DEEP MEDICINE LAB

Detecting Diabetic Retinopathy stages Using Transfer Learning Approch

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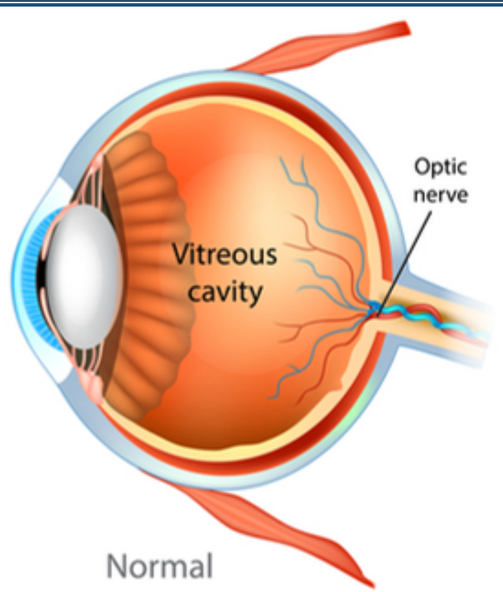
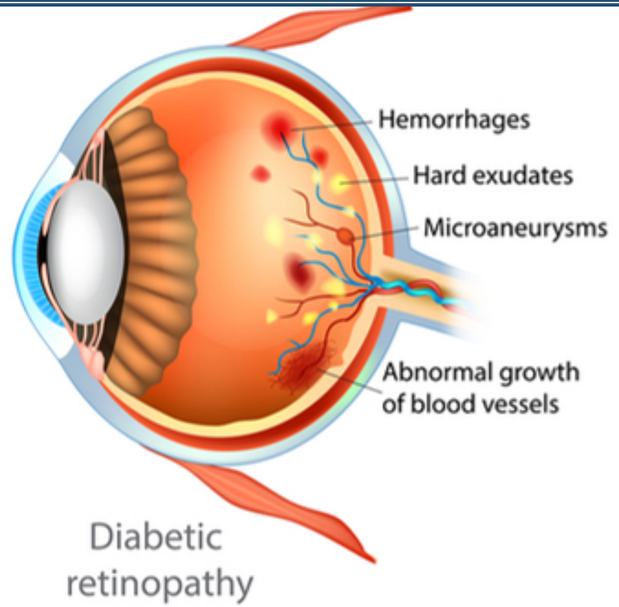
Introduction



