Eye Disease Classification

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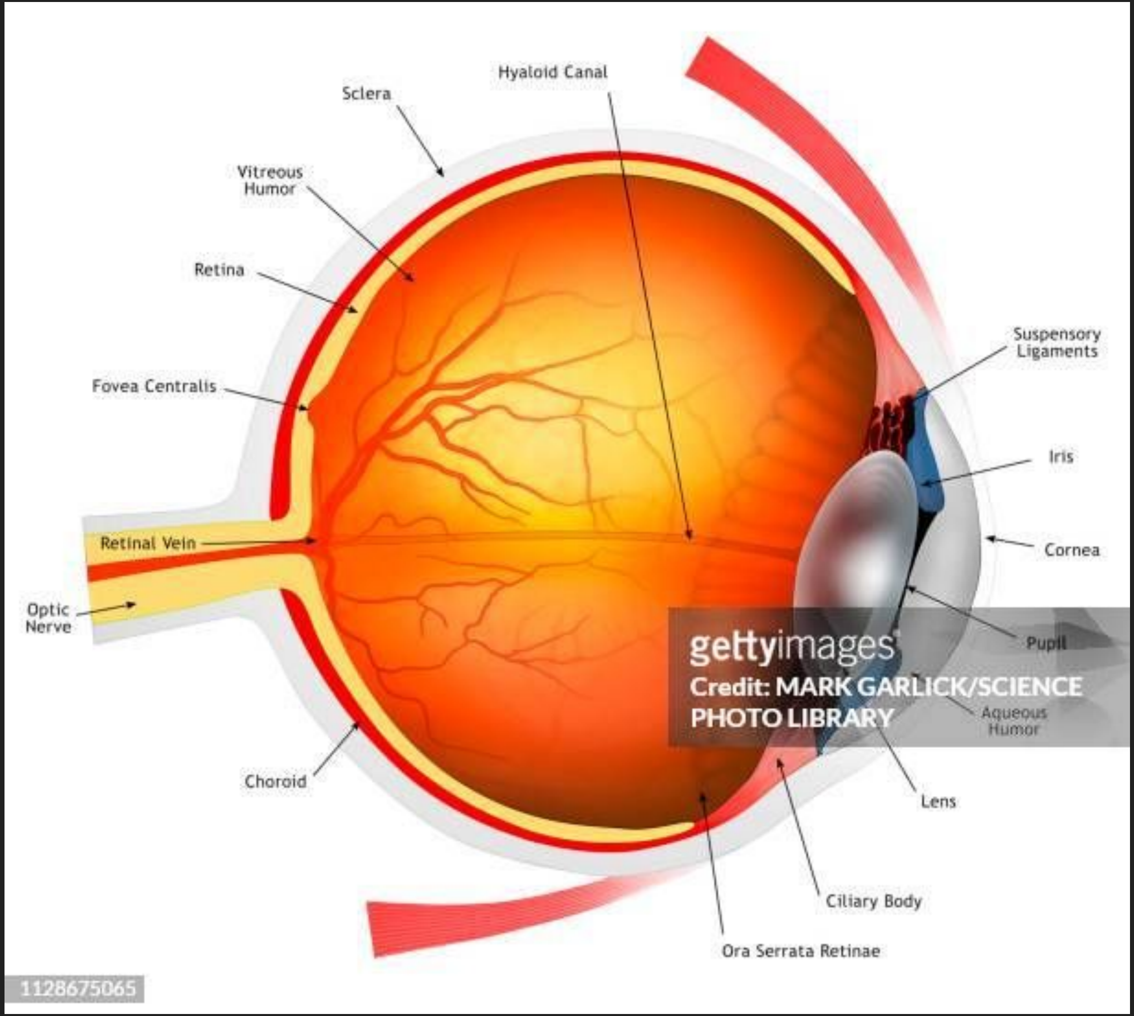


Objectives

- Educational Research: Reviewing existing literature on fundus image classification and eye defect detection.
- Data Preparation: Preprocessing and curating fundus image datasets for model training.
- Fundus Image Classification: Implementing deep learning models for automatic classification of fundus images.
- Comparing Model Performance: Analyzing and comparing the effectiveness of different classification models.
- Eye Defect Detection (Localization): Developing algorithms to detect and localize eye defects within fundus images.
- Web Application (Deployment): Creating a user-friendly interface to deploy the developed models for real-world usage.

