# Machine Learning Engineer Nanodegree Program

Report

STEM NGUYEN

**Blindness Detection (Kaggle Competition)**

## Project Overview

Imagine being able to detect blindness before it happened.

Millions of people suffer from diabetic retinopathy, the leading cause of blindness among working aged adults. Aravind Eye Hospital in India hopes to detect and prevent this disease among people living in rural

areas where medical screening is difficult to conduct. Successful entries in this competition will improve the hospital's ability to identify potential patients. Further, the solutions will be spread to other Ophthalmologists through the 4th Asia Pacific Tele-Ophthalmology Society (APTOS) Symposium.

Currently, Aravind technicians travel to these rural areas to capture images and then rely on highly trained

doctors to review the images and provide diagnosis. Their goal is to scale their efforts through technology;

to gain the ability to automatically screen images for disease and provide information on how severe the condition may be.

References

https://www.technology.org/2019/07/15/aptos-2019-blindness-detection/

https://www.kaggle.com/c/aptos2019-blindness-detection

https://towardsdatascience.com/aptos-2019-blindness-detection-520ae2a4acc

## Problem Statement

This is a deep learning problem. Inputs are the images and the goal is to predict severity of diabetic retinopathy on a scale of 0 to 4:

0 - No DR

1 - Mild

2 - Moderate

3 - Severe

4 - Proliferative DR

## Metrics

**Precision**

Let's start with precision, which answers the following question: what proportion of predicted Positives is truly Positive?

**Precision = (TP)/(TP+FP)**
In the asteroid prediction problem, we never predicted a true positive.
And thus precision=0

**Recall**
Another very useful measure is recall, which answers a different question: what proportion of actual Positives is correctly classified?
**Recall = (TP)/(TP+FN)**
In the asteroid prediction problem, we never predicted a true positive.
And thus recall is also equal to 0.

**F1 Score**
The F1 Score is the 2*((precision*recall)/(precision+recall)). It is also called the F Score or the F Measure. Put another way, the F1 score conveys the balance between the precision and the recall.

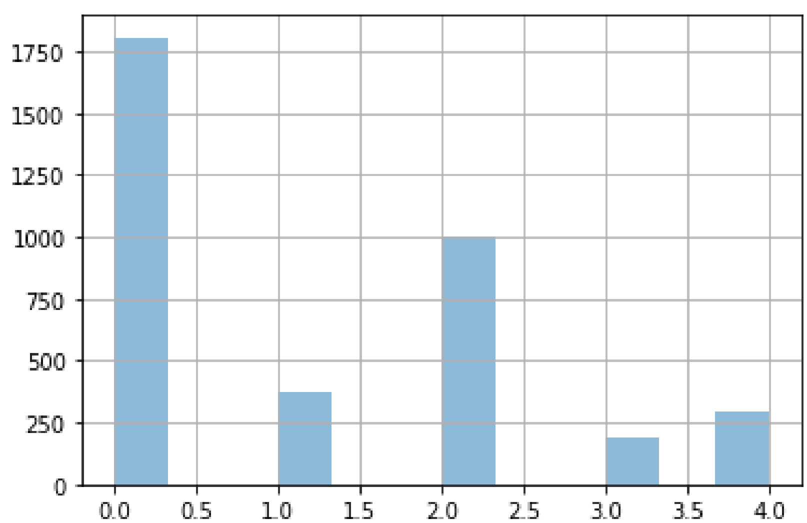
# Analysis

## Data Exploration

Datasets are **3662** color images with png format.

Example:

Dataset is imbalanced



We have 4 types of images.

