

DIABETIC RETINOPATHY DETECTION

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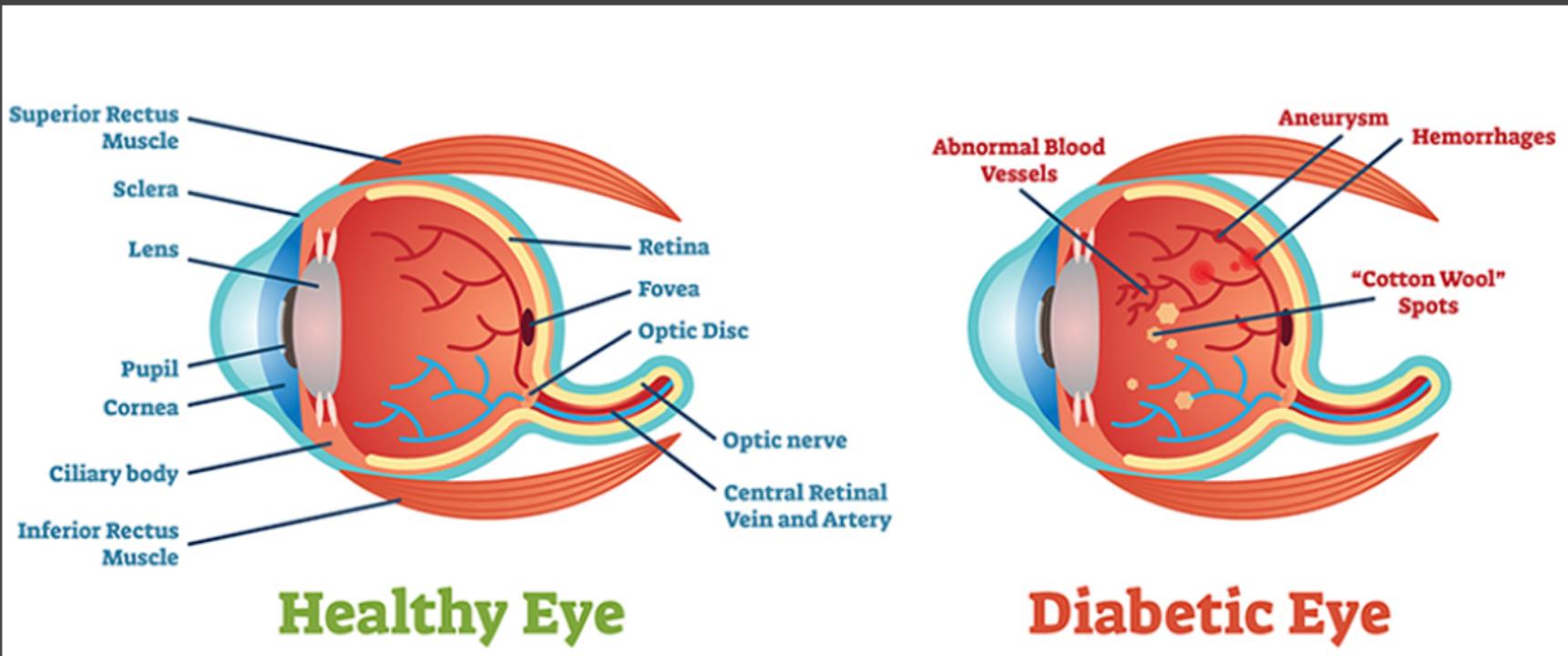
Conclusions

PROBLEM STATEMENT

Can I use image recognition models to detect diabetic retinopathy?

- Diabetic retinopathy is the most common diabetic eye disease and can lead to vision loss.
- Early detection and timely treatment can help reduce the severity of the disease.

WHAT IS DIABETIC RETINOPATHY?



WHY IS IT IMPORTANT?

