software able to correctly categorize images of retinas into 5 categories of diabetic retinopathy.

❖ The Challenges:

- Varying image sizes
- Unbalanced data. There are many more images of health eyes than severely diseased retinas.

The Data

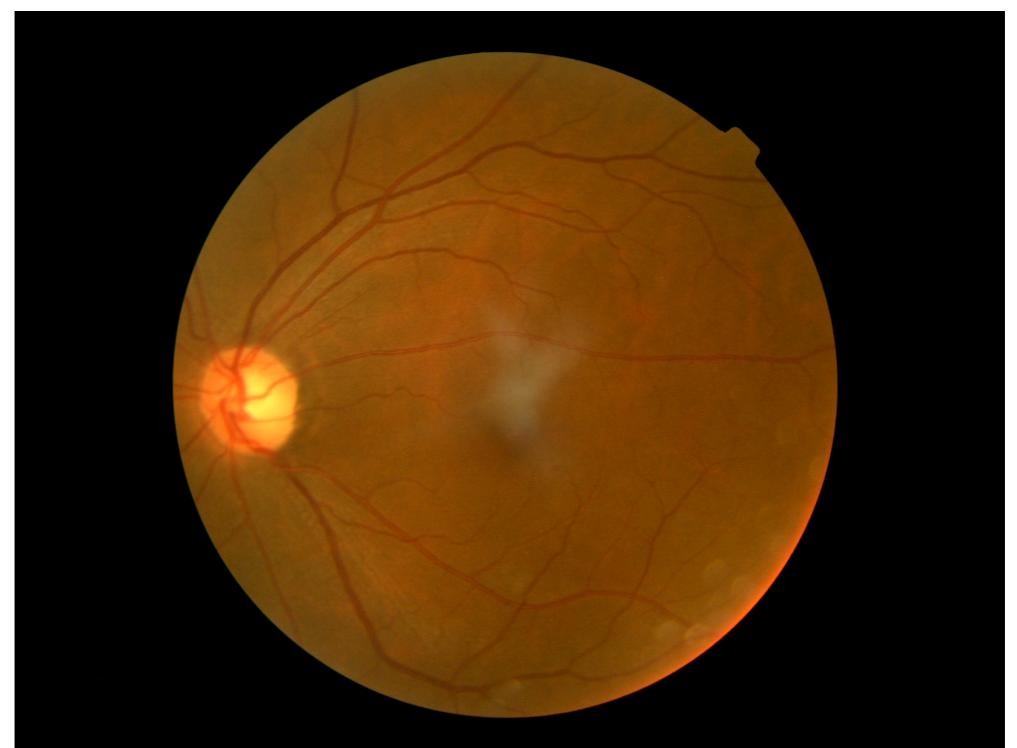
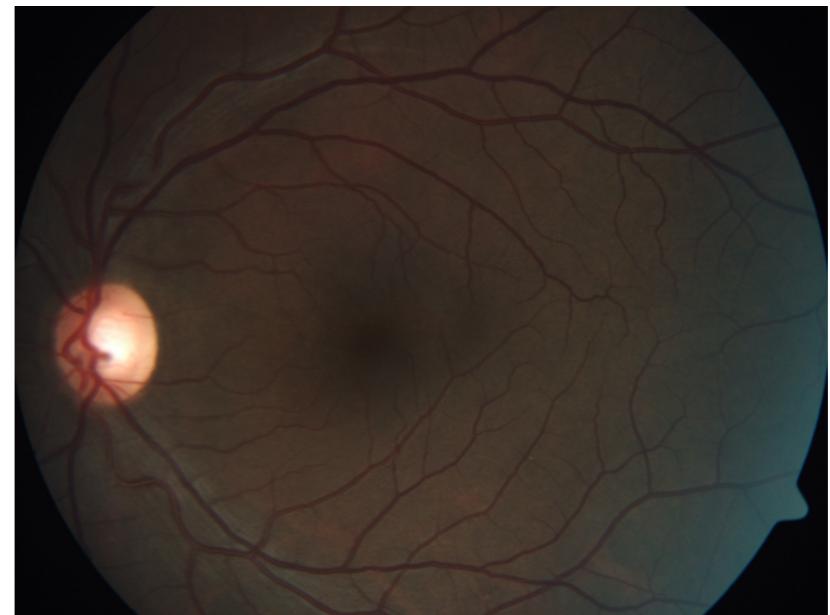
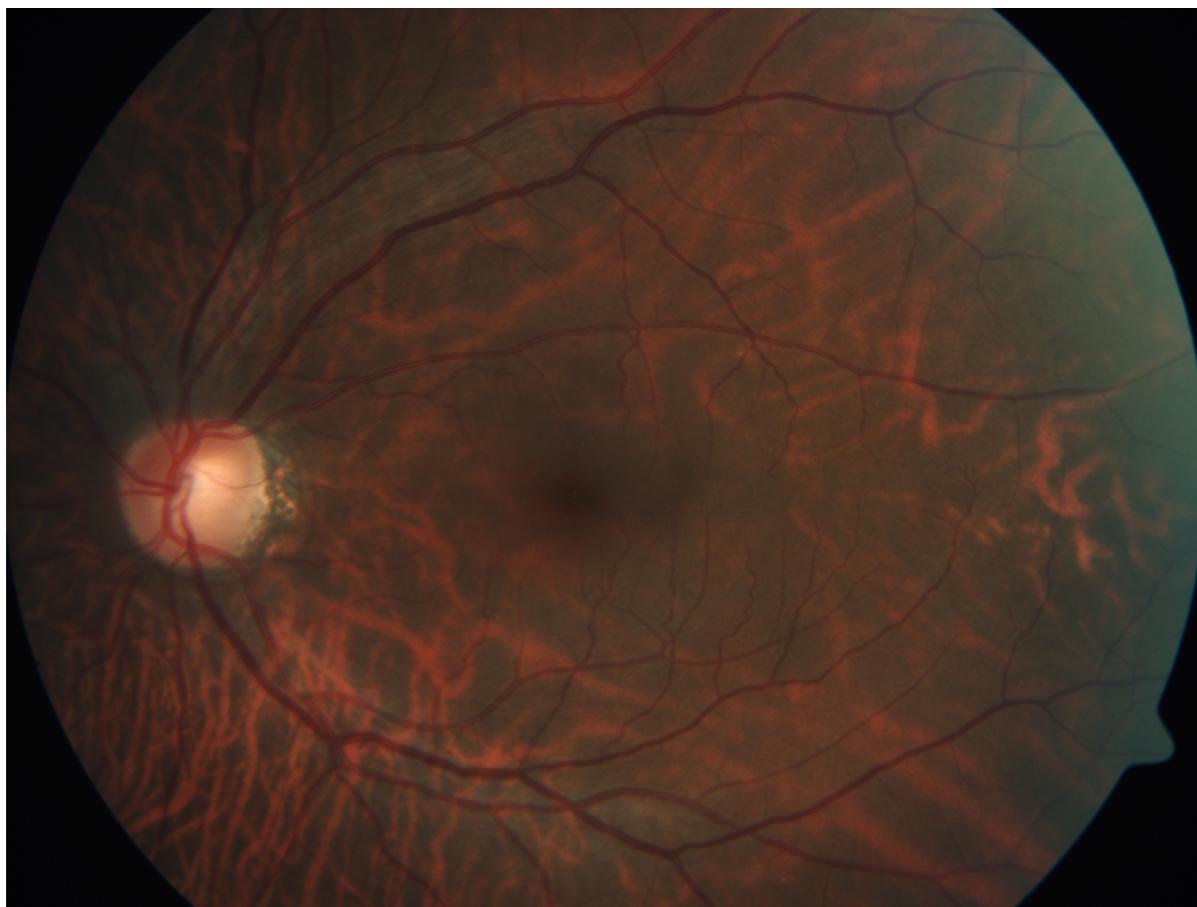
- ❖ 3,662 Training Images
 - No DR - 1,805 images
 - Mild DR - 370 images
 - Moderate DR - 999 images
 - Severe DR - 193 images
 - Proliferative DR - 295 images
- ❖ Sizes Vary
 - Smallest: 474 x 358
 - Largest: 4,288 x 2,848
- ❖ Quality Varies
 - Different clinics, different cameras
 - Varying amounts of black around the edges
 - Brightness and Contrast varies