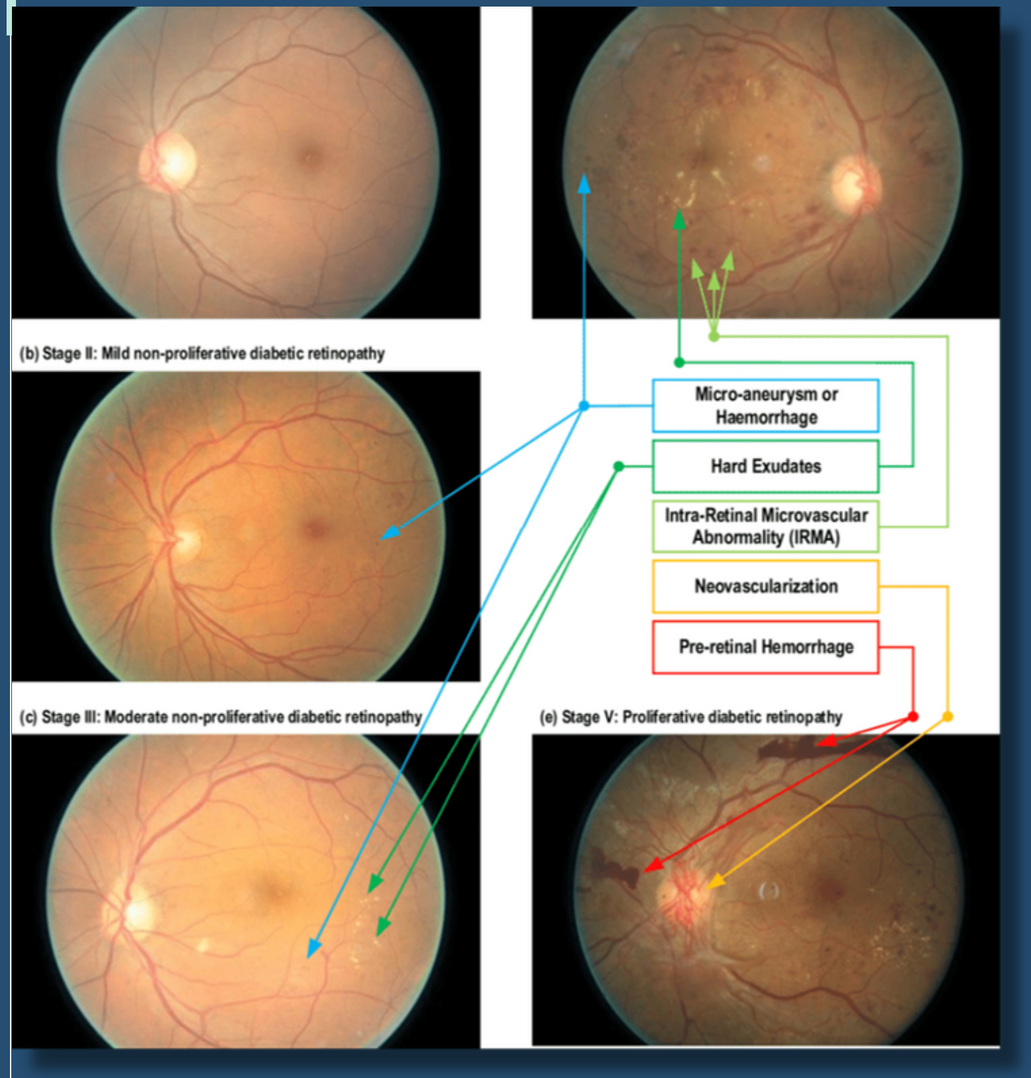


PROBLEM STATEMENT

Diabetic Retinopathy is a leading problem throughout the world and many people are losing their vision because of this disease.

The damage in the retinal blood vessel eventually blocks the light that passes through the optical nerves which makes the patient with Diabetic Retinopathy

The disease can get severe if it is not treated properly at its early stages.



OBJECTIVES

- To process color fundus retinal images for Diabetic Retinopathy detection.
- To extract key features from the pre-processed images.
- To build the Transfer Learning Techniques for DR Detection
- To detect the stage of Diabetic Retinopathy.
- To evaluate the performance metrics of various Transfer Learning Methodologies.

Literature Review

Sarki, R., Ahmed, K., Wang, H. et al. Image Preprocessing in Classification and Identification of Diabetic Eye Diseases. Data Sci. Eng. 6, 455–471 (2021). https://doi.org/10.1007/s41019-021-00167-z

- Image quality enhancement,
- Image segmentation (region of interest),
- Image augmentation (geometric transformation)
- Transfer Learning ; VGG16, DenseNet121 & Inception
- diabetic eye disease, diabetic retinopathy,diabetic macular edema & Glaucoma
- Classification : Normal or Mild

Hemanth, D.J., Deperlioglu, O. & Kose, U. An enhanced diabetic retinopathy detection and classification approach using deep convolutional neural network. Neural Comput & Applic 32, 707–721 (2020). https://doi.org/10.1007/s00521-018-03974-0

- Resized image, HE & CLAHE

Deep Medicine Labs

Artificial Intelligence|Public Health|Precision Medicine

A team of public health scientists, epidemiologists, medical doctors, biodesign engineers and health technology entrepreneurs united with the idea to solve problems in public health using technology. Their core areas of interdisciplinary expertise include Clinical Data Science, Clinical AI, Biodesign and Health Technology.