*DR – Diabetic Retinopathy

1/3

Americans with diabetes over 40 age have DR

40%

Americans with diabetes have a stage of DR

x2

U.S adults with DR is expected to double by 2050

8M

Americans living with DR

Source: <https://www.healthcentral.com/condition/diabetic-retinopathy>
Article as of Dec 2020

CONCERNS / ISSUES WITH DIABETIC RETINOPATHY

Symptoms:

- Blurry vision
- Loss of central vision
- Loss of color vision
- Floating spots on the object

Issues:

- No symptoms in early stage
- Vision loss can be permanent if not treated

Concern:

- Only 50% of patients get eye exam
- 24 -70 age group affected
- Early detection is key, can only be performed when exam is taken

METHODOLOGY

IMAGE DATA

Healthy – 8857
Not Healthy – 1365
Kaggle Datasets
1024 x 627

PRE-PROCESSING

Keras Preprocessing
244 X 244
Augmentation: flip,
contrast, shear and rotate

CNN MODEL

6-layer CNN
85 M- Trainable
Dropout layers

TRANSFER LEARNING

MobileNet V2
Feature Extraction
Fine tuning

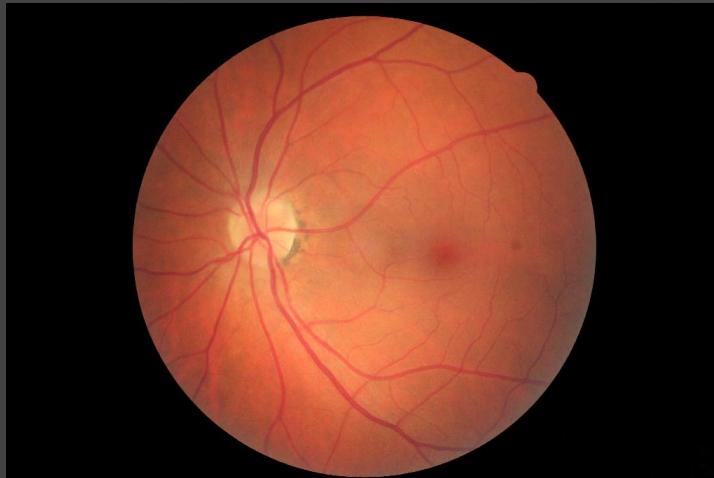
DATASETS

Data Folders	Count
No Disease	25,809
Mild	1152
Moderate	1340
Severe	704
Proliferative	752

Issues:

- Each image has - Left image & Right image
- Some cases – left labeled in one category and right labeled in different category
- Only considered pairs

CURRENT SCOPE



Healthy



Non-Healthy

Binary classification:

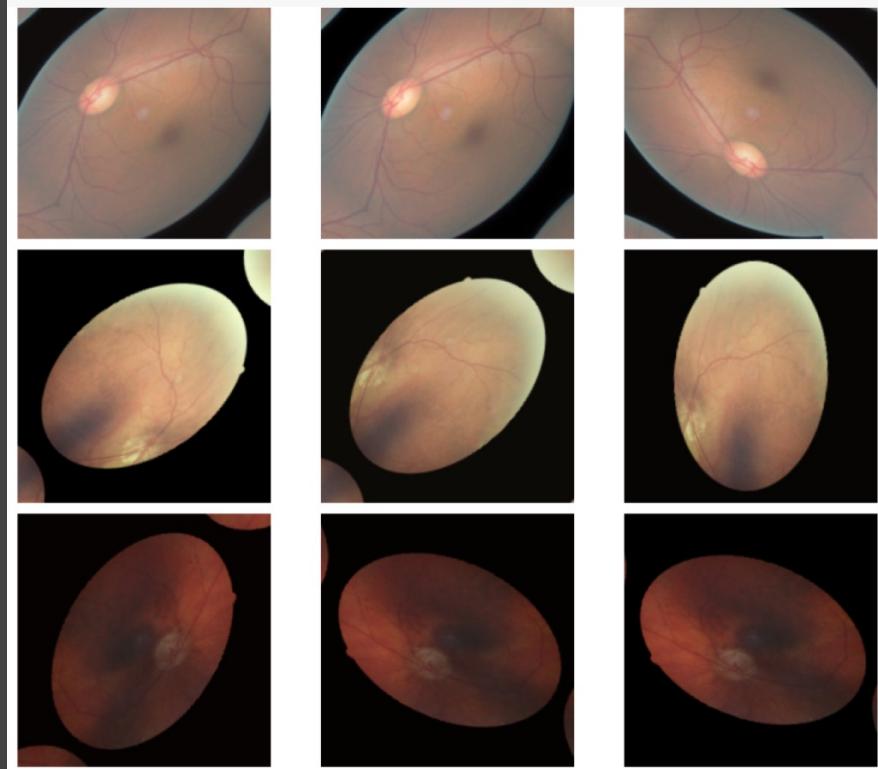
- Healthy – includes the images of no diabetic retinopathy - 8857
- Non-Healthy – includes the images from moderate to advanced stage diabetic retinopathy - 1345