Dataset

The dataset consists of

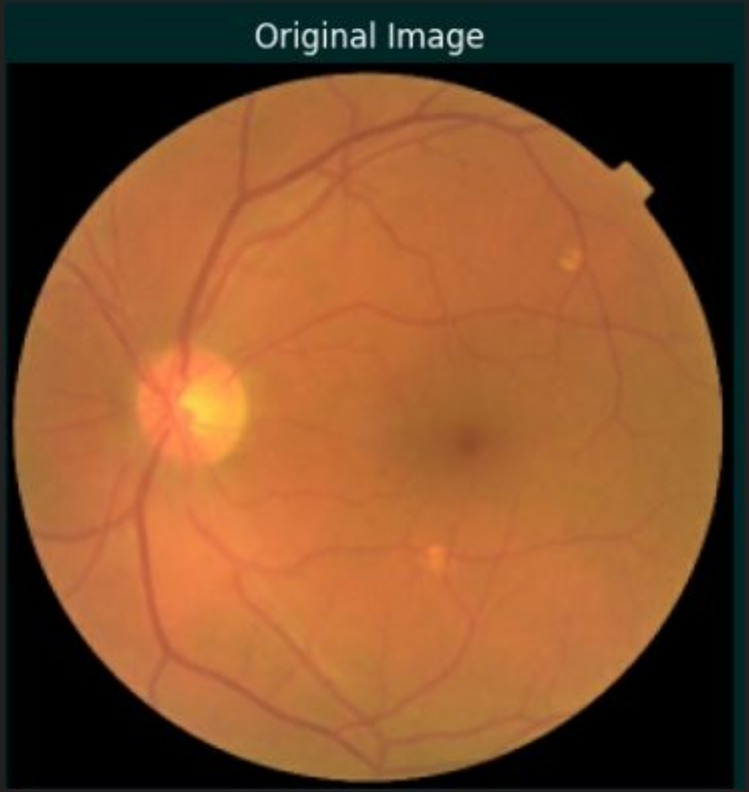
- ❏ Normal (1074)
- ❏ Diabetic Retinopathy (1098)
- ❏ Cataract (1038)
- ❏ Glaucoma (1007)

These Fundus (RGB) images are collected from various sources like IDRiD, Ocular recognition, HRF etc.

