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Department of Electronics and Communication Engineering

# Diabetic Retinopathy Detection Using Artificial Intelligence

**UNDER THE GUIDANCE OF**

**MR.V.PRAVEEN KUMAR, M.TECH**  
**ASSOCIATE PROFESSOR,**  
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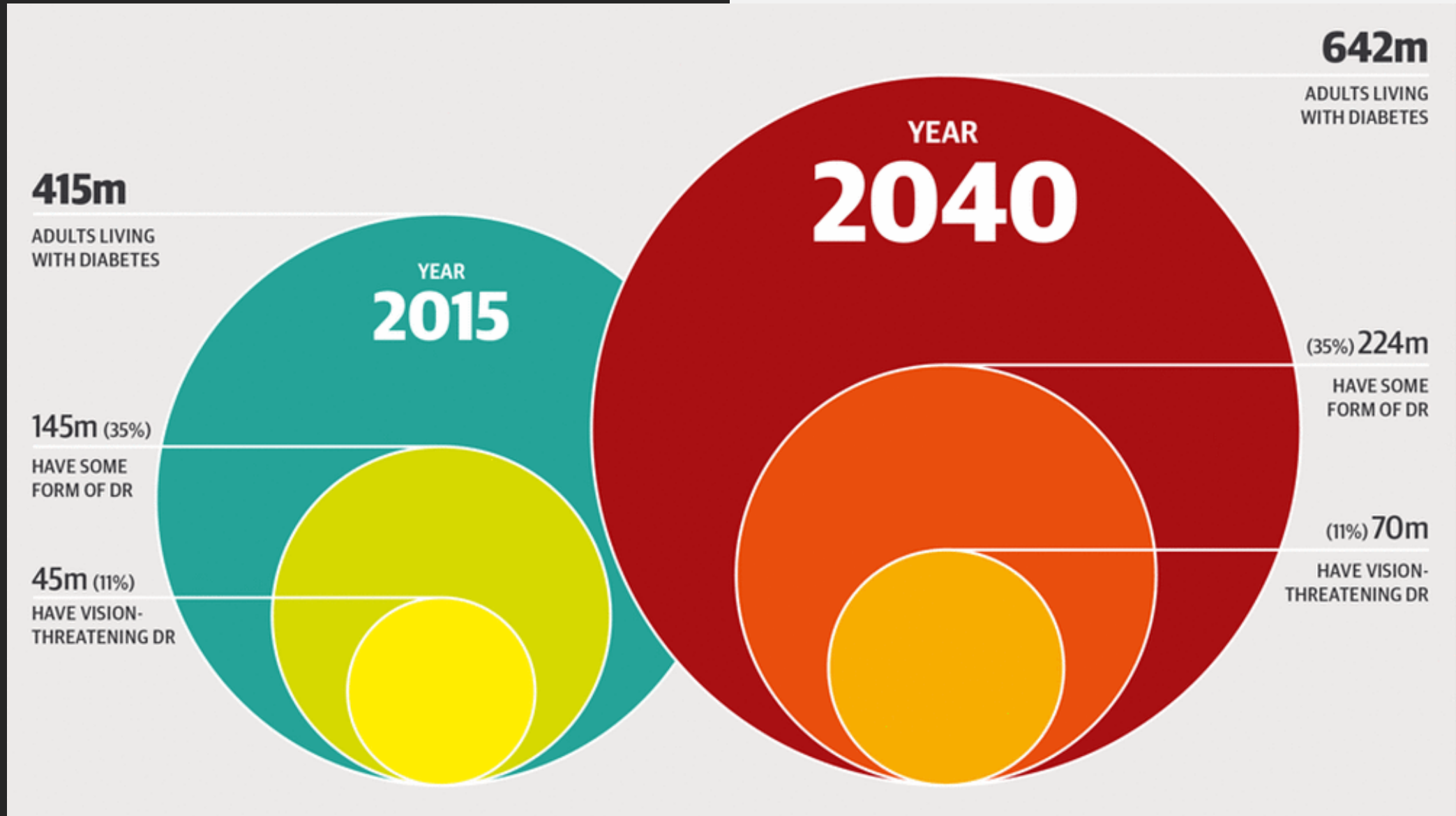
**BY**

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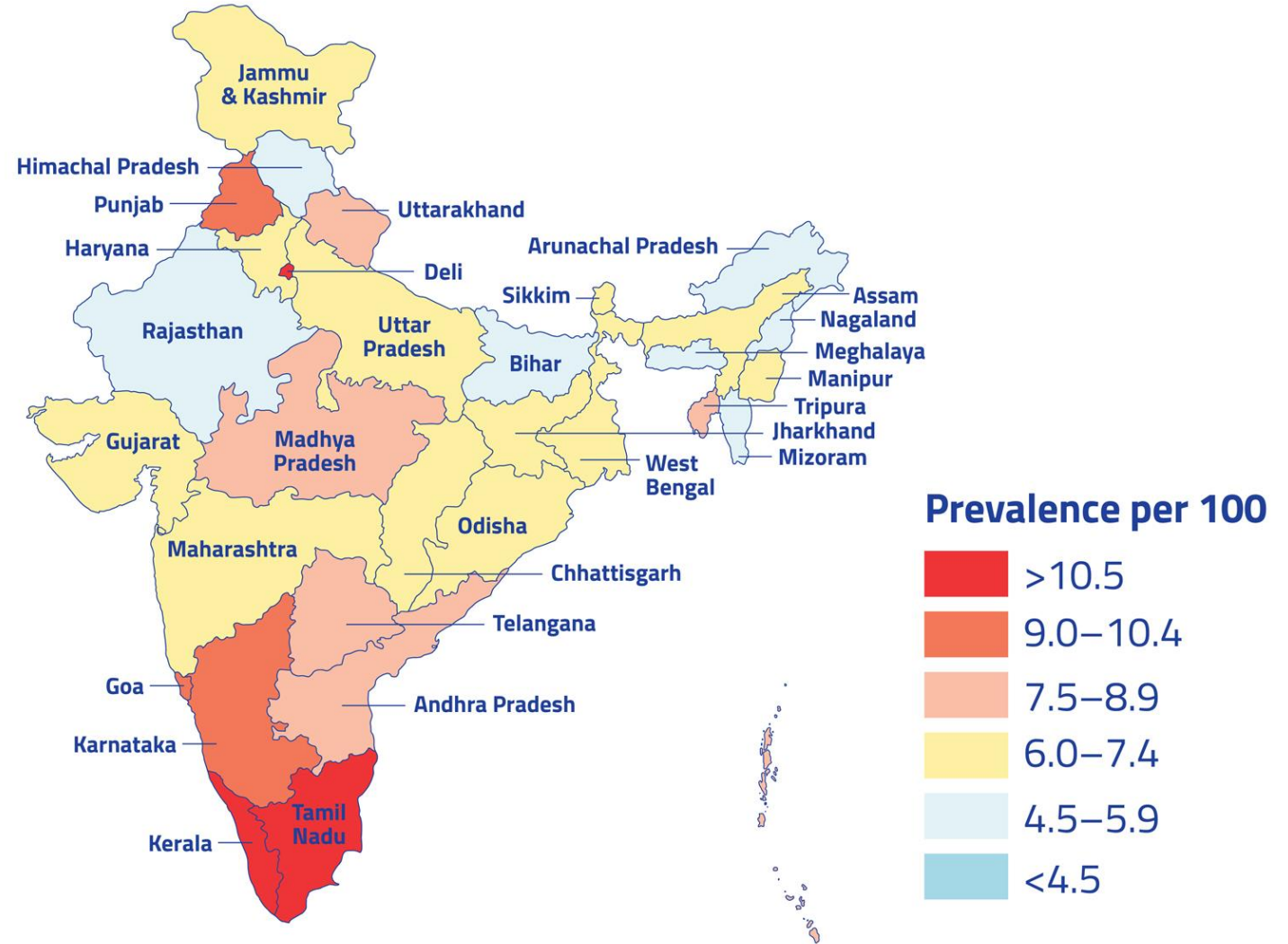
# Abstract