Company Profile

Director of Clinical Research: Dr.Arunkumar Annamalai
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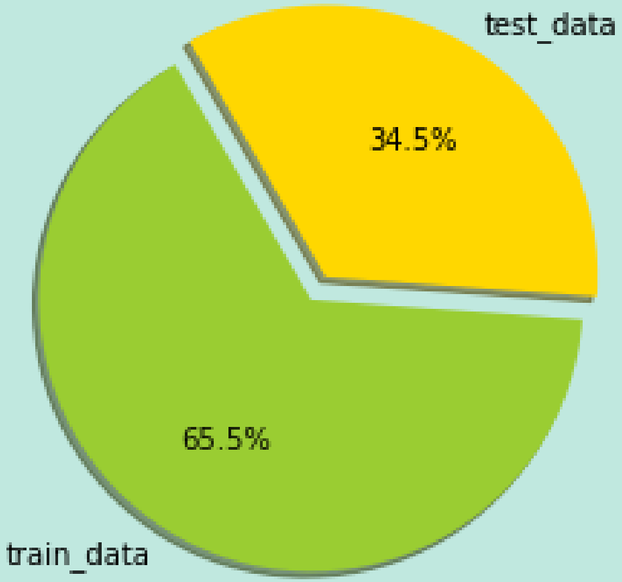
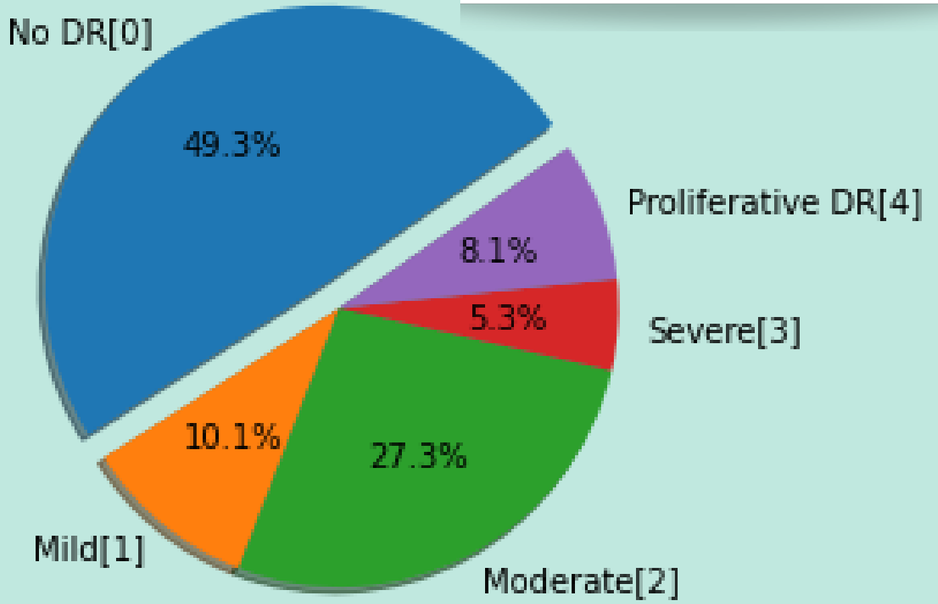
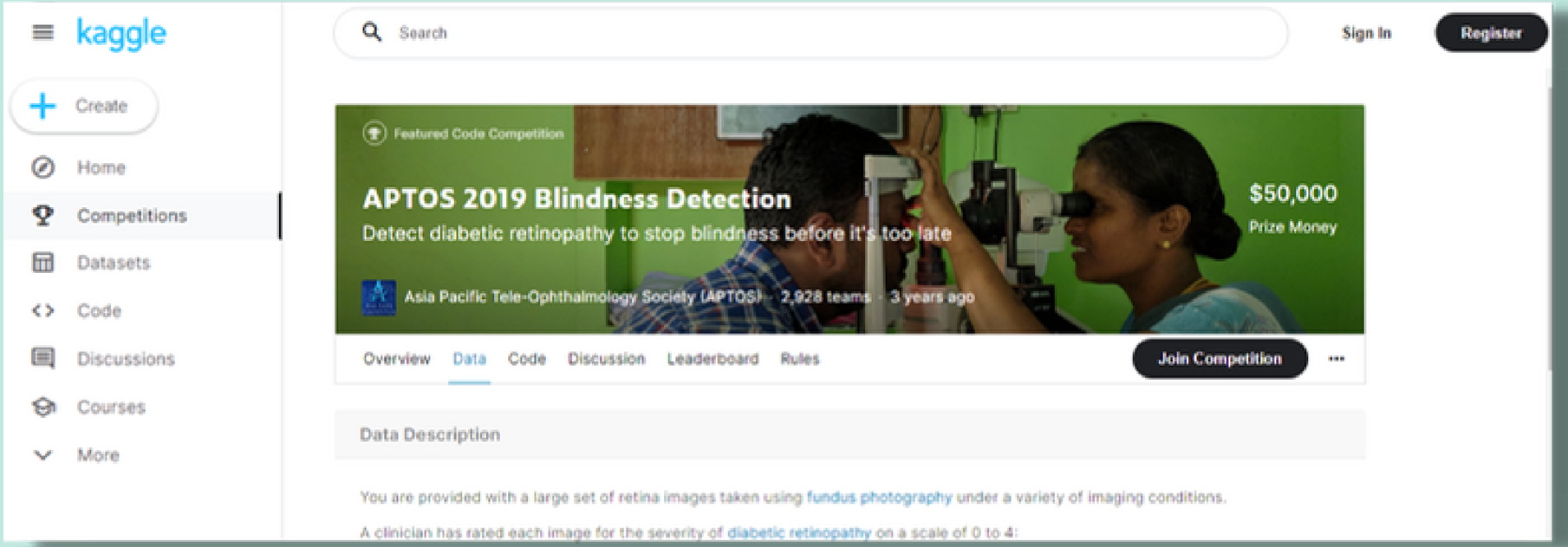
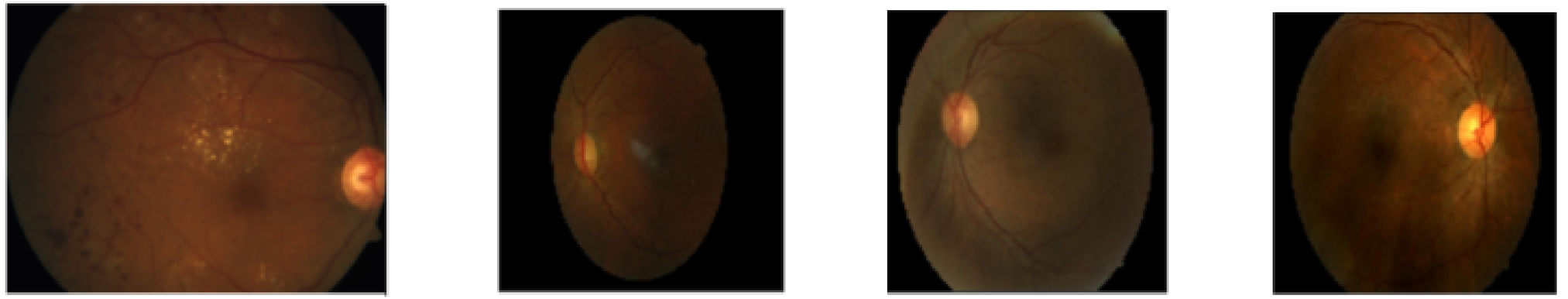
Methodology