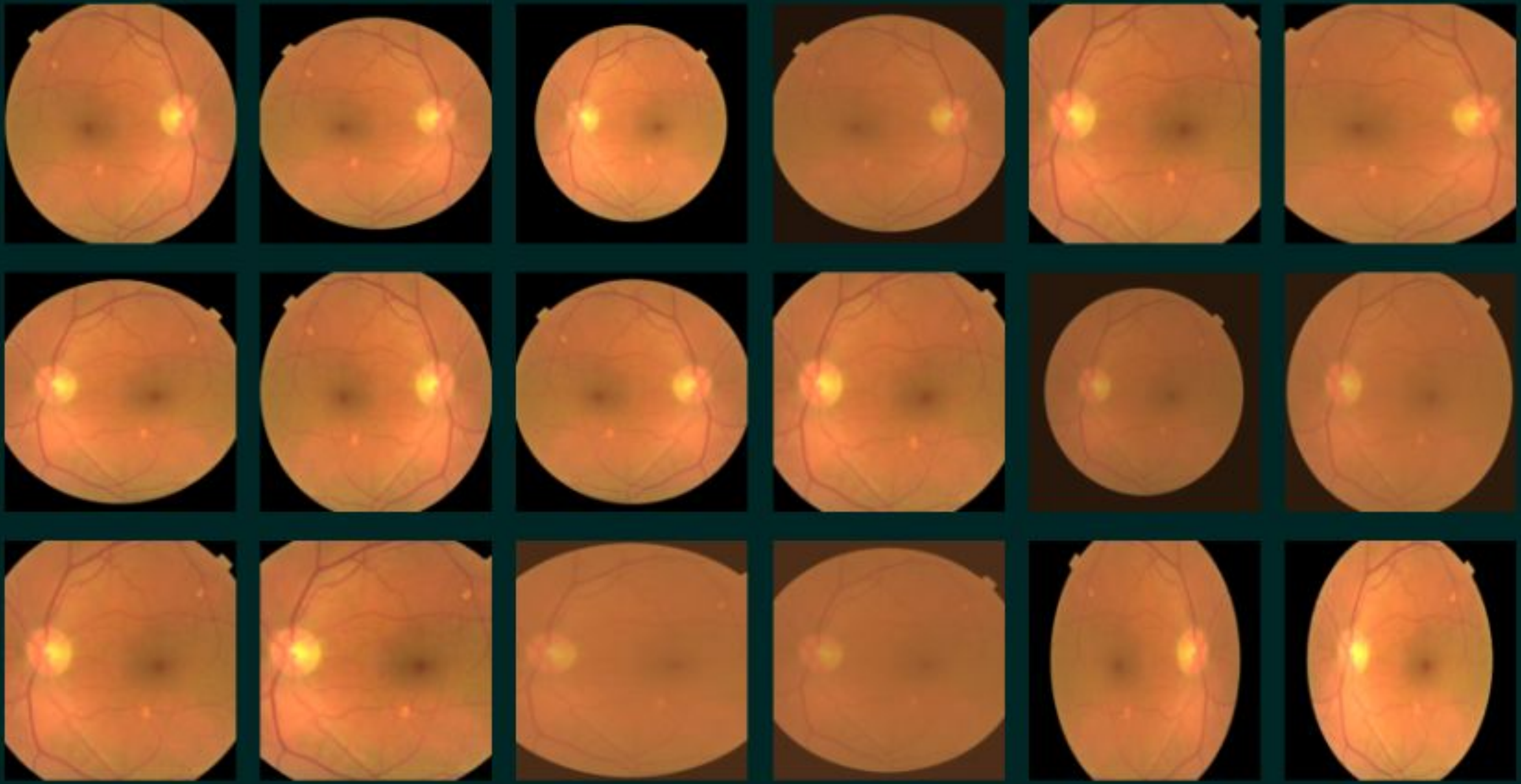
Split Ratio:- Train:Test:Val = 8:1 : 1

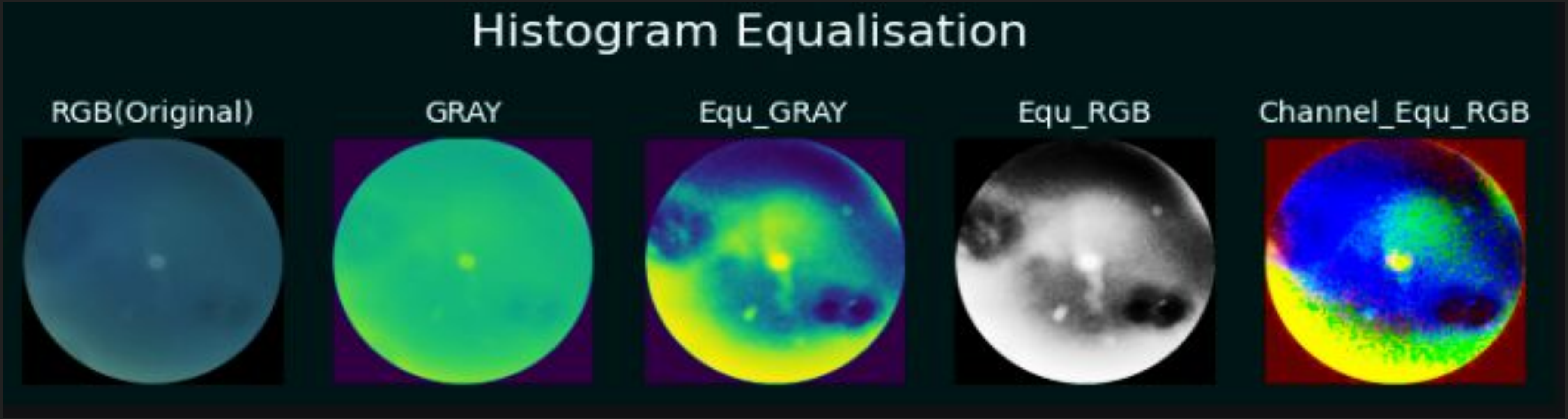
Preprocessing

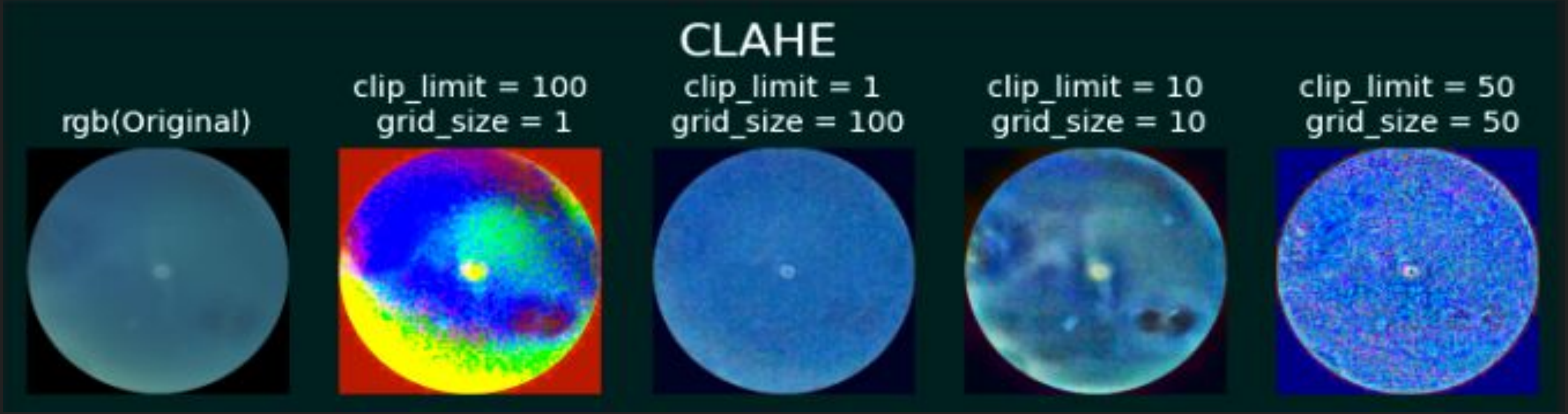
- Using tf.keras.layers
  - Resizing
  - Rescaling
  - Random Zoom
    - width wise
    - Height wise
  - Random Flip
    - Horizontal flip
  - Random Contrast