IMAGES – AUGMENTED

Flip – Horizontal

Rotation – 20%

Contrast - (-15% to 15%)



MODELS & METRICS

1. CNN MODEL / METRICS

Baseline

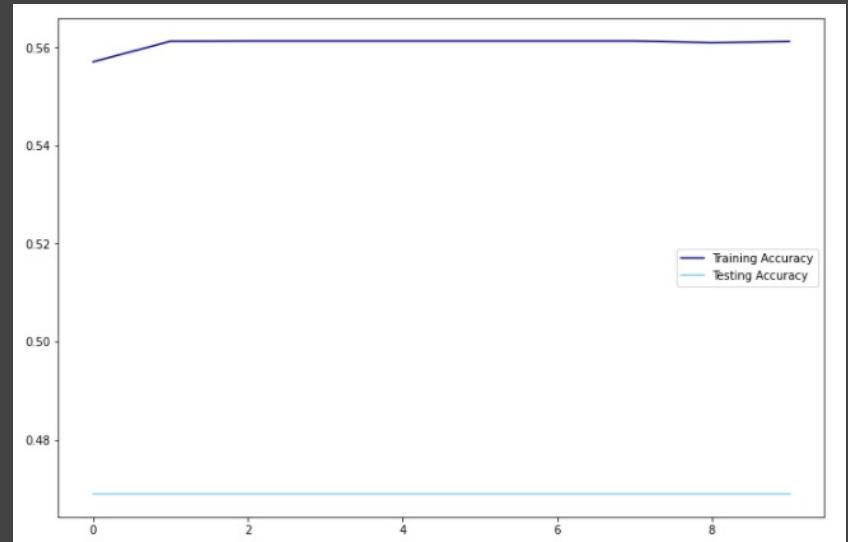
- Basic CNN Model for Baseline
- 3 layers/pooling
- Image size to 244x244
- Basic Augmentation options

Training accuracy: 51%

Second iteration

- CNN Model (layers/dropouts)
- 6 layers/pooling
- Image size to 244x244
- Enhanced Augmentation options

