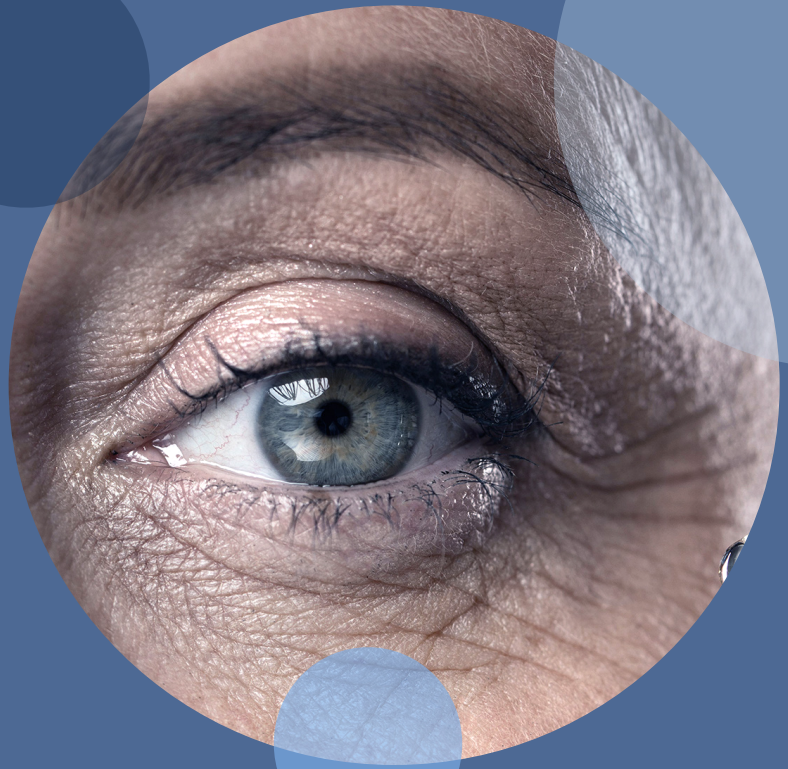
Identifying Diabetic Retinopathy with CNN model

John Michitsch

6-11-2021



Diabetic Retinopathy

A diabetes complication that affects eyes caused by damage to the light sensitive tissue at the back of the eye (retina)

Leading cause of blindness in working age adults

Magnitude of Eye Disease

30,000,000

Cases of Cataracts in US (projected 2020)

642,000,000

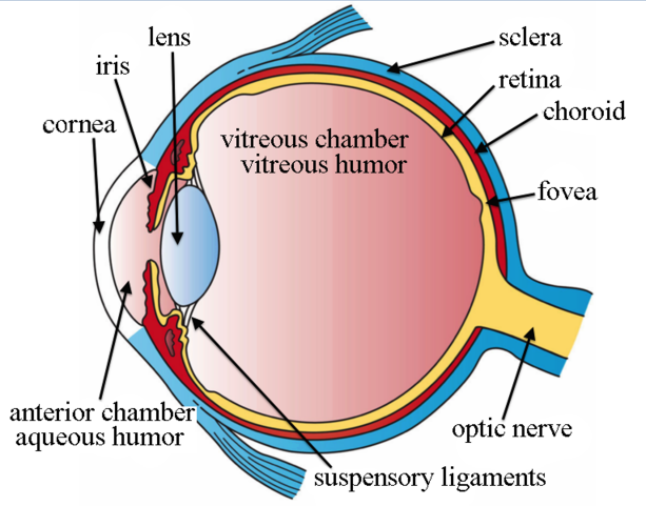
Projected cases of diabetes 1/3 of which are impacted by Diabetic Retinopathy