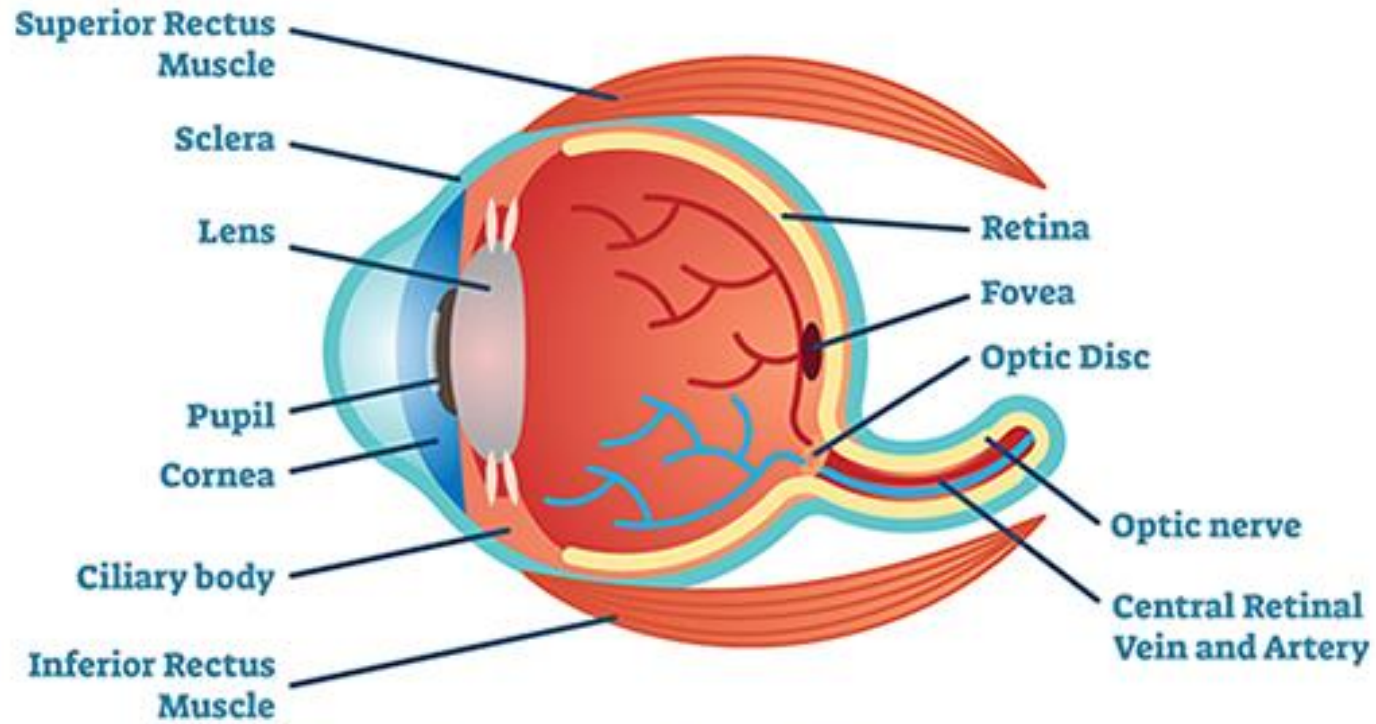
- Diabetes mellitus that causes blood leaks in the retina
- Diabetic Retinopathy (DR) early detection and treatment can significantly reduce the risk of vision loss
- Computer-aided diagnosis results in much better accuracy and more economical
- Convolution Neural Network (CNN) are more widely used as a deep learning method in medical image analysis, and they are highly effective



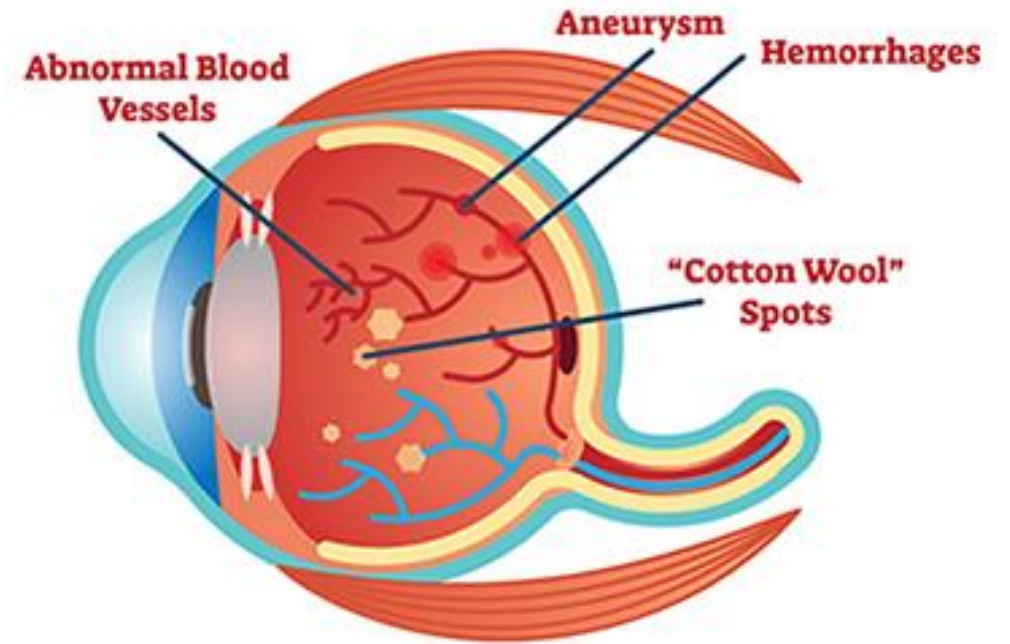


# Diabetic Retinopathy in India





**Healthy Eye**



**Diabetic Eye**

How to Identify |



# Diabetic retinopathy symptoms

Diabetic retinopathy is asymptomatic in early stages of the disease

As the disease progresses symptoms may include

- Blurred vision
- Floaters
- Fluctuating vision
- Distorted vision
- Dark areas in the vision
- Poor night vision
- Impaired color vision
- Partial or total loss of vision