Training accuracy: 57%
Test accuracy: 47.5%

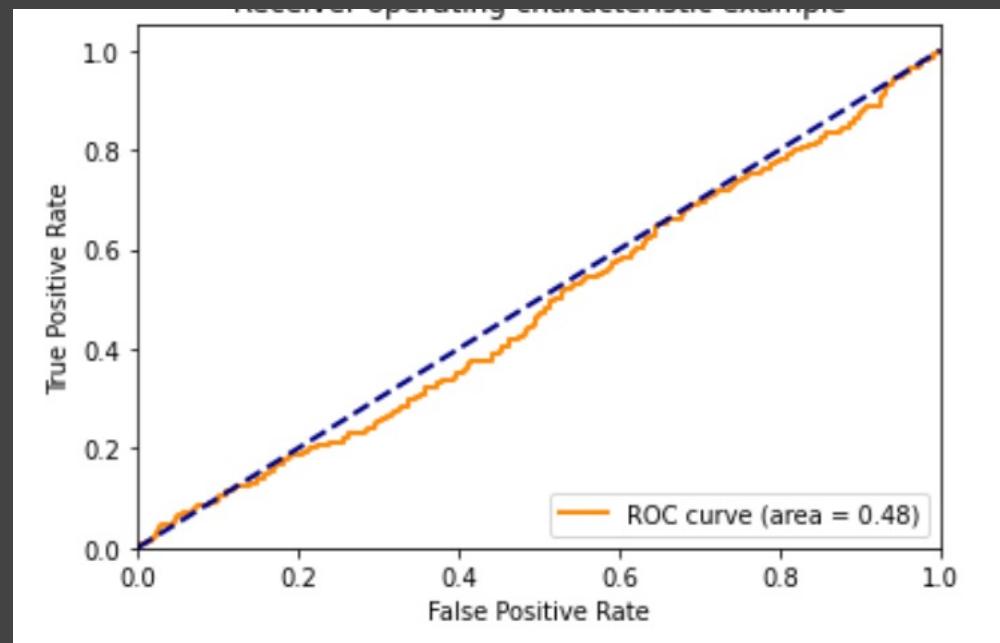


CNN – ROC/AUC

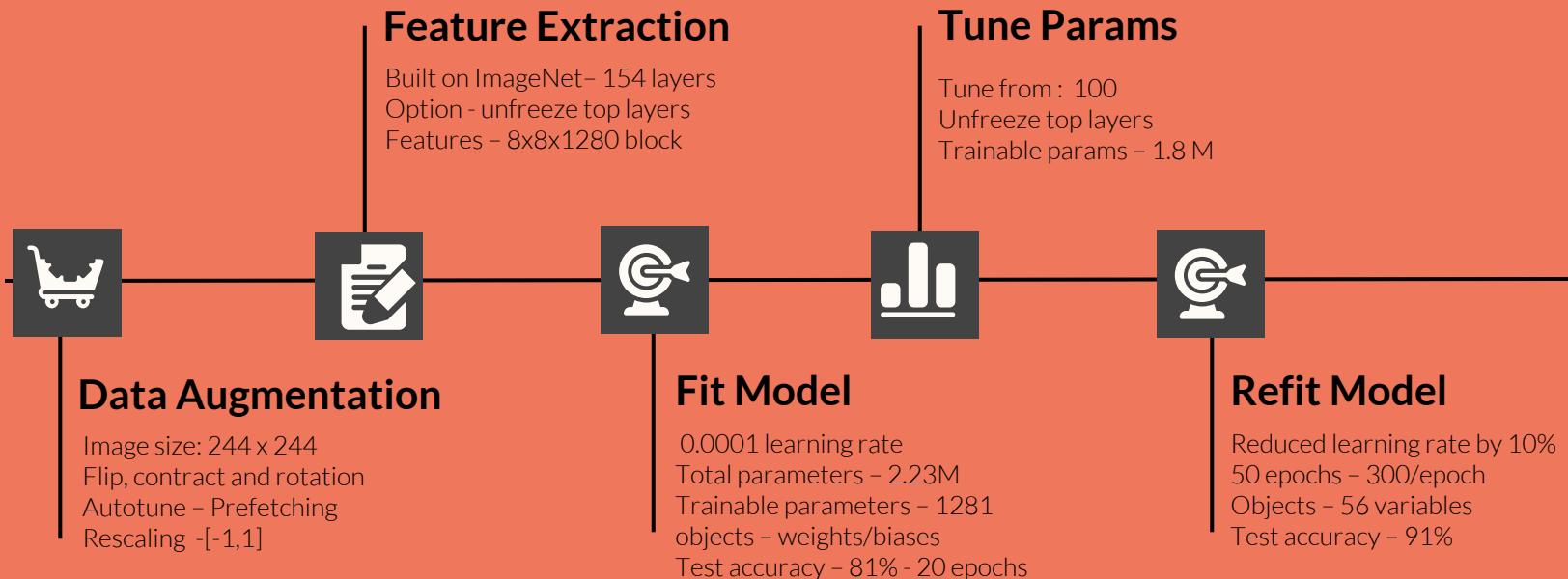
AUC / ROC metric

AUC / ROC – 48%

- performance measurement for the classification problems
- degree of measure of separability