0 - No DR

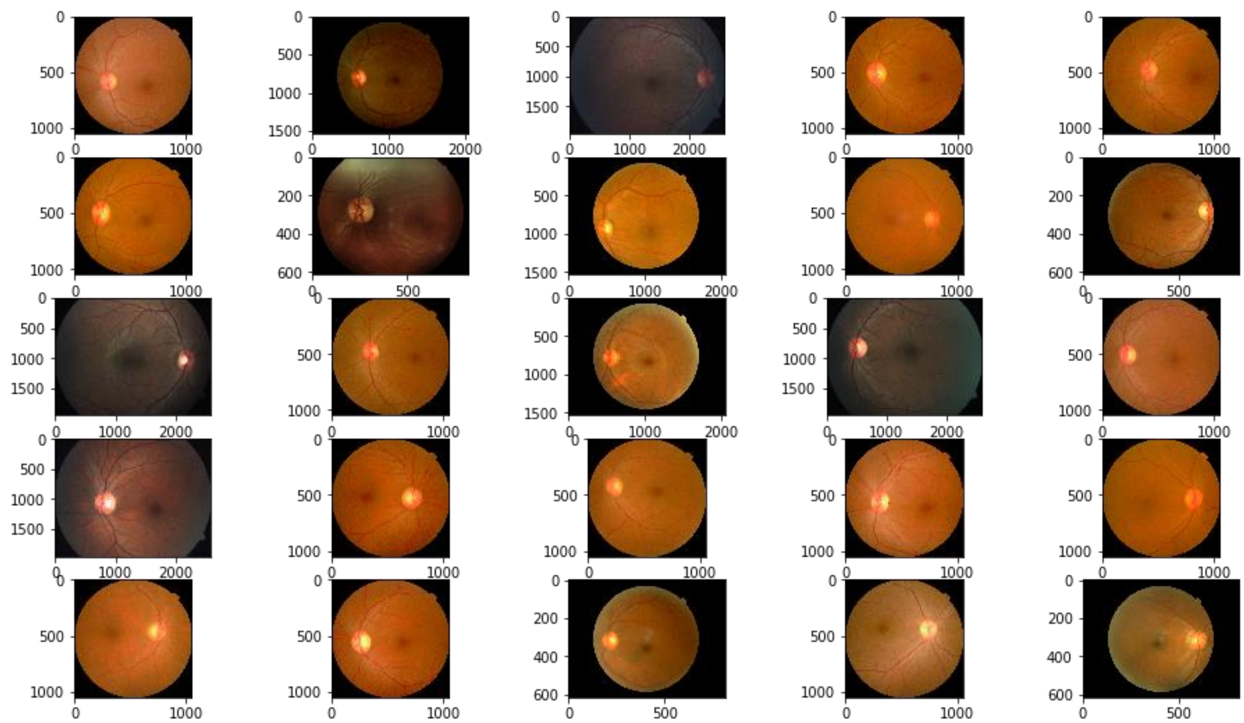
1 - Mild

2 - Moderate

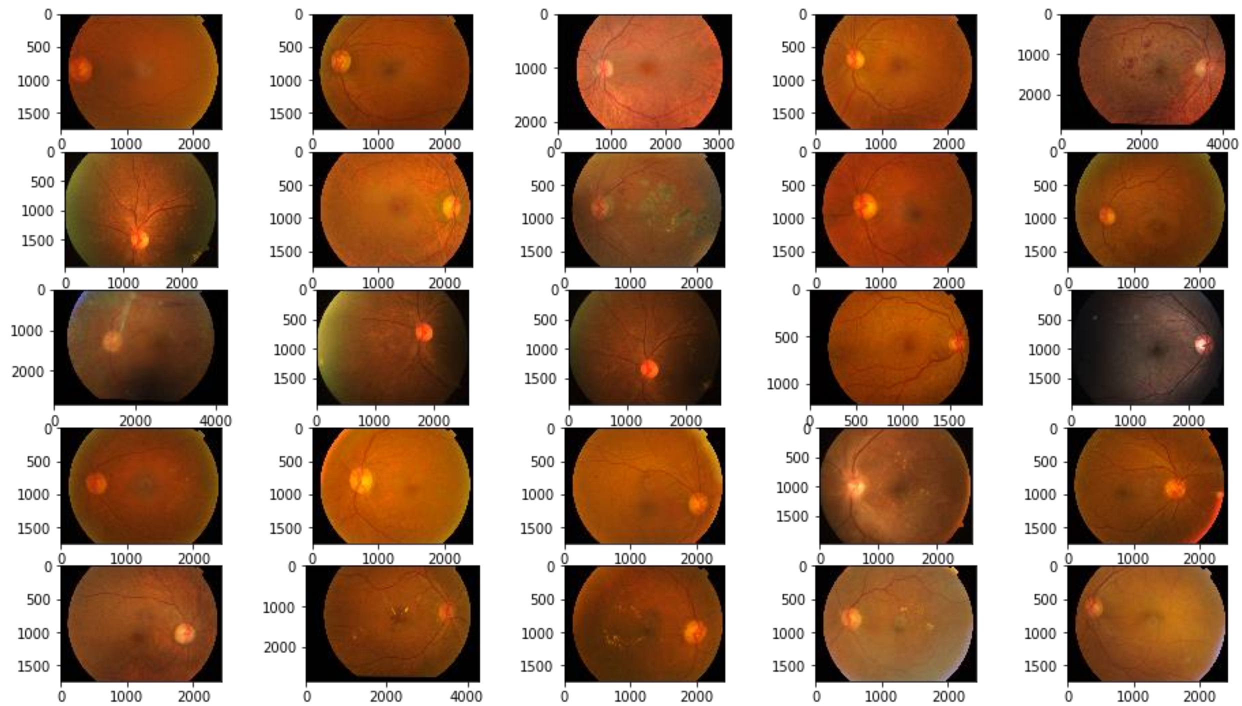
3 - Severe

4 - Proliferative DR

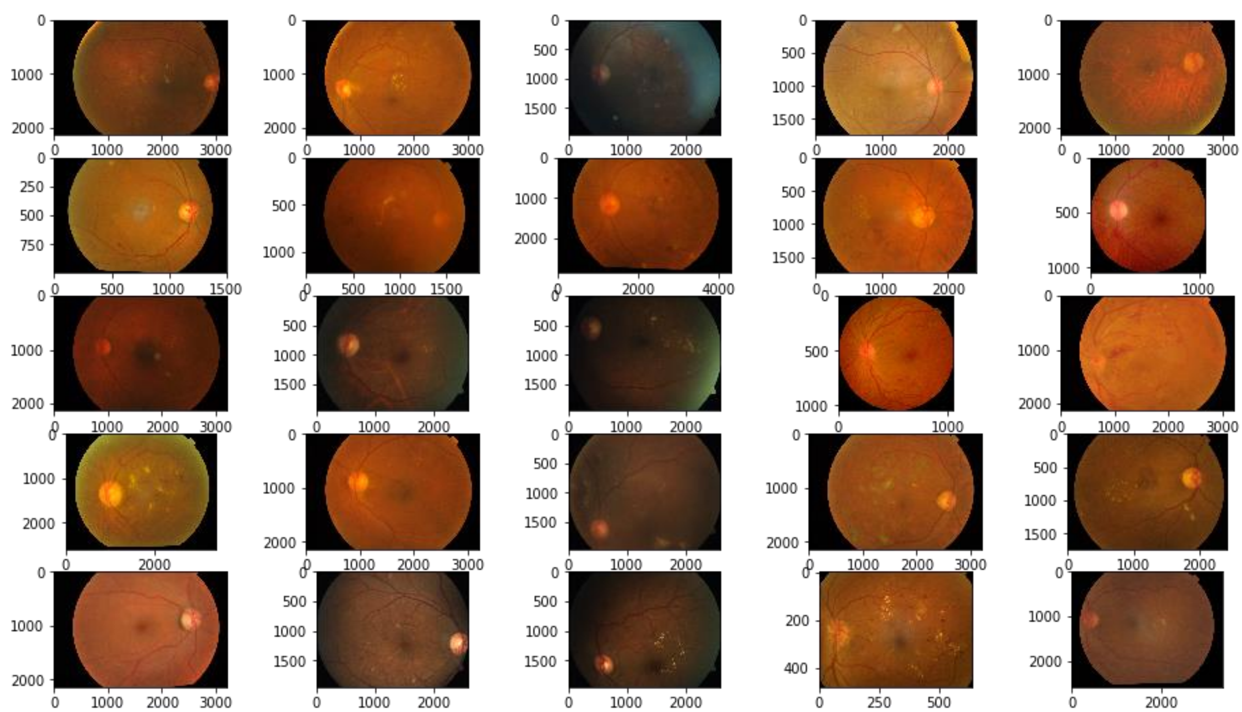
0 - No DR



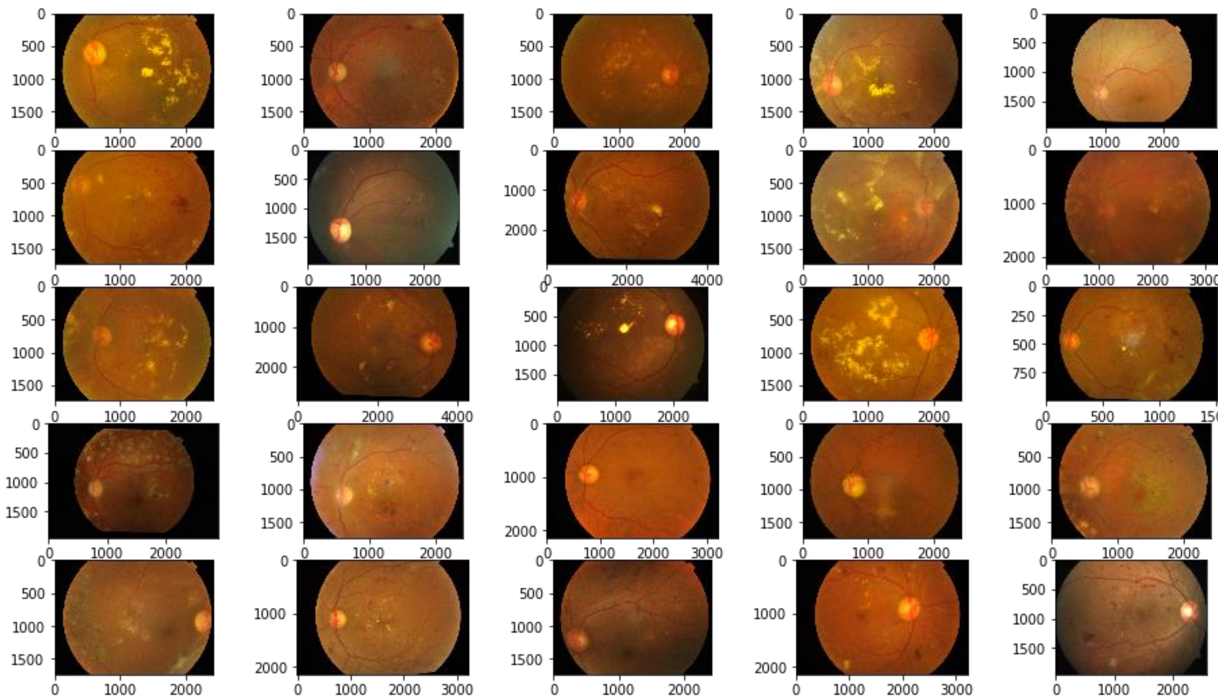
Severity 1: Mild



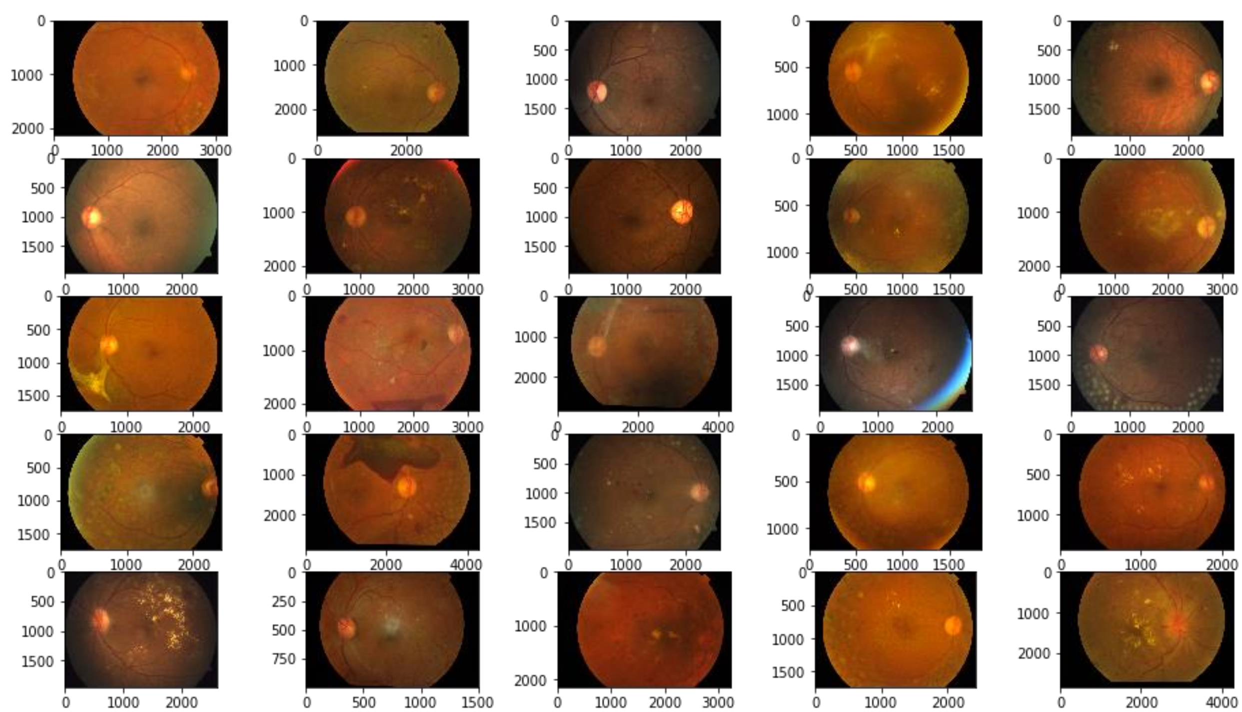
Severity 2: Moderate



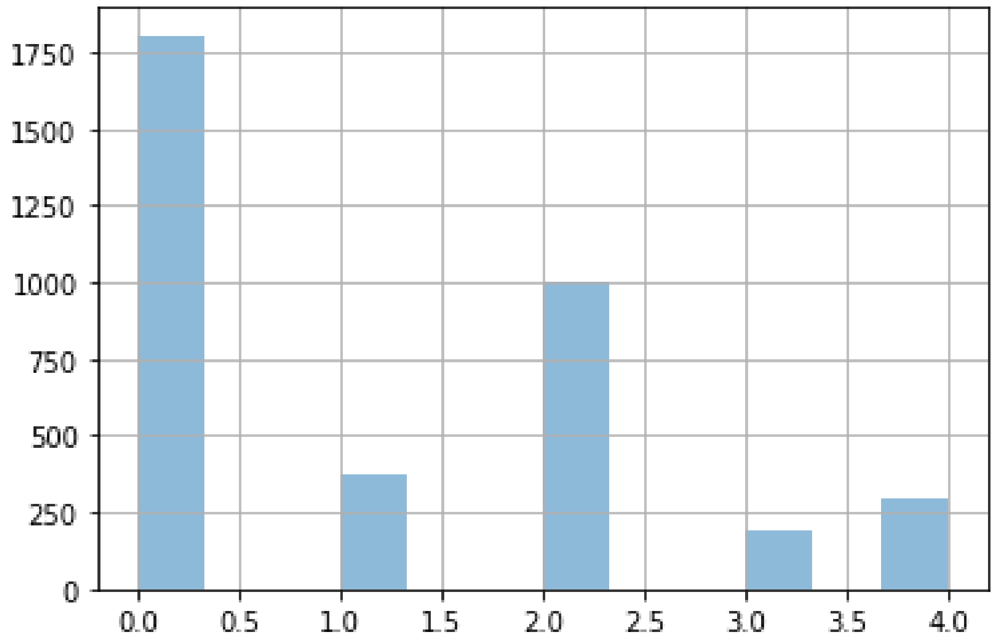
Severity 3: Severe