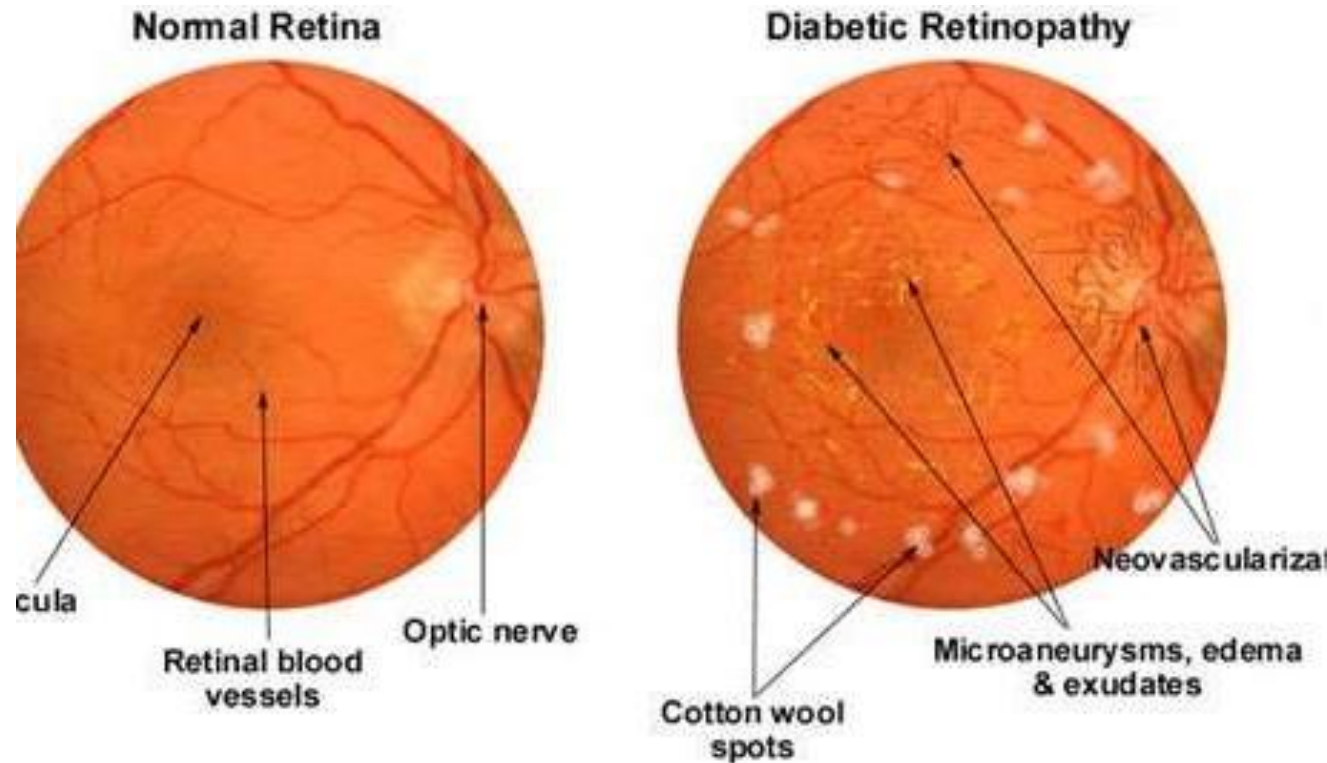


Normal Vision



Same scene viewed by a person with Diabetic  
Retinopathy.

# SIGNS OF DIABETIC RETINOPATHY



- Microaneurysm
- Retinal hemorrhage
- Hard exudates
- Cotton wool spot
- Venous beading
- Intraretinal microvascular abnormalities (IRMA)
- Macular oedema



# CLASSIFICATION

## *Non-proliferative Diabetic Retinopathy (NPDR):*

- No DR
- Very Mild NPDR
- Mild NPDR
- Moderate NPDR
- Severe NPDR
- Very Severe NPDR