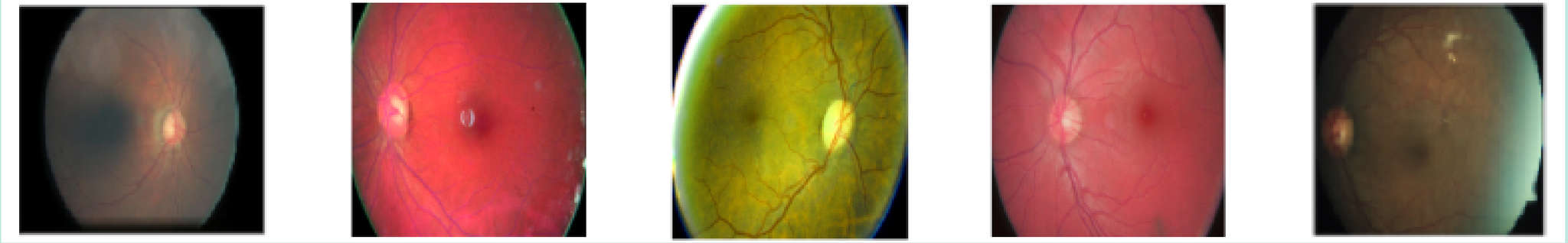




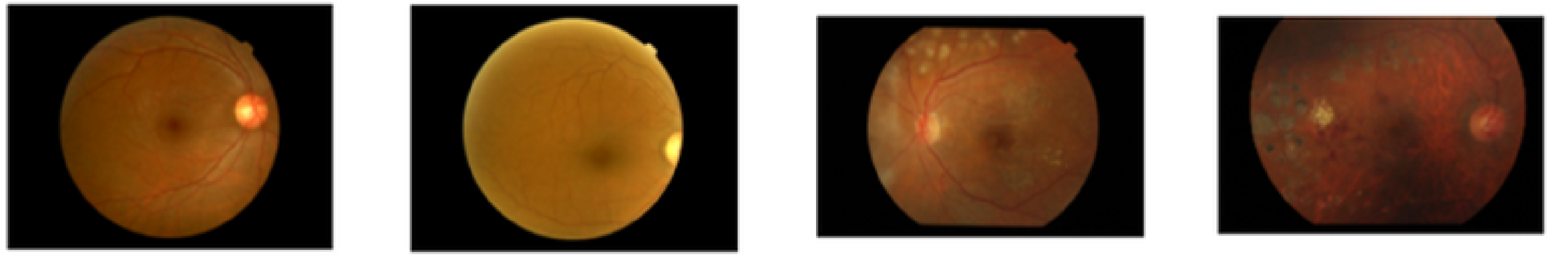
Images with dark color Illumination:



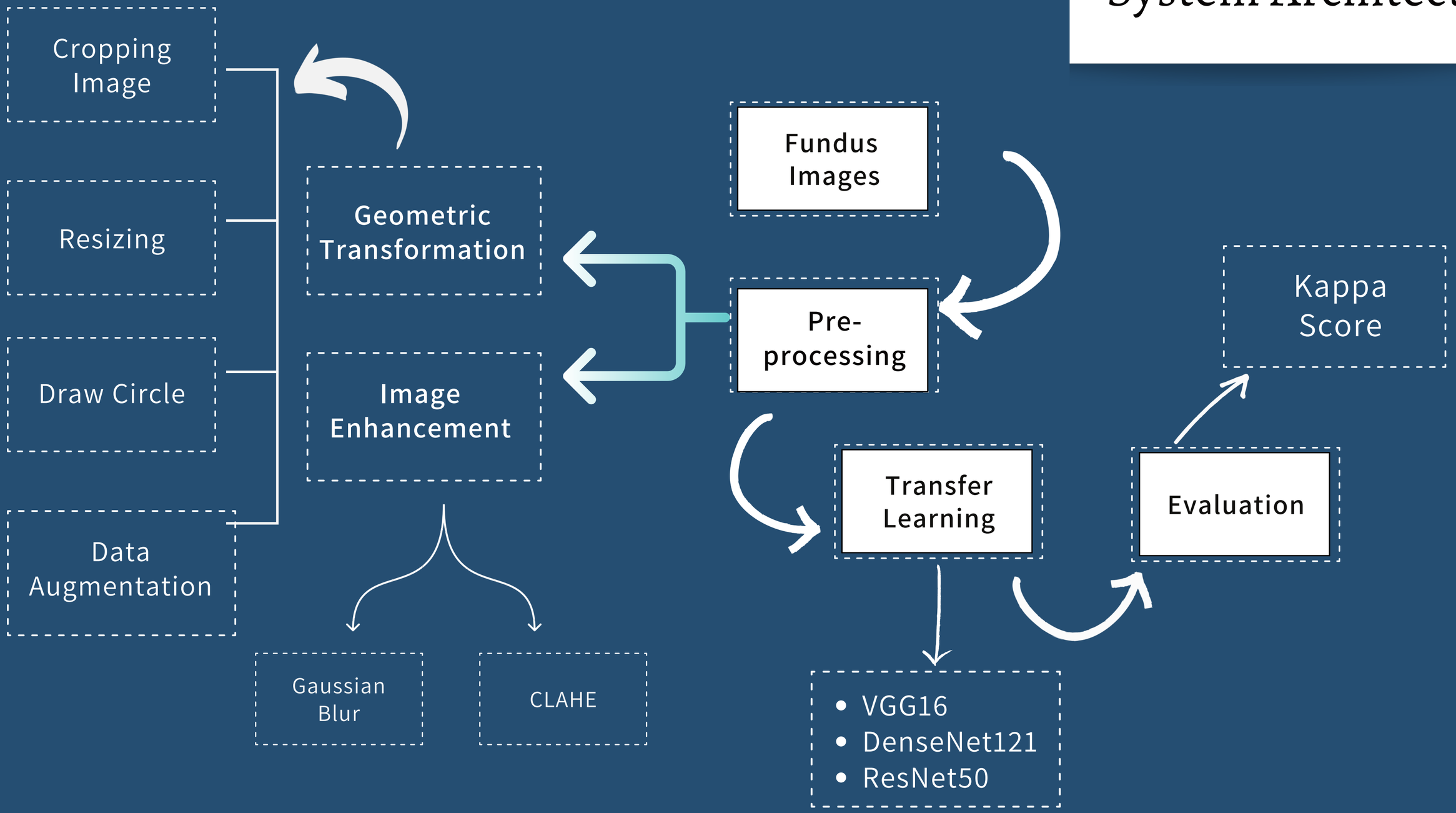
Images with different color invertion:

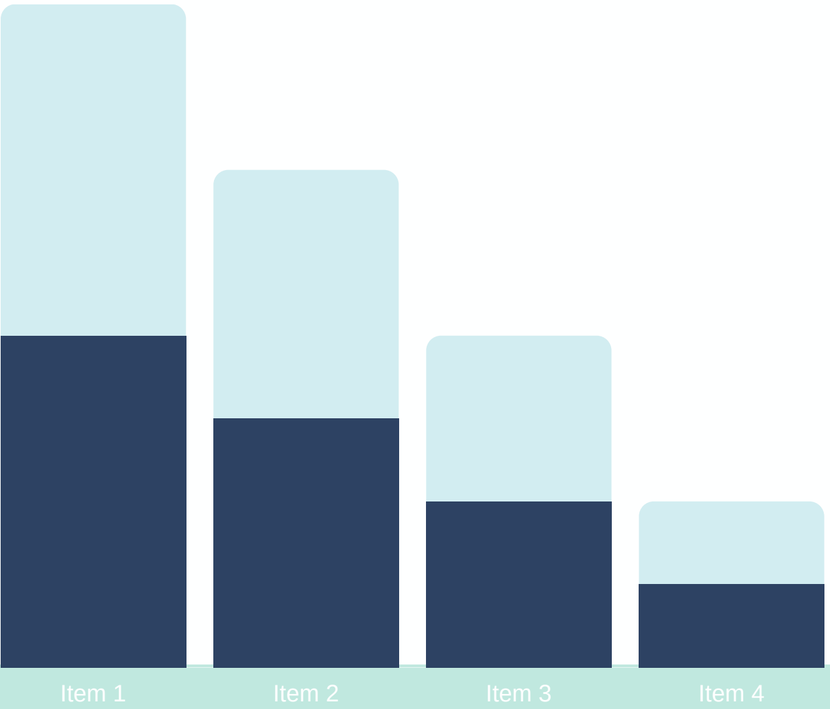


Images with uninformative extra dark black pixels



System Architecture





Results and Discussion

Pre-processing

Before Image Processing:

Step-1: (Cropping extra dark pixels)

Geometric Transformation

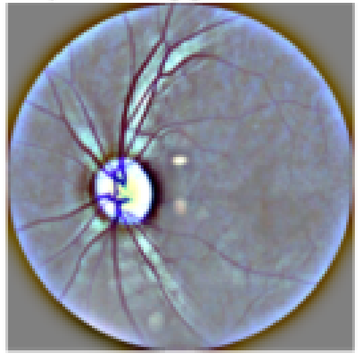
Image Enhancement

Step-1: (Cropping extra dark pixels)

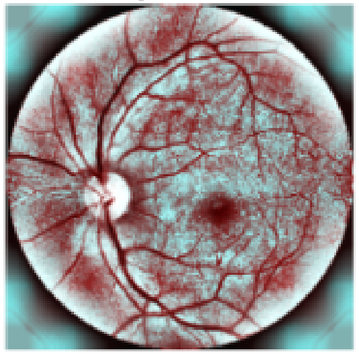
Step-2: (Resizing the image)

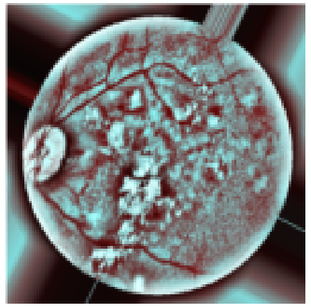
Step-3: (Drawing circle)

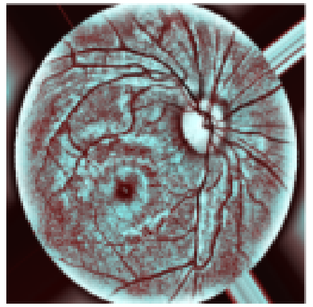
Step-4: (Adding gaussian blur)