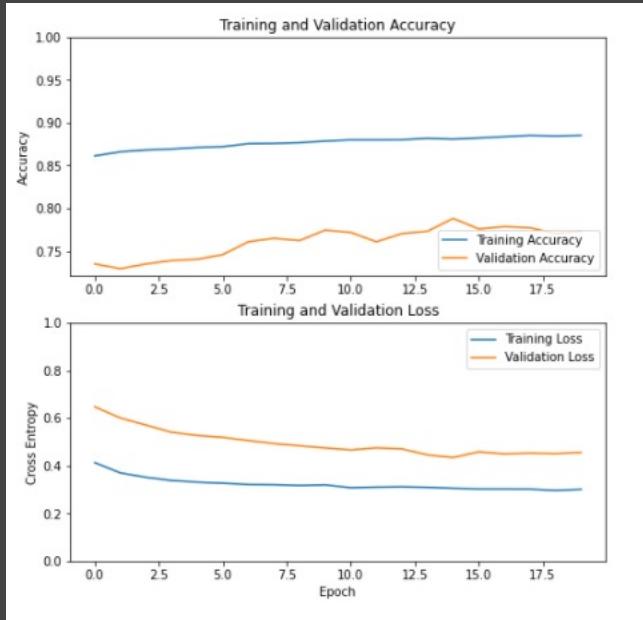


2. TRANSFER LEARNING WITH MOBILENET V2



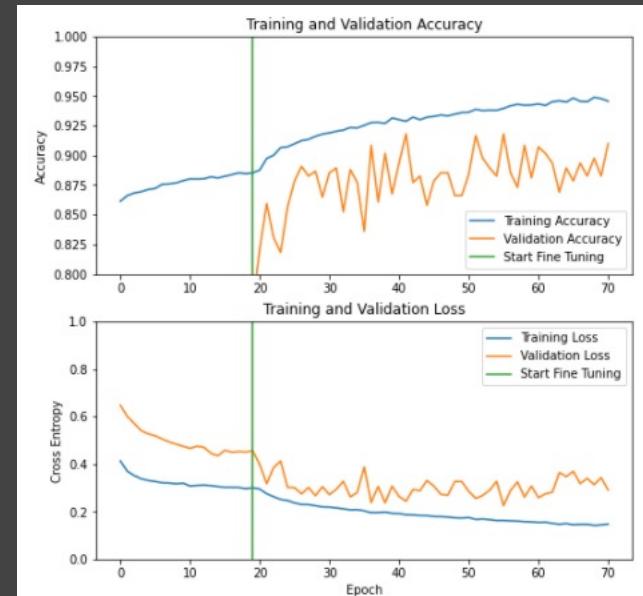
METRICS

With Feature extraction on base model



Train accuracy – 88%
Validation accuracy – 77%

With Fine Tuning on base model



Train accuracy – 94%
Validation accuracy – 90%

METRICS

Train accuracy – 94%
Validation accuracy – 90%
Test accuracy – 91%

	Precision	Recall	F1-Score
Healthy	0.95	0.95	0.95
Non-Healthy	0.92	0.92	0.92
Accuracy			0.94