## *Proliferative Diabetic Retinopathy (PDR):*

- Mild to Moderate PDR
- High Risk PDR

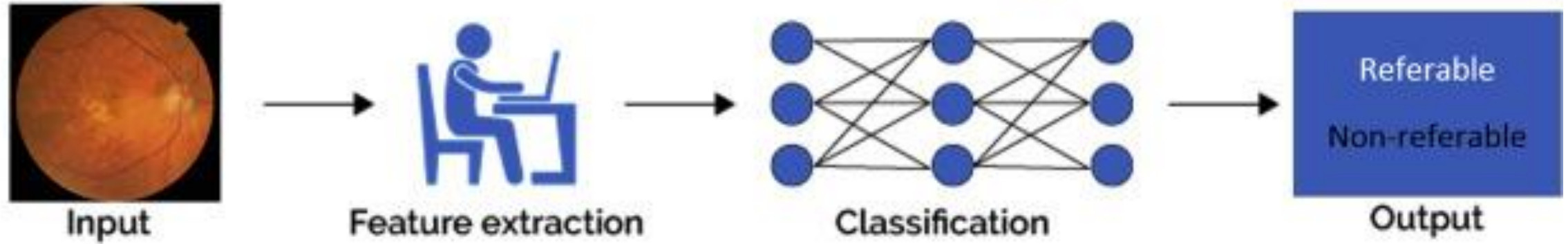
# Diabetic Retinopathy Classification

Using Artificial Intelligence

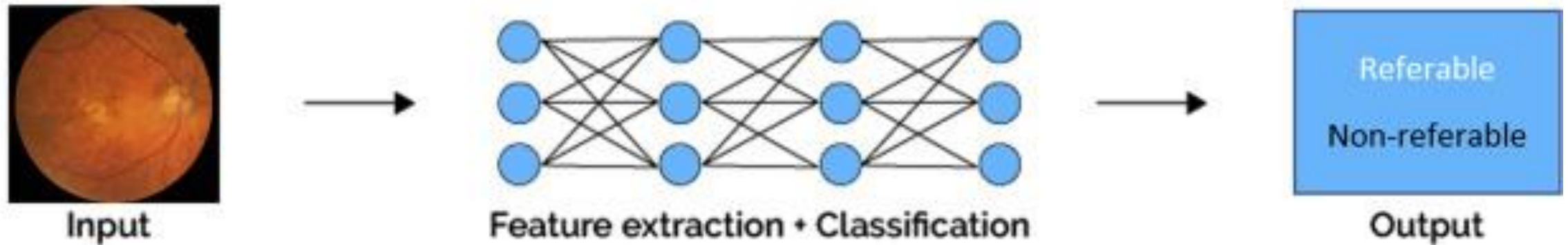
## STAGES OF DIABETIC RETINOPATHY



## Classic Machine Learning



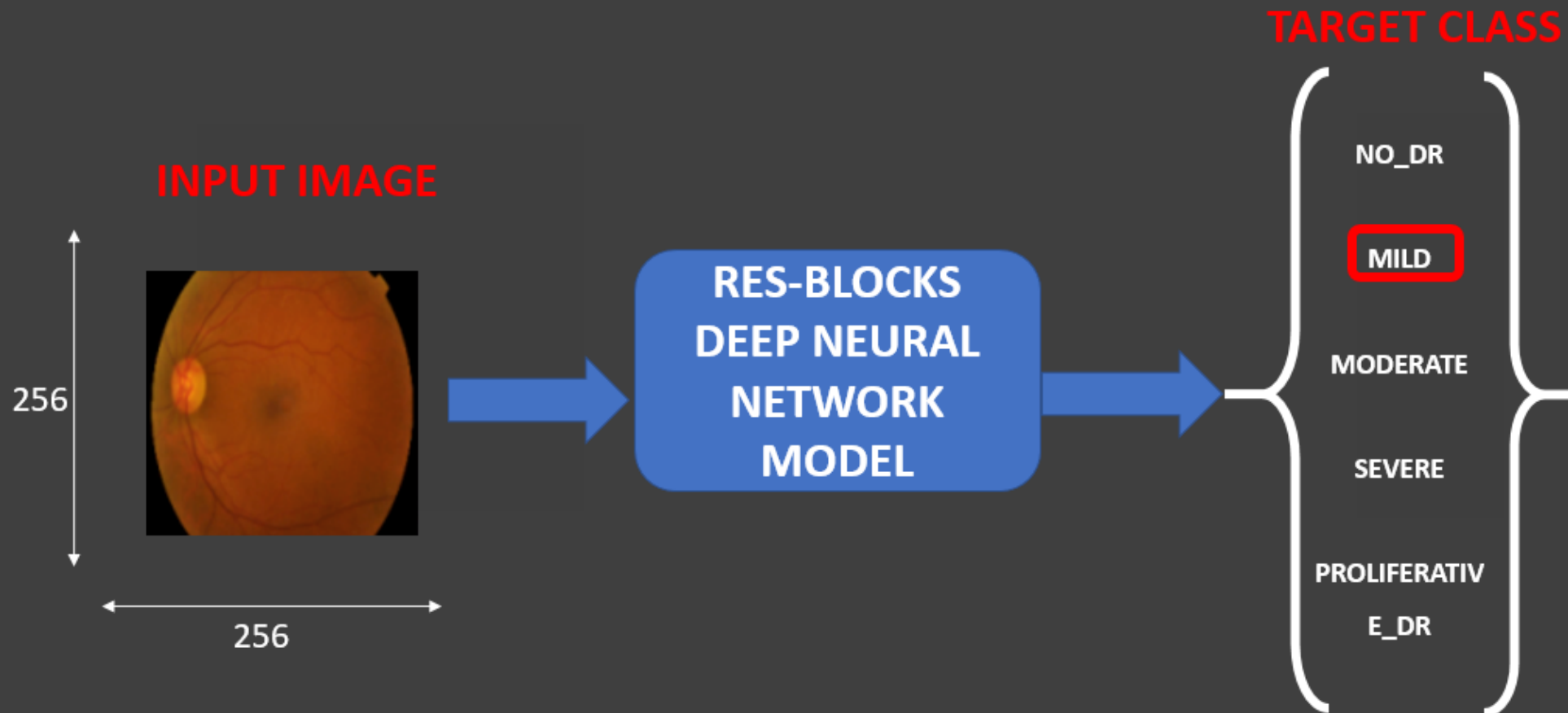
## Deep Learning

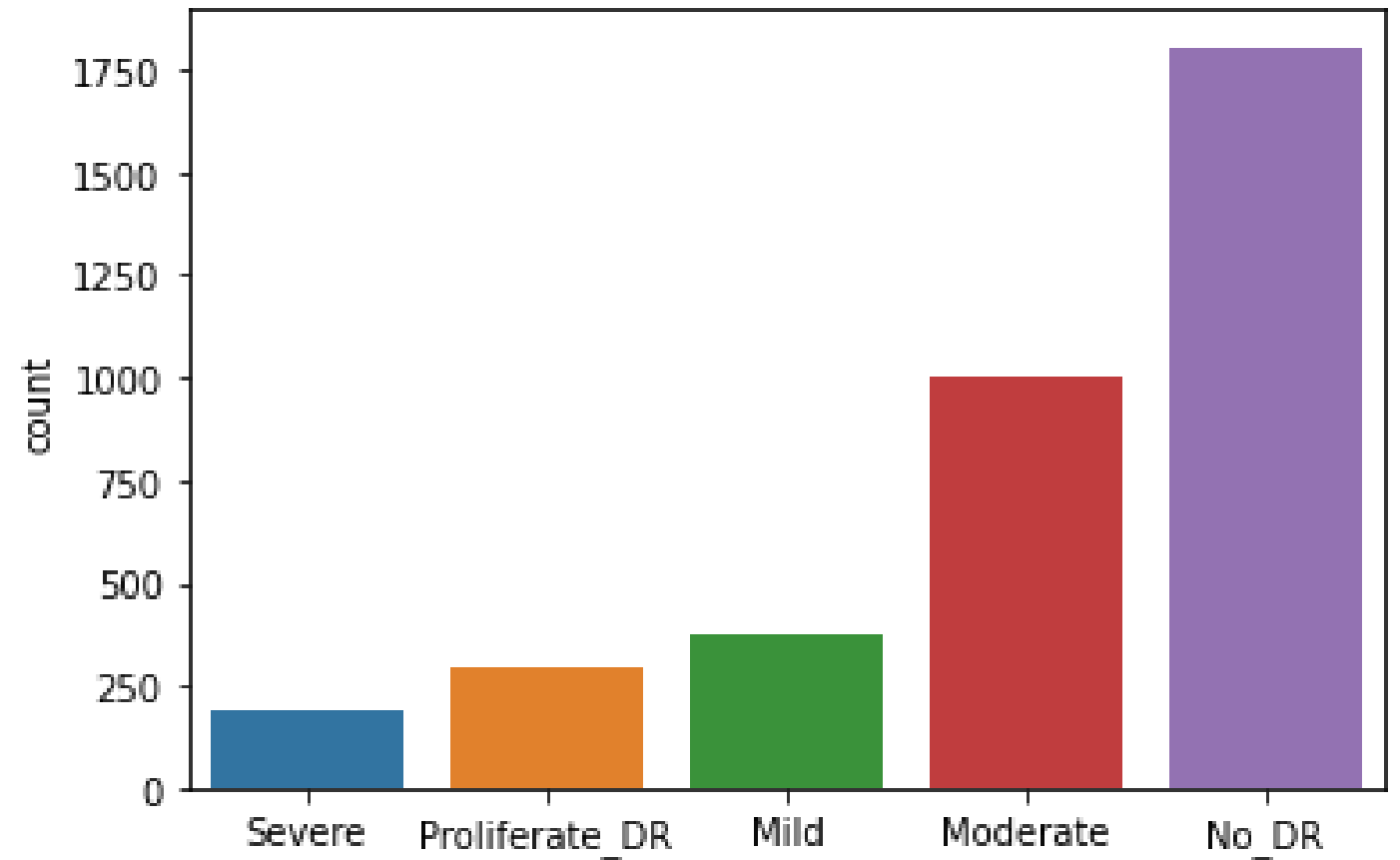
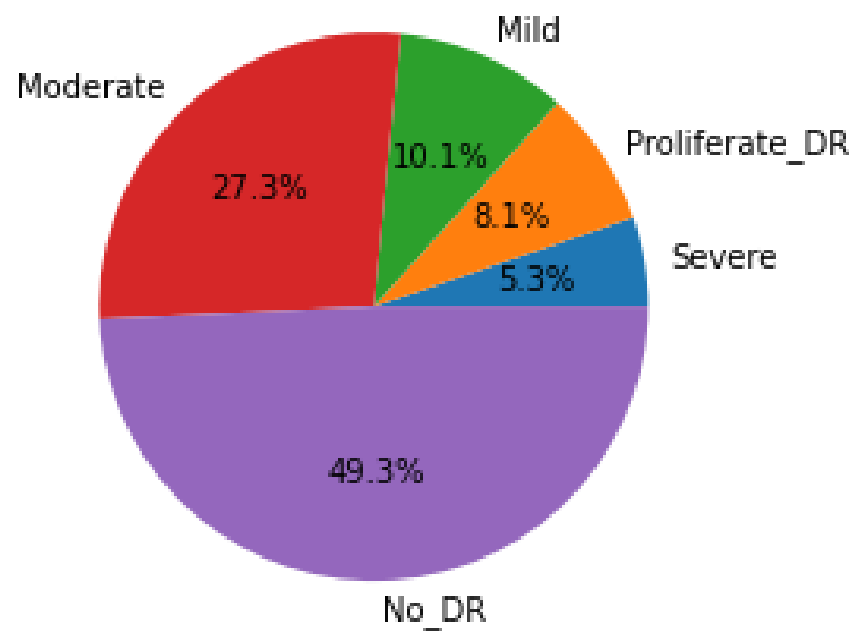