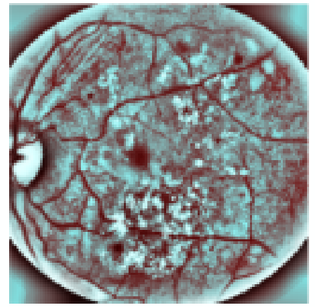


Step-5: (CLAHE)



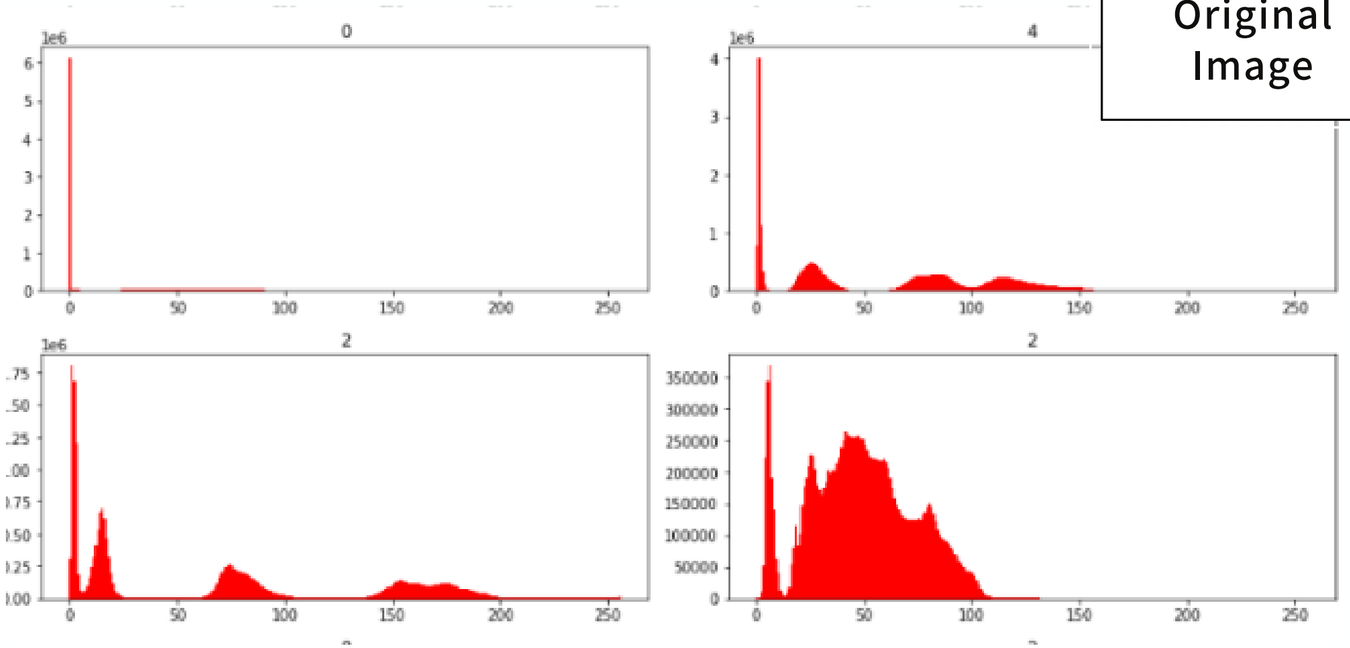


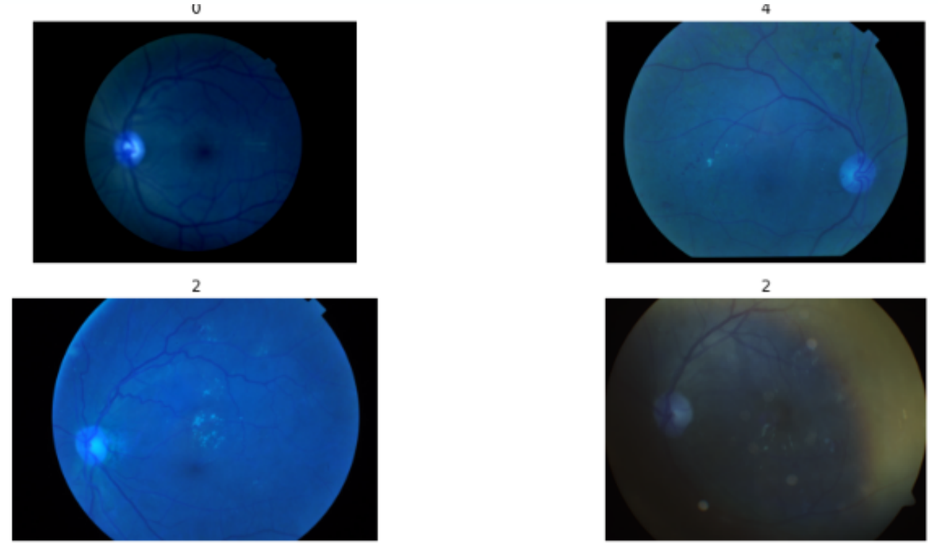




Data Augmentation

Original Image

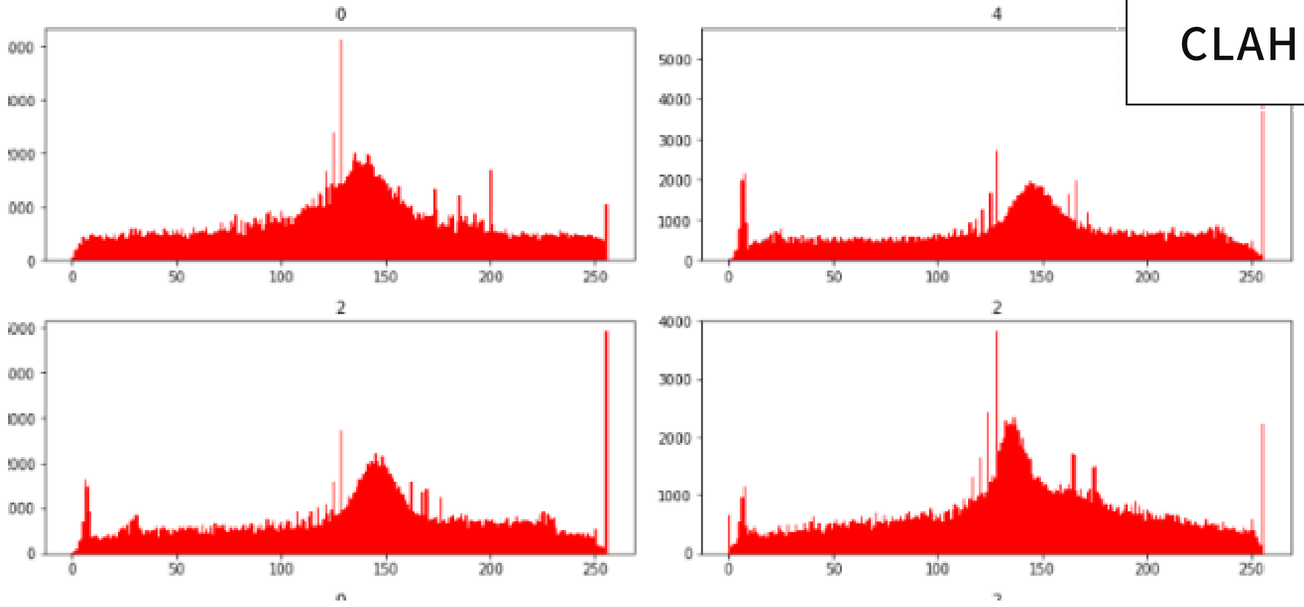


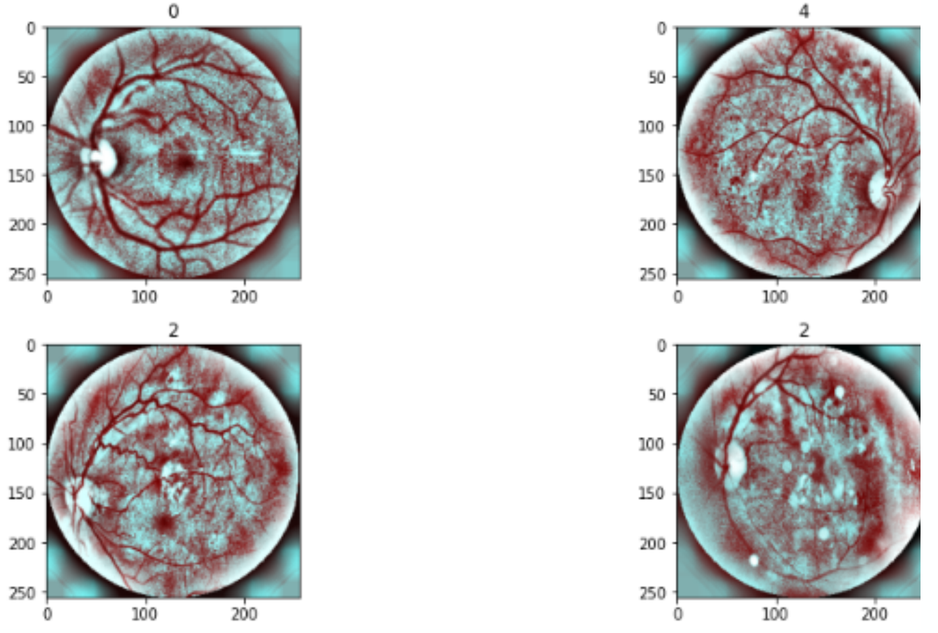


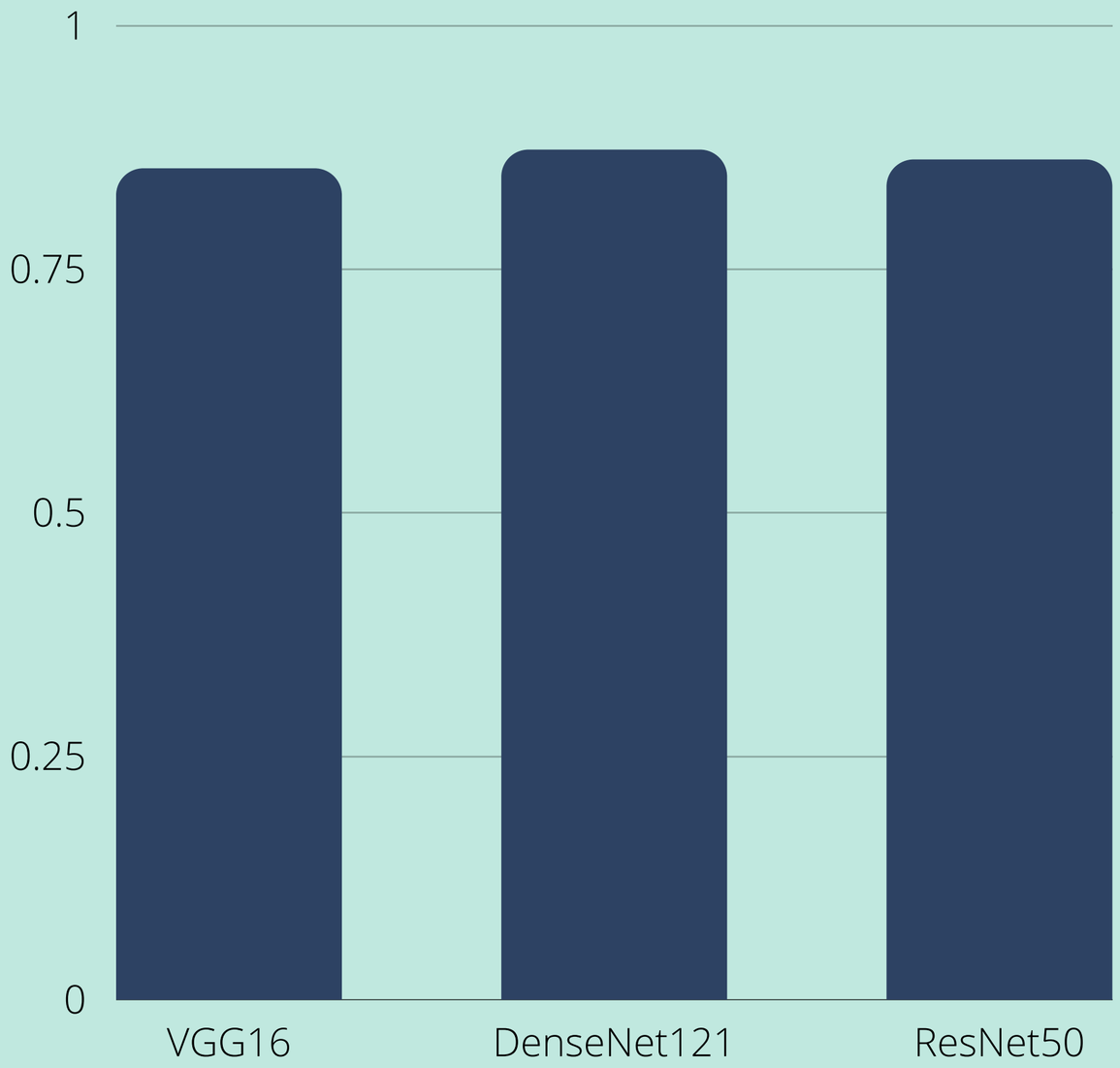
Y axis : No of Pixels in the Images

X-axis : Tonal scale (Black to White)

CLAHE







Results

Models	Kappa Scorce
Vgg16	0.8532
DenseNet121	0.8724
ResNet50	0.8623

Prediction

```
ytrain_vgg16 = vgg16.predict(x_train)
ytrain_vgg16 = test_prediction(ytrain_vgg16)
print("First five data points predictions in training:",ytrain_vgg16[:5])
print("length of traindata prediction:",ytrain_vgg16.shape,"\n")

yvalidation_vgg16 = vgg16.predict(x_validation)
yvalidation_vgg16 = test_prediction(yvalidation_vgg16)