PREDICTIONS

Train accuracy - 94%
Validation accuracy - 90%
Test accuracy - 91%

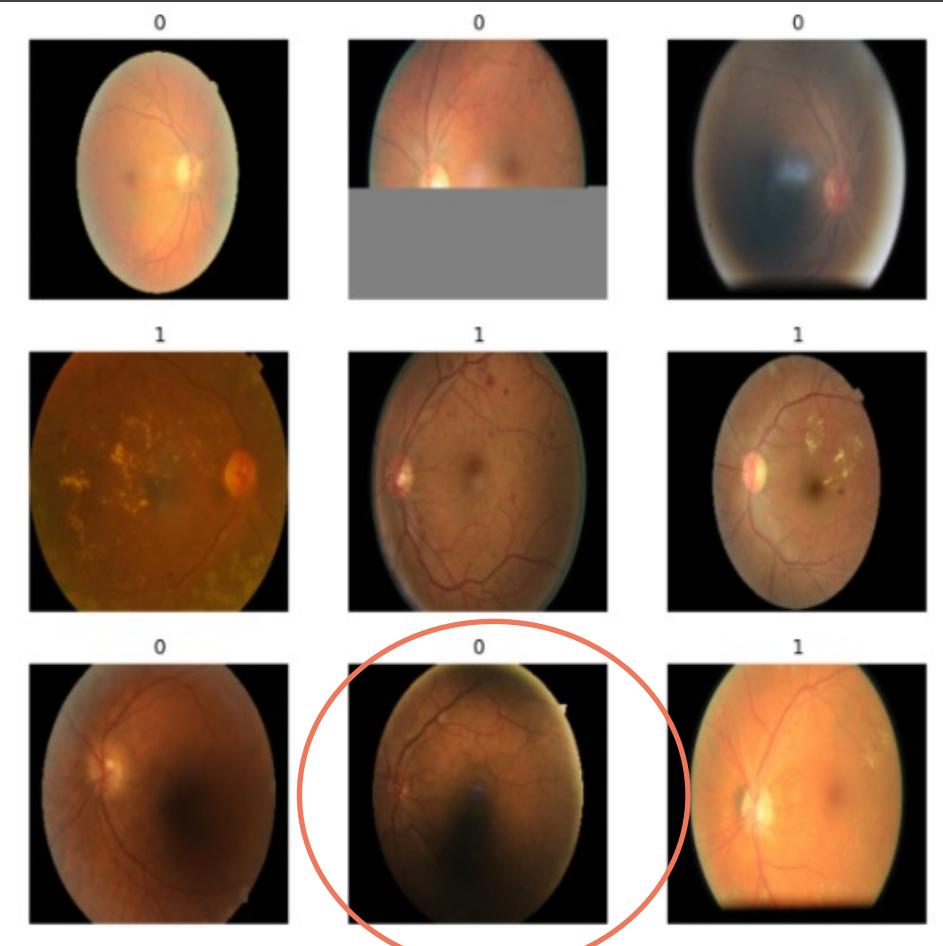
Predictions:

```
[0 0 0 1 1 1 0 0 1 0 0 1 0 1 0 1 1 1 1 0 0 1 0 0 1 0 1 0 1 0 0 0 0]
```

Labels:

```
[0 0 0 1 1 1 0 1 1 0 0 1 0 1 0 1 0 1 0 1 0 0 1 0 0 1 0 1 0 1 0 0 0 0]
```

Train accuracy – 94%
Validation accuracy – 90%
Test accuracy – 91%





NEXT STEPS

1. Extend to multiclass detection
2. Collect more data for disease stages
3. Experiment with more computational power and resources
4. Explore other pre-train models

Photo by [Wil Stewart](#) on [Unsplash](#)