    - (-50,50)



Augmented Image for the previous Image




Histogram Equalisation
RGB(Original)
GRAY
Equ_GRAY
Equ_RGB
Channel_Equ_RGB


CLAHE
rgb(Original)
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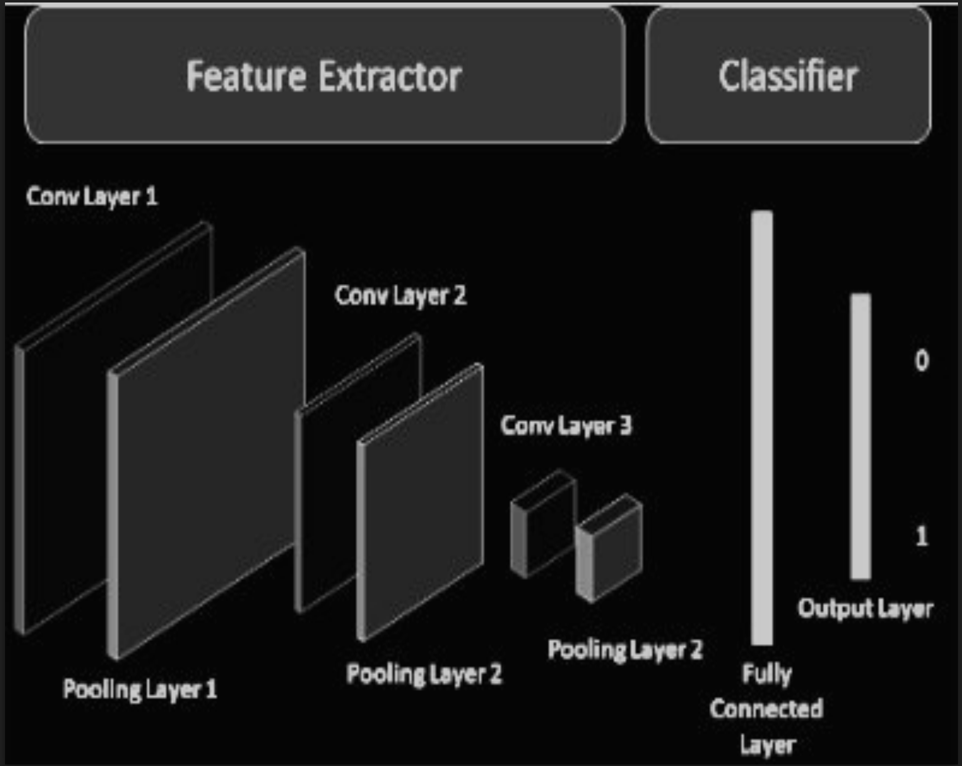
clip_limit = 1
grid_size = 100
clip_limit = 10
grid_size = 10
clip_limit = 50
grid_size = 50