80,000,000

Number of people with glaucoma worldwide in 2020

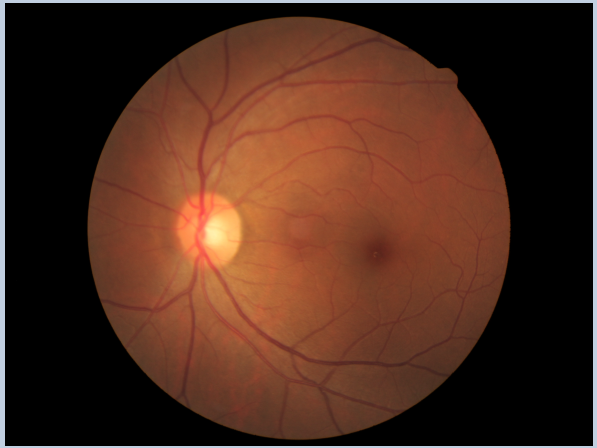
Source: BrightFocus Foundation (brightfocus.org)

What is the Retina?

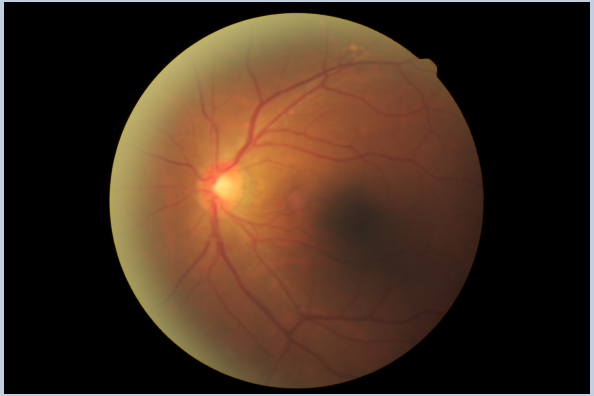


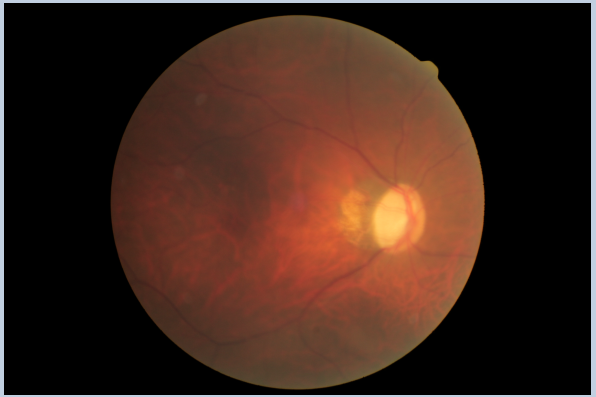
By Artwork by Holly Fischer - http://open.umich.edu/education/med/resources/second-look-series/materials - Eye Slide 3, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=24367145

Fundus Photographs - Normal Retinas



Fundus Photographs - Retinal Disorders





Cataract

Clouding of the normally clear lens of the eye

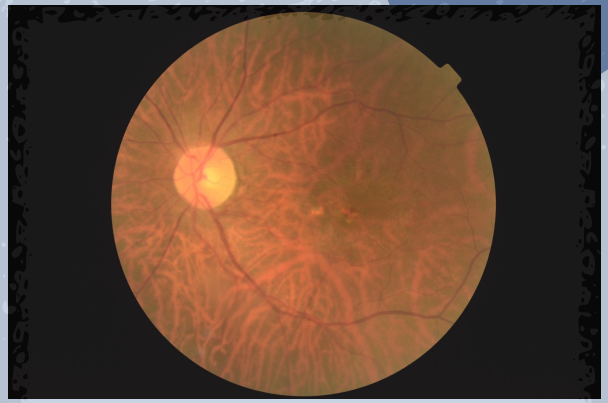
Glaucoma

Build up of pressure in the eye can damage the optic nerve

Retinal Disease

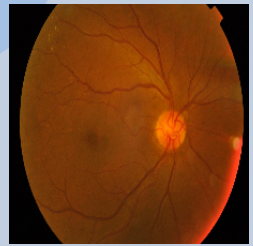
Set of disorders including macular degeneration, diabetic eye disease, and others

Fundus Photographs - Retinal Disorders



Retinal Disease
Set of disorders including macular degeneration, ***diabetic eye disease***, and others