# INPUTS AND OUTPUTS

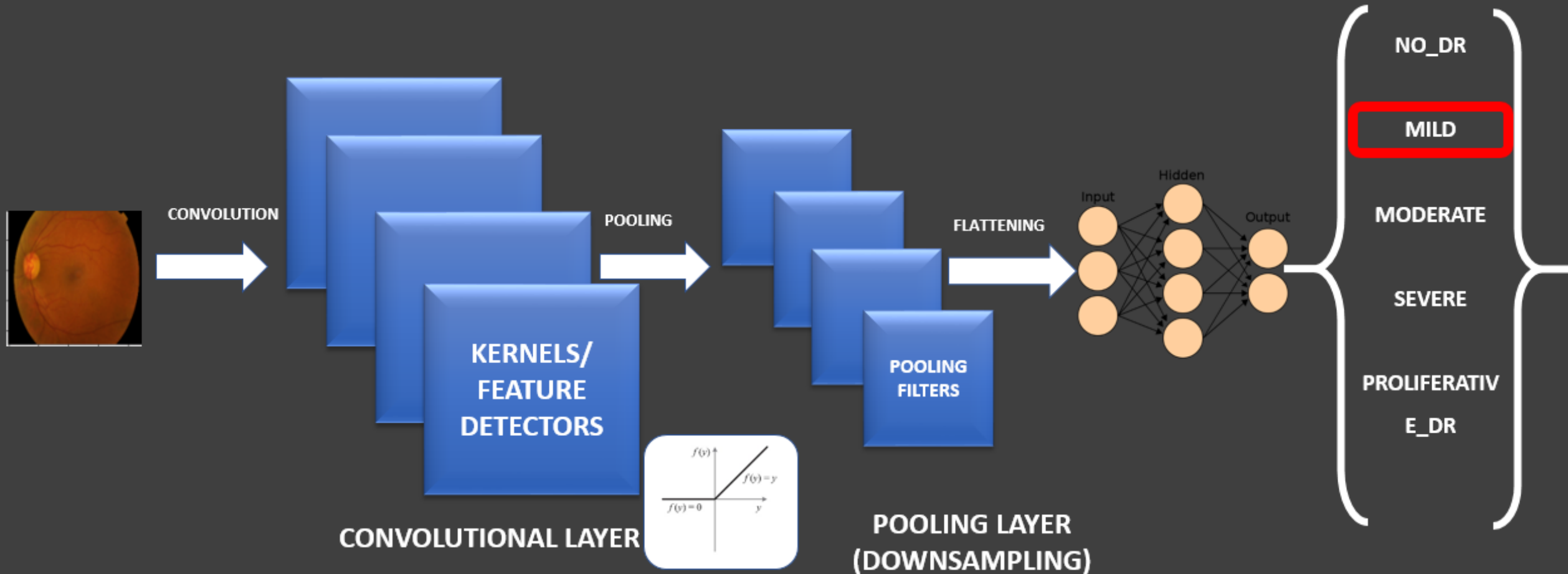
- The dataset consists of 3553 color images belonging to 5 categories.
- Categories that are present in the data are No\_DR, Mild, Moderate, severe and proliferative (rapidly growing).