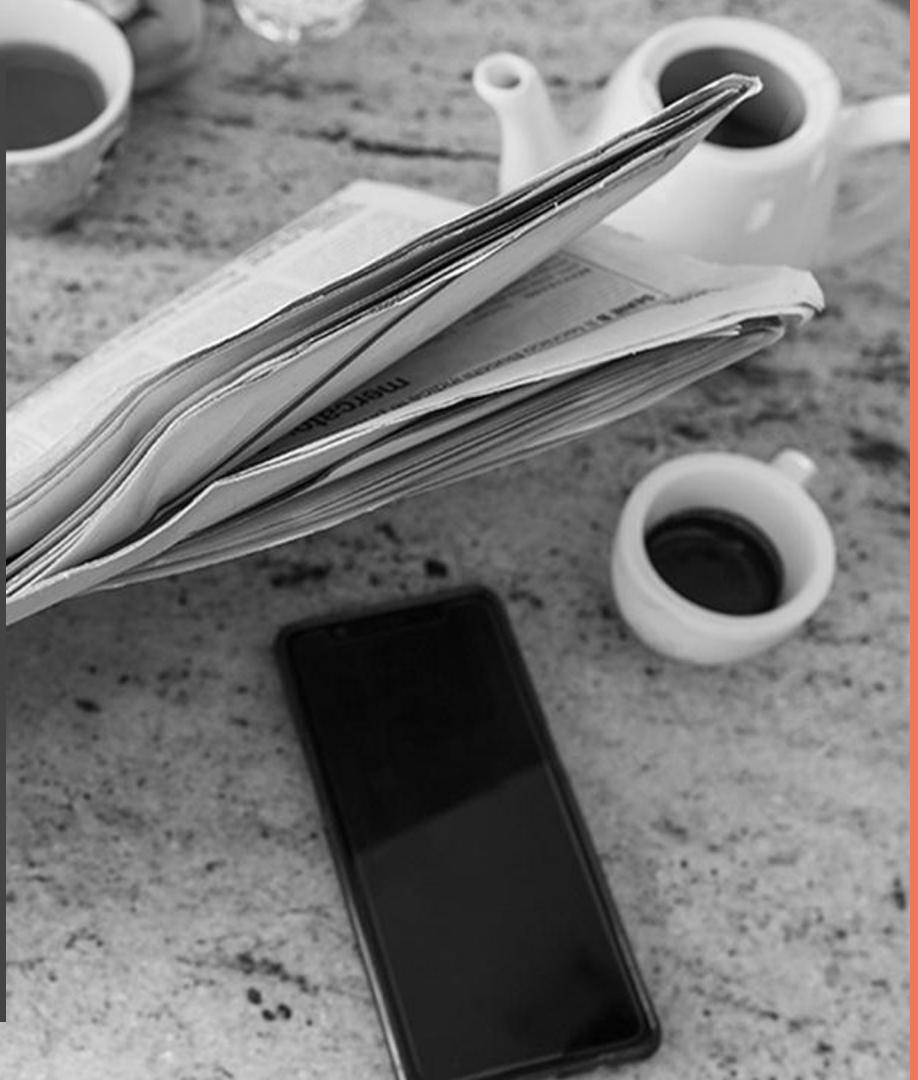
CONCLUSION

- Diabetic retinopathy is possible using image recognition models
- 95% precision and recall on healthy class and 92% precision and recall on non-healthy class using transfer learning methods
- Basic CNN model scores have been low and needed a bigger dataset

THANKS!

Any questions?

CREDITS: This presentation template was created by [Slidesgo](#), including icons by [Flaticon](#), and infographics & images by [Freepik](#)



RESOURCES

- Slidesgo for templates
- Stats used in the slides
- Unsplash for images
- Articles for references:
 - <https://www.aoa.org/healthy-eyes/eye-and-vision-conditions/diabetic-retinopathy?sso=y>
 - <https://www.kaggle.com/sovitrath/diabetic-retinopathy-224x224-gaussian-filtered>
 - <https://www.kaggle.com/sovitrath/diabetic-retinopathy-2015-data-colored-resized>
 - <https://towardsdatascience.com/covolutional-neural-network-cb0883dd6529>
 - <https://towardsdatascience.com/blindness-detection-diabetic-retinopathy-using-deep-learning-on-eye-retina-images-baf20fcf409e>
 - <https://rgony.com/diabetic-retinopathy>
 - <https://www.dovepress.com/prevalence-of-diabetic-retinopathy-and-its-associated-factors-among-di-peer-reviewed-fulltext-article-DMSO#:~:text=Background%3A%20Diabetic%20retinopathy%20is%20a,ands%20risk%20factors%20in%20Ethiopia.>
 - https://care.diabetesjournals.org/content/27/suppl_1/s84
 - <https://www.analyticsvidhya.com/blog/2020/02/learn-image-classification-cnn-convolutional-neural-networks-3-datasets/#:~:text=It%20is%20composed%20of%20images,pixels%20in%20width%20and%20height.>