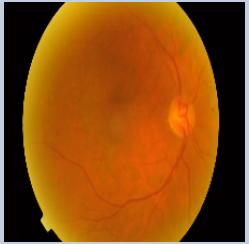
The 4 stages of Diabetic Retinopathy



Stage 1

Mild

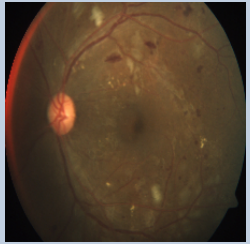
Microaneurysms



Stage 2

Moderate

Blocked blood vessels



Stage 3

Severe

Significant portion of blood vessels blocked

Stage 4

Proliferative

New weak abnormal blood vessels grow on retina

Original Dataset

DATA SAMPLE TOO SMALL

601 images

300	Normal
100	Glaucoma
100	Cataract
100	Retinal Disease

Hosted on Kaggle

Link: https://www.kaggle.com/fabianogalaxy/dataset-with-catarats-images

Dataset

Hosted on Kaggle
Author: Sovit Ranjan Rath

Link:
https://www.kaggle.com/sovitrath/diabetic-retinopathy-224x224-2019-data

"Diabetic Retinopathy 224x224 (2019 Data)"

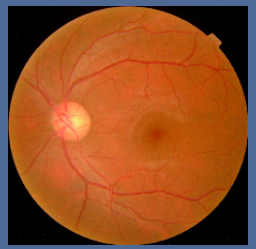
3663 images

370	Mild
999	Moderate
193	Severe
295	Proliferate
1805	Normal

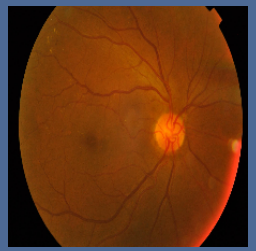
Methodology

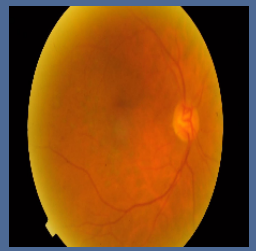
1) Binary classification

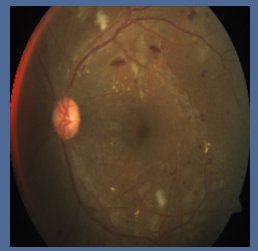
Normal

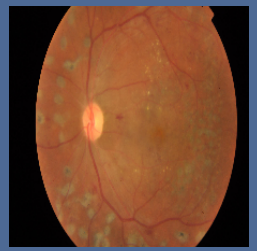


Diseased





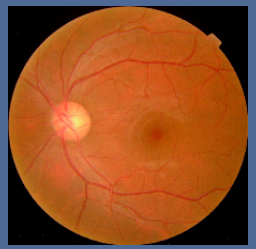




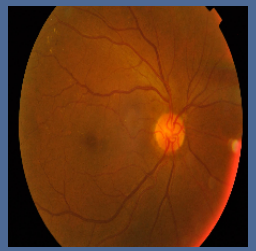
Normal samples and Disease samples are roughly balanced