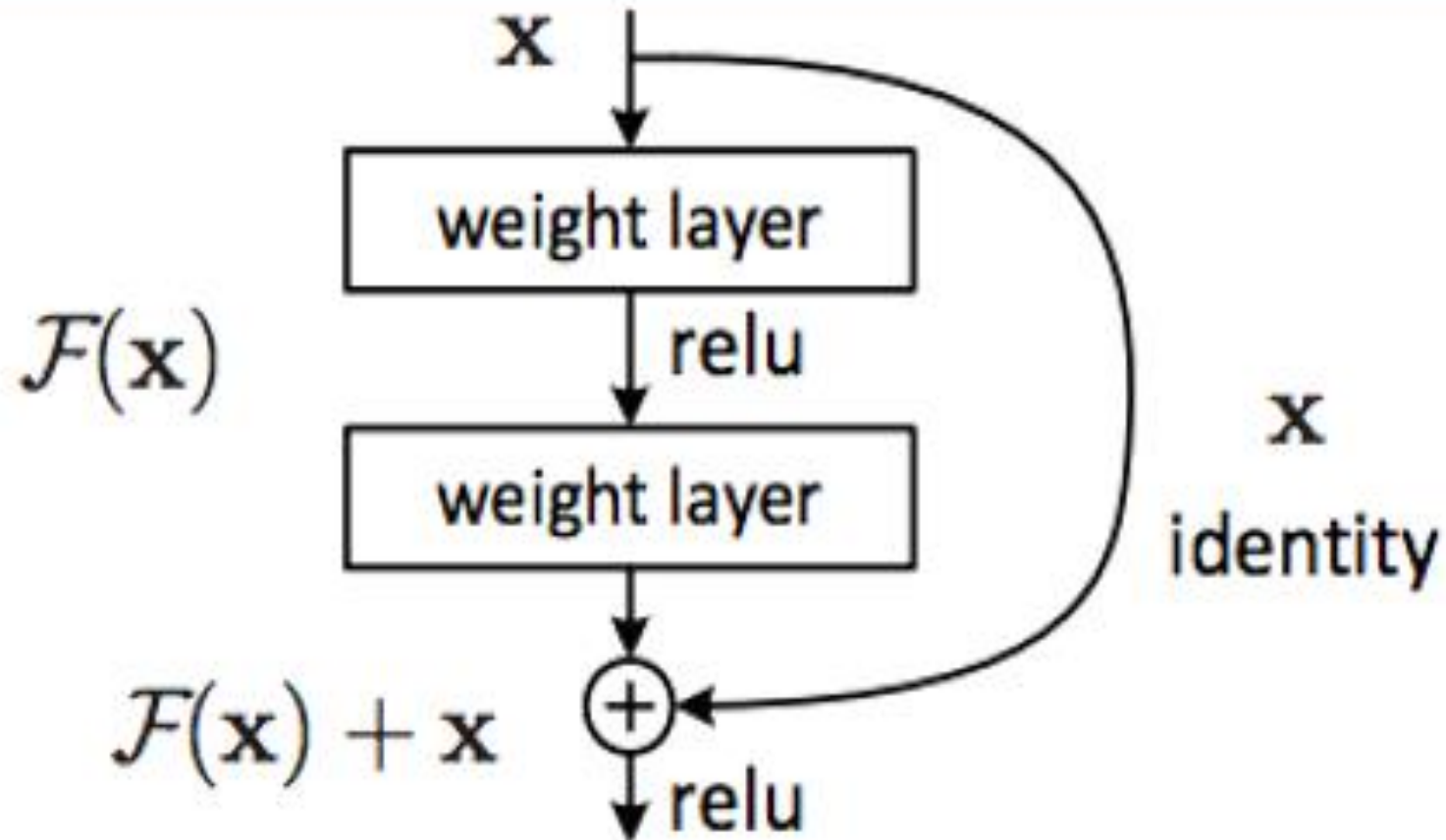


# CONVOLUTIONAL NEURAL NETWORKS

- CNN in action: <https://www.cs.ryerson.ca/~aharley/vis/conv/flat.html>

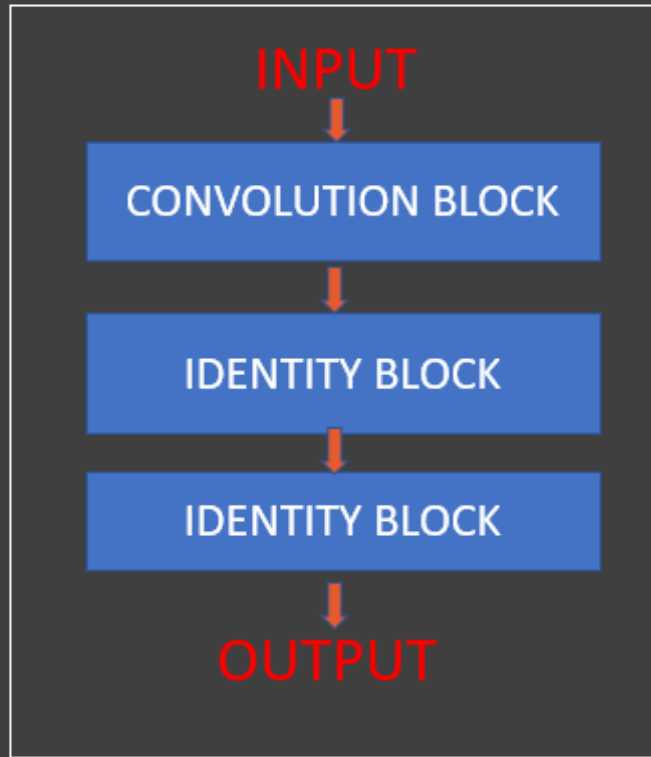


# RESNET ( RESIDUAL NETWORK)

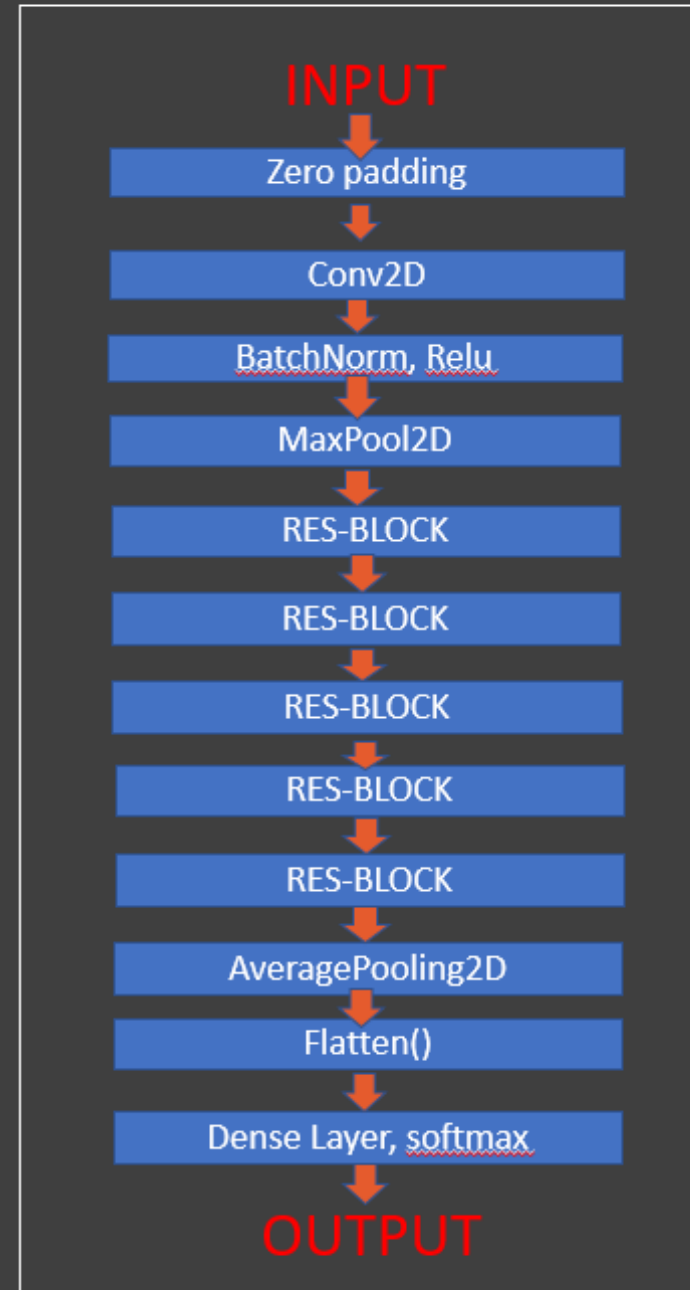




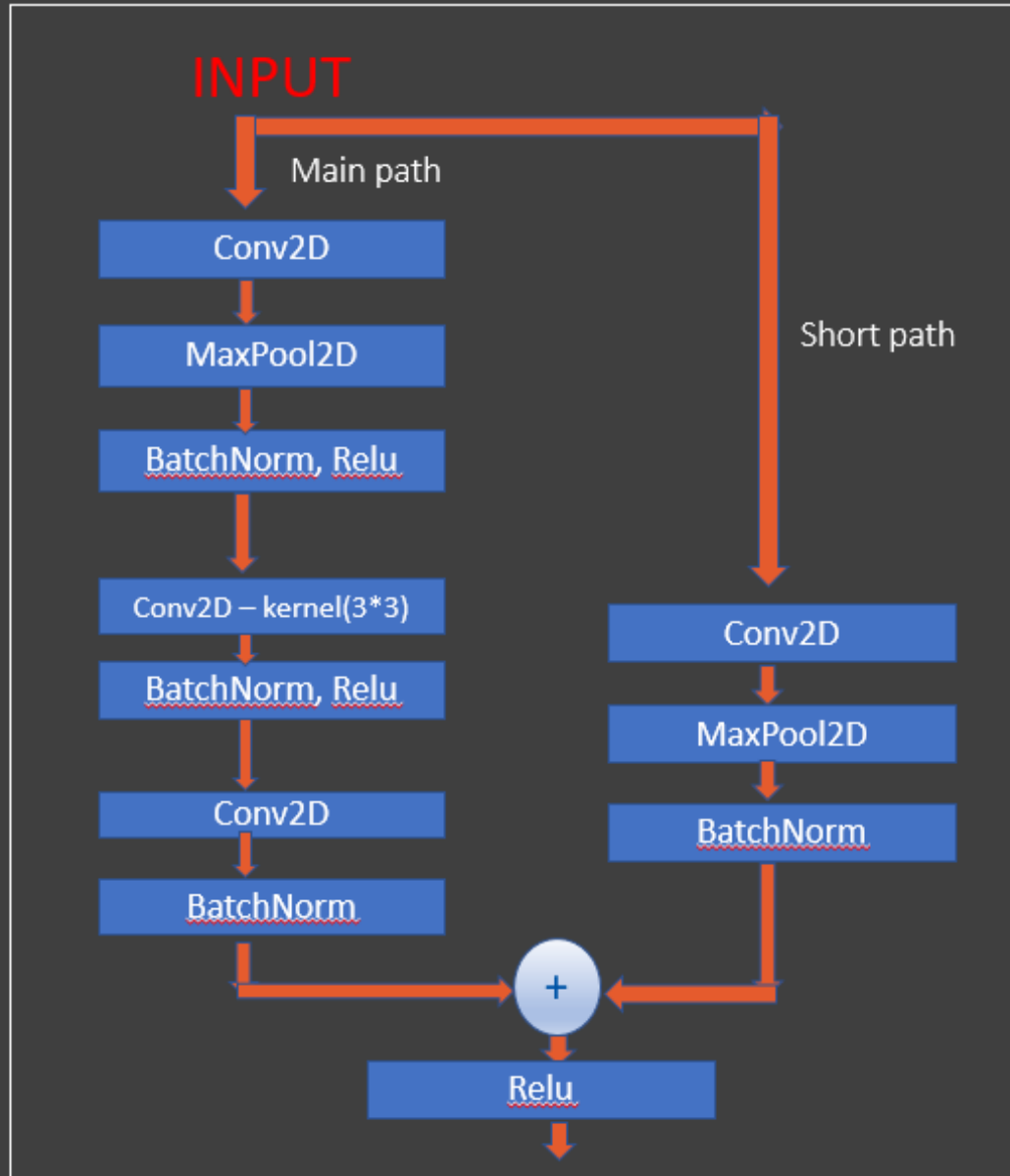
## RES-BLOCK



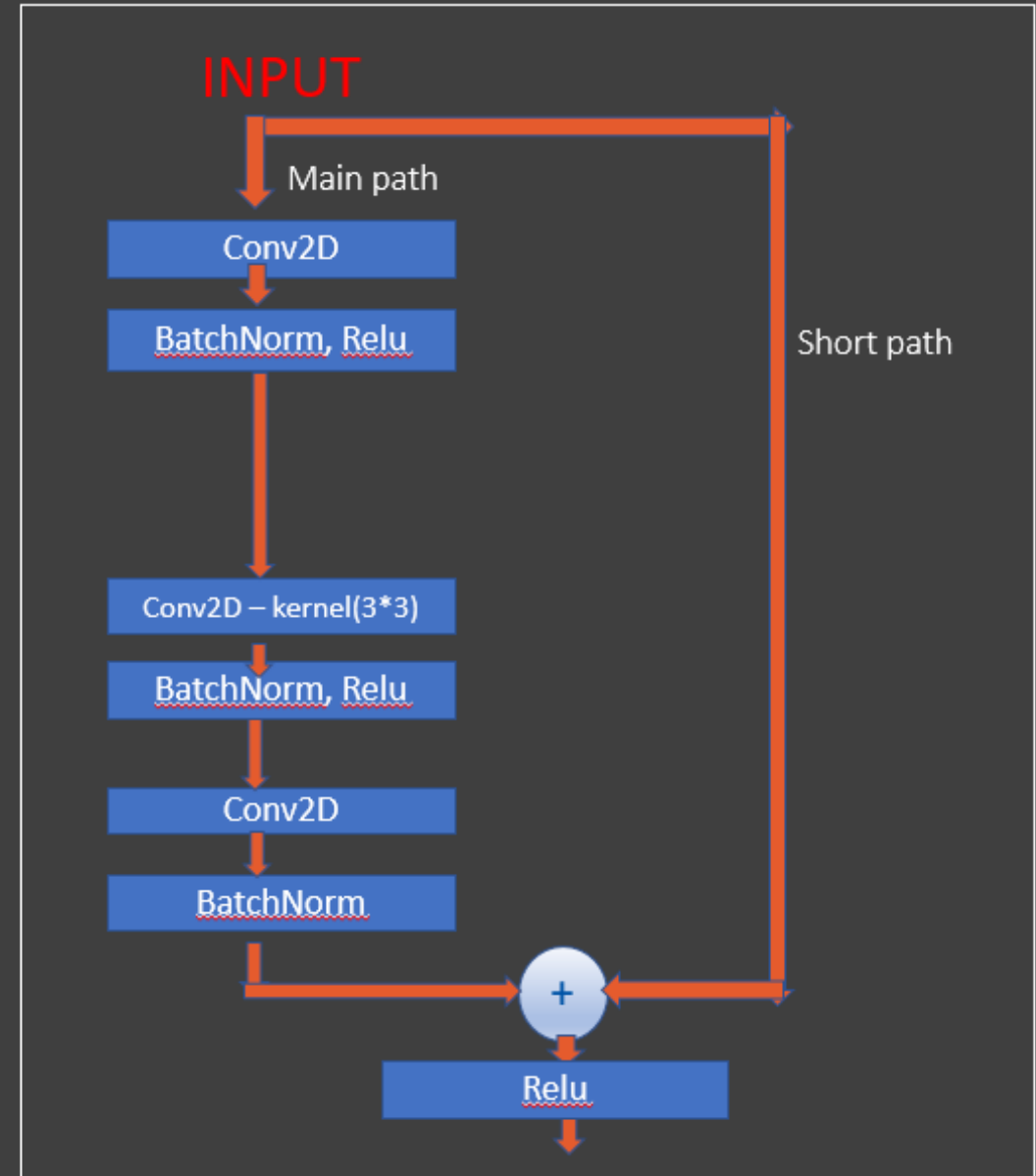
## RESNET-18 MODEL



## CONVOLUTION BLOCK



## IDENTITY BLOCK



Output class	0	1439 49.1%	3 0.1%	0 0.0%	0 0.0%	1 0.0%	99.7% 0.3%
	1	4 0.1%	287 9.8%	2 0.1%	0 0.0%	0 0.0%	98.0% 2.0%
	2	1 0.0%	6 0.2%	782 26.8%	14 0.5%	7 0.2%	96.6% 3.4%
	3	0 0.0%	0 0.0%	7 0.2%	136 4.6%	6 0.2%	91.3% 8.7%
	4	0 0.0%	0 0.0%	6 0.2%	4 0.1%	222 7.6%	95.7% 4.3%
		99.7% 0.3%	97.0% 3.0%	98.1% 1.9%	88.3% 11.7%	94.1% 5.9%	97.9% 2.1%
		0	1	2	3	4	
		Target Class					

## Classes and total testing accuracy for the different CNN models

Accuracy/Model	AlexNet	VGG16	ResNet18	SqueezeNet	VGG19	GoogleNet
Class 0	99.7%	99.8%	99.5%	97.8%	99.6%	99.7%
Class 1	98.0%	96.3%	90.7%	80.0%	98.6%	96.8%
Class 2	96.6%	98.1%	97.3%	87.5%	97.6%	91.4%
Class 3	91.3%	89.1%	91.4%	67.8%	88.8%	92.3%
Class 4	95.8%	92.7%	89.8%	80.9%	88.7%	94.4%
Total Accuracy	97.9%	97.8%	96.8%	90.3%	97.4%	96.3%



### Performance metrics for the different CNN models

Metric/Model	Alex Net	VGG16	Res Net 18	Squeeze Net	VGG19	Google Net
Precision	96.23%	95.19%	93.75%	82.80%	94.64%	94.92%
Recall	95.42%	96.02%	94.57%	82.16%	95.76%	90.63%
F1 Score	95.82%	95.60%	94.16%	82.48%	95.20%	92.73%