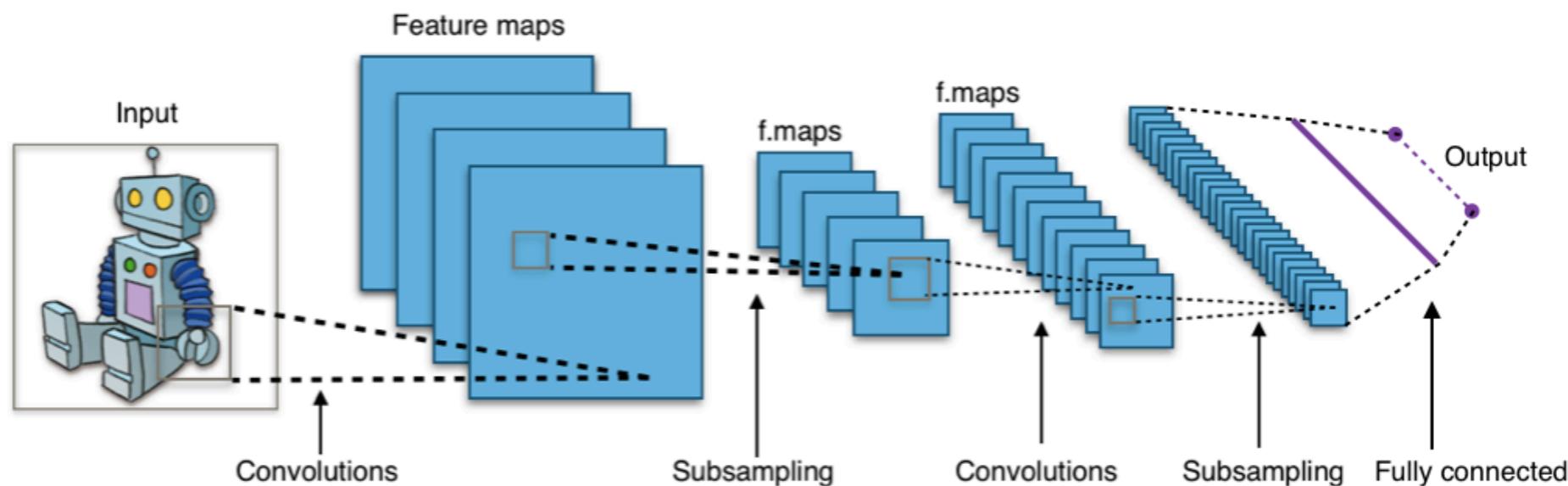
The Data

- ❖ Sizes Vary
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Convolutional Neural Network