2) Multi Class classification

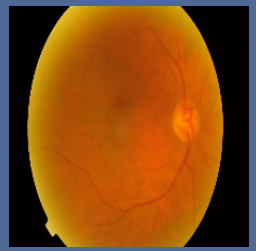
Normal



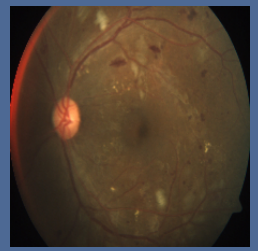
Mild



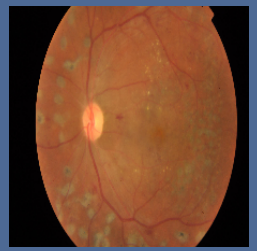
Moderate



Severe



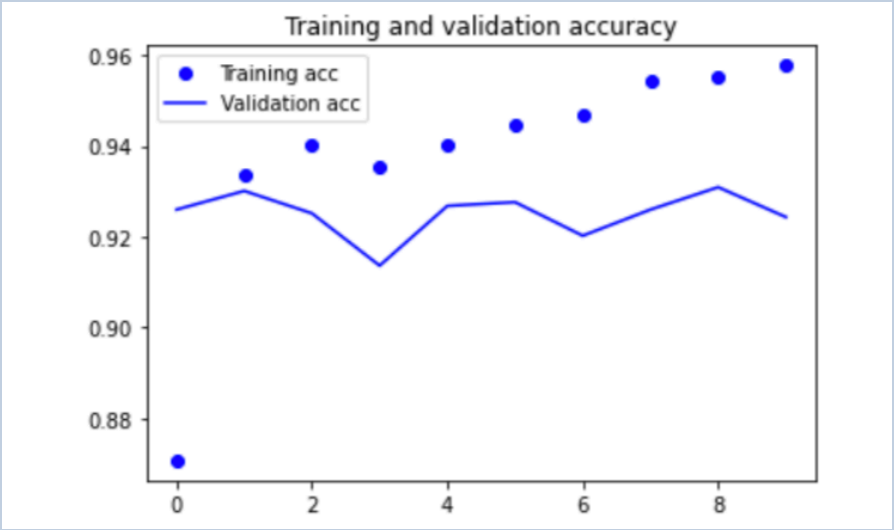
Proliferate

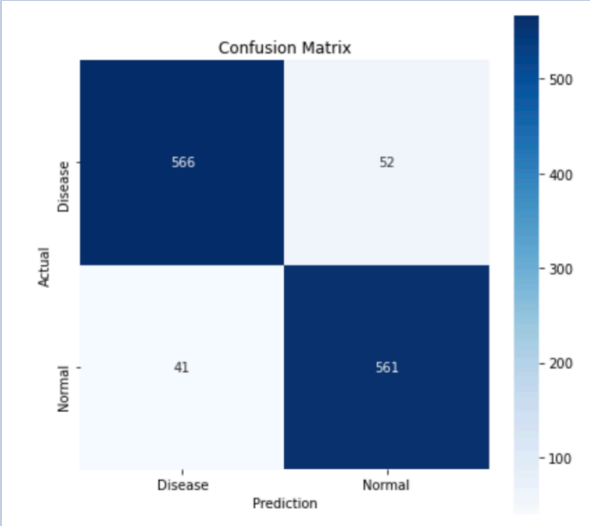


Normal samples are much greater than any other category - using class_weight= to deal with class imbalance

Model Performance Summary - Binary

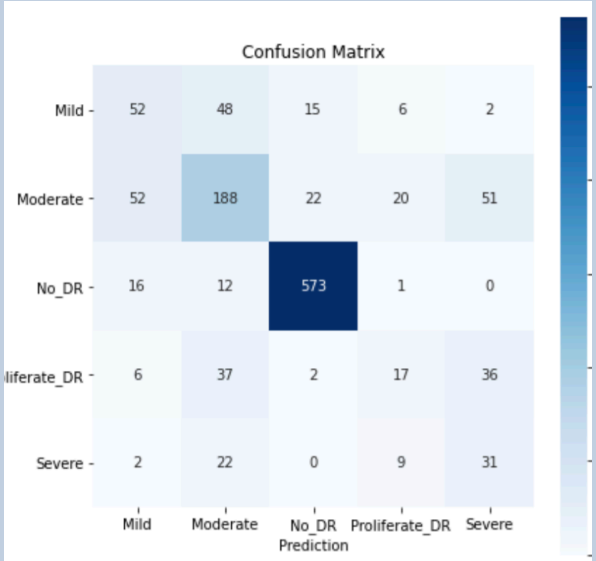
	CNN	Augmented
Validation Accuracy	92 %	72%





Model Performance Summary - Multi Class (5 classes)

CNN	Augmented	MobileNetV2
71%	72%	75%



Conclusions

- Correlation between number of ima
  and strength of model
- Trying various combinations of hyper
  parameters + running models is very time
  intensive

Future Work

01

Investigate other models

Maybe other image pre-trained image libraries would lead to better results

02

Add examples

Presentation could use examples of actual vs. prediction

03

Add more data

Second dataset much better but still might be suffering from small size

Thanks

Do you have any questions?

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