# Advantages



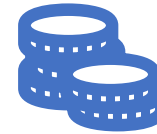
Remote treatment  
increases



Accuracy and time  
efficient



Flexible



Cost Effective



Scalable

# Disadvantages

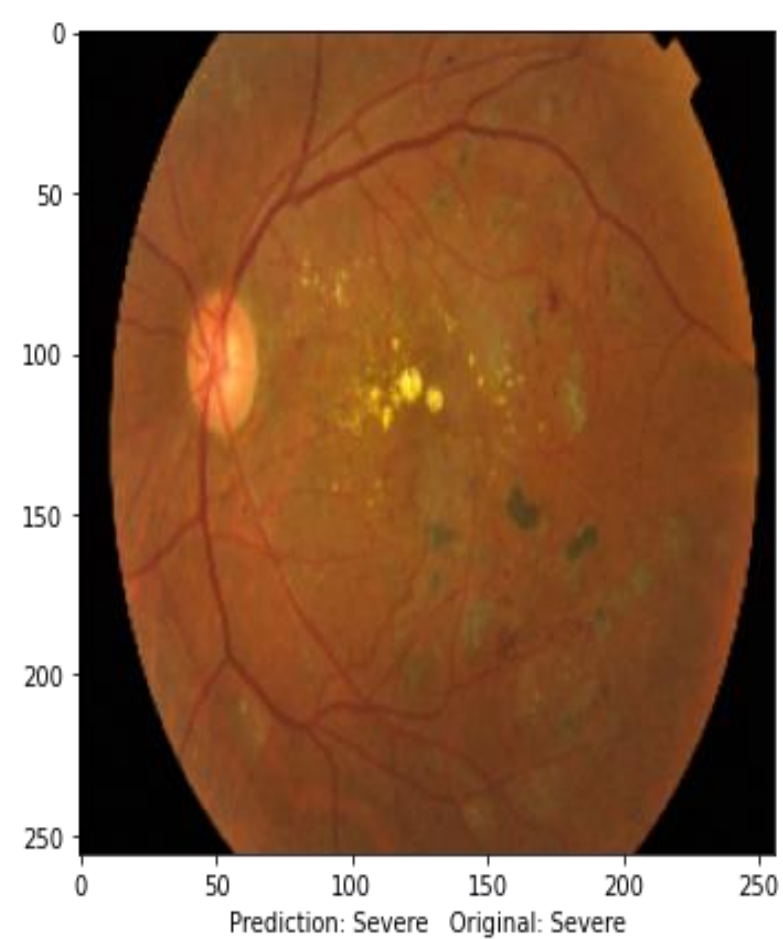
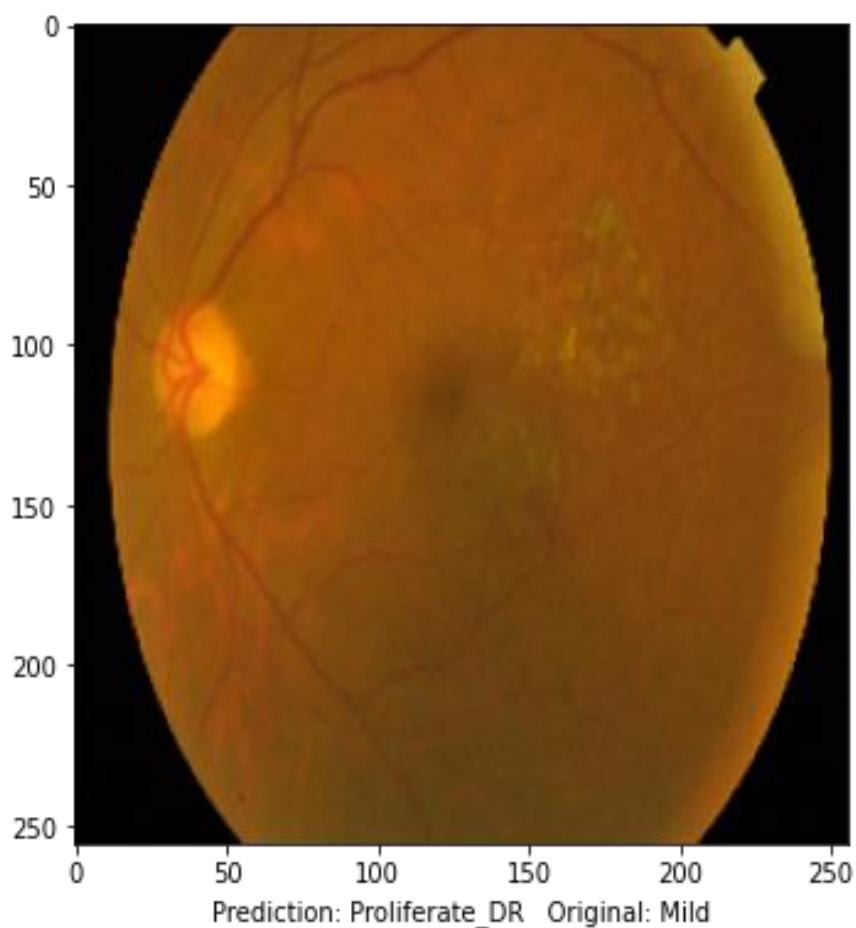
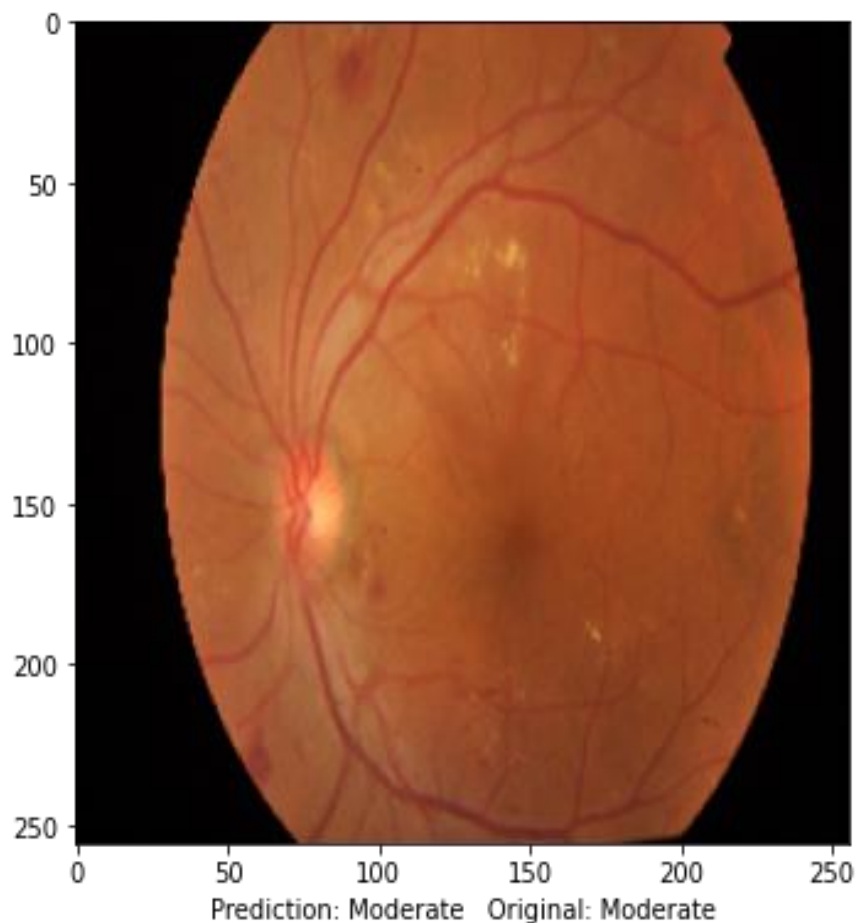


Trade off on high accuracy



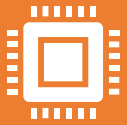
High Data required to develop modal

# Model Output





# Conclusion



In order to tackle the disease computer aided tools are highly effective, low cost, remote equipment



They are other models such as AlexNet, GoogleNet, VGG models and other are the extensions of these method



ResNet's with good augmentation along with deeper residues will get good accuracy

# Future Scope



Selective approach of deeper networks will result more accuracy in real time



Include these model in fundus cameras will results instant analysis of prediction

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



# Any Queries?

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Thank You

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