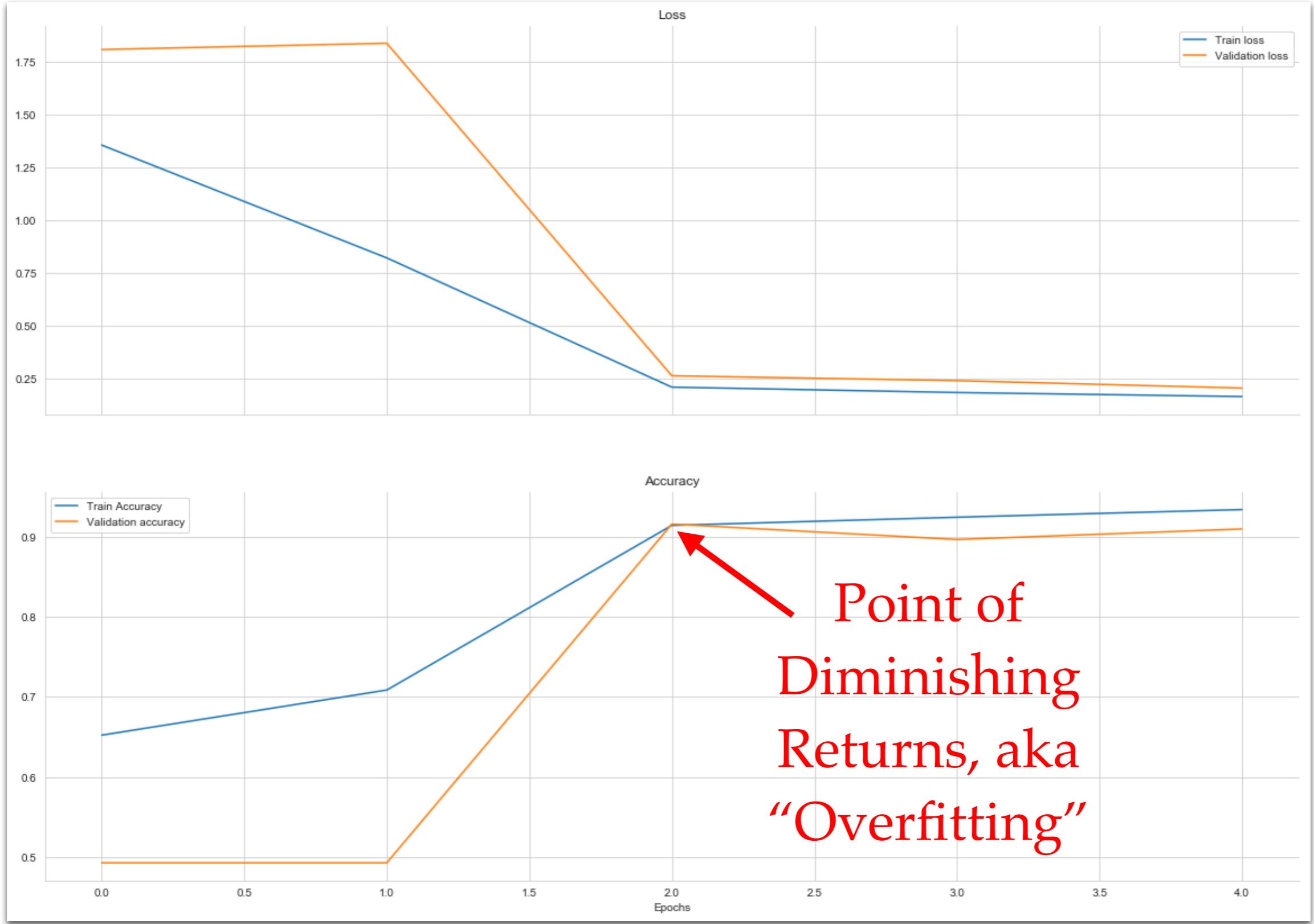
- ❖ An Example of a Machine Learning Model

- Many layers
- Many cycles
- Learns by repeatedly attempting to identify the components in the image so that it can correctly classify the image.