Severity 4: Proliferative DR



## Exploratory Visualization




So, we can see the data is imbalanced.

## Algorithms and Techniques

I used these 4 models

resnet18

seresnext50

resnet34

resnet50

Reference - https://github.com/qubvel/classification_models

## Benchmark

**Reference - https://github.com/BloodAxe/Kaggle-2019-Blindness-Detection**

| **Solutions** | **Accuration** | **Data** |
|---|---|---|
| resnet18 | 0.77659225<br>(Cross validation 5 folds) | 3662 images |

| | | |
|---|---|---|
| seresnext50 | 0.8007201<br>(Cross validation 5 folds) | 3662 images |
| resnet34 | 0.7721284<br>(Cross validation 5 folds) | 3662 images |
| resnet50 | 0.70864904<br>(Cross validation 5 folds) | 3662 images |

# Methodology

## Data Preprocessing

Resize the images to 224x224 for inputs. Change the color from BGR to RGB. Scaling and Normalization operations on data and splitting the data in training, validation and testing sets.

## Implementation

Two main stages: training, test.

# Results

After training for 4 models. The results like below.

```
resnet18: 0.77659225
seresnext50: 0.8007201
resnet34: 0.7721284
resnet50: 0.70864904
```

Based on the results above, I will choose the model seresnext50 for this problem