METRICS - Addon

First iteration

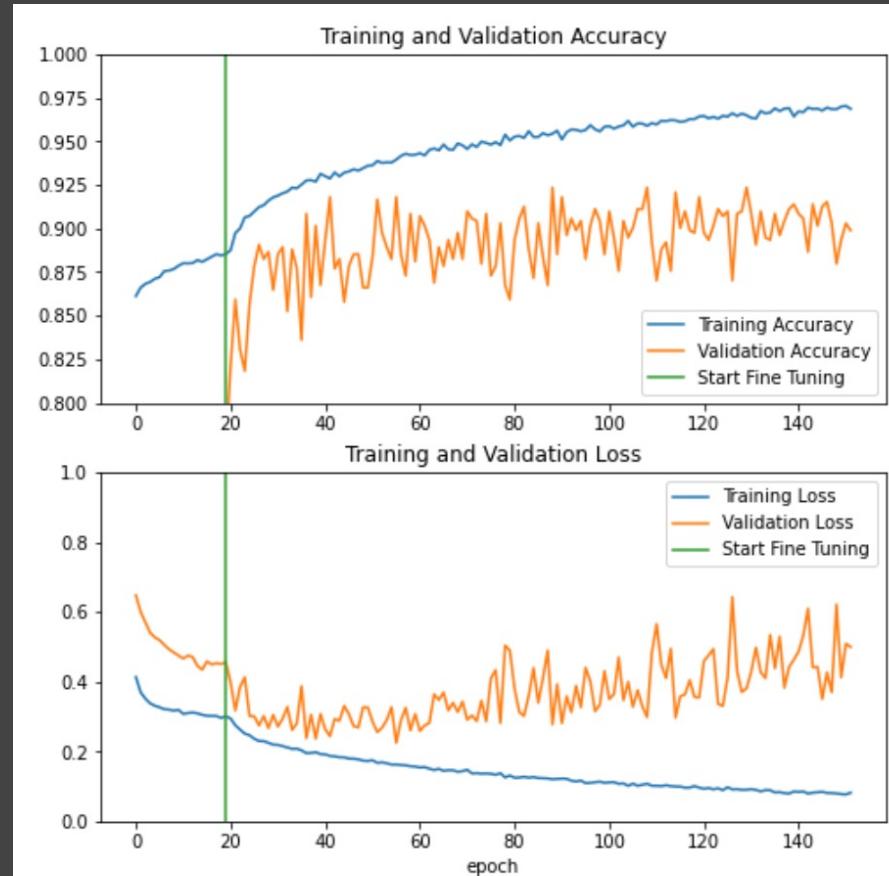
Train accuracy – 88%
Validation accuracy – 77%

Second iteration

Train accuracy – 94%
Validation accuracy – 90%

Third iteration

Train accuracy – 96%
Validation accuracy – 89%
Test accuracy – 94%



YOLOv5 – 5 class

First iteration

2500 –annotated using roboflow

6276 – Augmented images

1000 epochs

Link to reports:

<https://wandb.ai/lbandari/YOLOv5/runs/3h1vuyin?workspace=user-lbandari>

What is Yolov5?

- You only look once
- Single shot detector
- Most versatile
- Creates weights from pre-trained weights
- Can train on custom dataset