print("First five data points predictions in validation:",yvalidation_vgg16[:5])
print("length of validation data prediction:",yvalidation_vgg16.shape,"\n")

ytest_vgg16 = vgg16.predict(x_test)
ytest_vgg16 = test_prediction(ytest_vgg16)
print("First five data points predictions in test:",ytest_vgg16[:5])
print("length of test data prediction:",ytest_vgg16.shape)
```

```
First five data points predictions in training: [0 2 2 0 2]
length of traindata prediction: (3112,)

First five data points predictions in validation: [2 2 0 1 0]
length of validation data prediction: (550,)

First five data points predictions in test: [2 3 3 2 2]
length of test data prediction: (1928,)
```

Conclusion

- The pre-processing techniques such as histogram equalization and geometric transformation were performed using google colab.
- Transfer learning(Vgg16,ResNet50 and DenseNet121) is implemented to classify DR into 5 classes.
- DenseNet121 performed better than the other Transfer Learning models with quadratic weighted kappa function.
- Deep learning techniques that can learn from small dataset to categorize medical images should be utilized to classify DR, as this can be transferred to other medical image classification problems facing the challenge of insufficient training data.

FUTURE ENHANCEMENT

- Apply the different image pre-processing techniques
- Apply the pre-trained models
- Using fundus images, will diagnosis other diseases related to diabetic retinopathy.
- Create automated web applications to detect the stages of diabetic retinopathy of that person in a minute.

Thank You