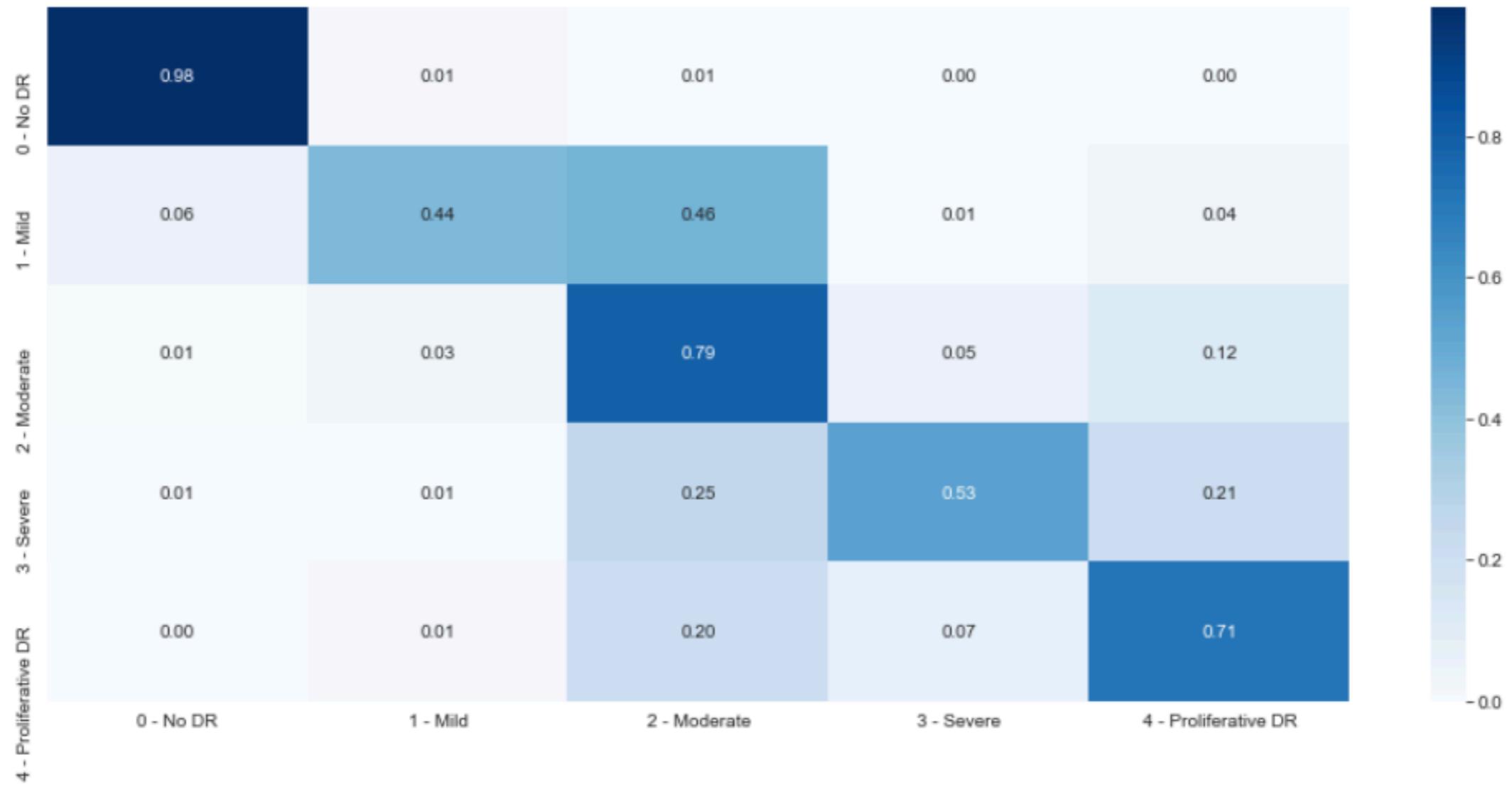
- ❖ Model Used

- Images resized to 128 pixels x 128 pixels
- Over 27 million “trainable” parameters

Learning at Each Cycle



Accuracy Varies



The model's accuracy varies by the severity of the disease. 98% of images with no DR are correctly classified, but only 44% of images with mild DR are correctly classified. The model seems to have the most difficulty with separating images between Mild and Moderate DR.

The Future

In 2018 the FDA approved software to screen patients for diabetic retinopathy, and the methods are rapidly making their way into other applications for image analysis, natural language processing, EHR data mining, drug discovery, and more.*

*Journal of American Medical Association, December 13, 2018