Models

- Model From Scratch
  - Lenet_2
  - ResNet_34
- Pretrained models
  - EfficientNet-V2B0
  - Inception-V3
  - DenseNet-121
  - VGG-16
  - ResNet-50



Above pretrained models were pretrained on imagenet dataset

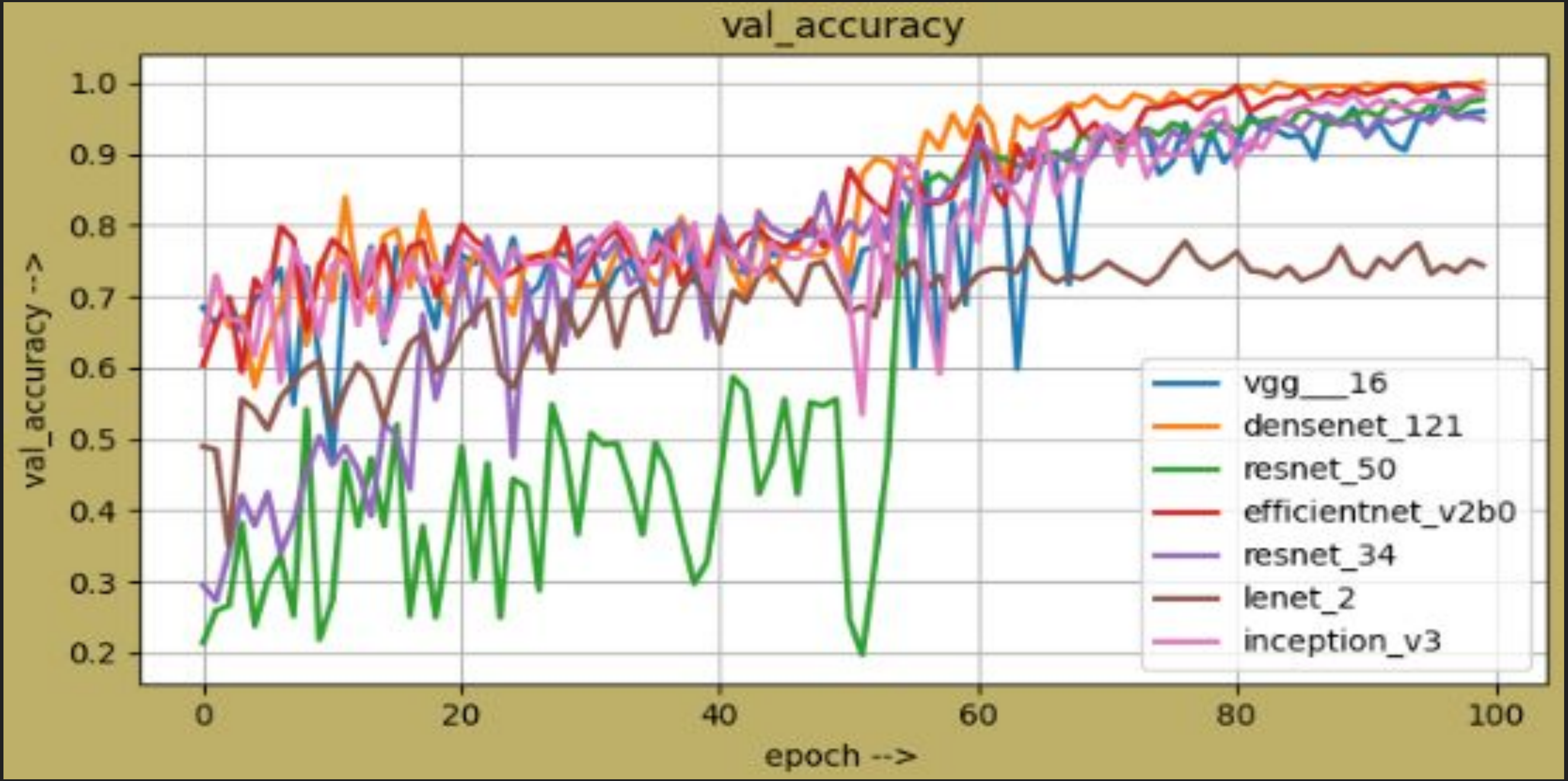
Model’s Parameter

- Feature Extraction Parameter
  - Image Size = (128,128)
- Classifier Parameter
  - Units (128,16,4)
- General Parameters:
  - Optimizer = Adam
  - Epochs = 100
  - Batch Size = 16
- Callbacks
  - Checkpoint (for best Weights)
  - ReduceLROnPlateau (0.7,5)

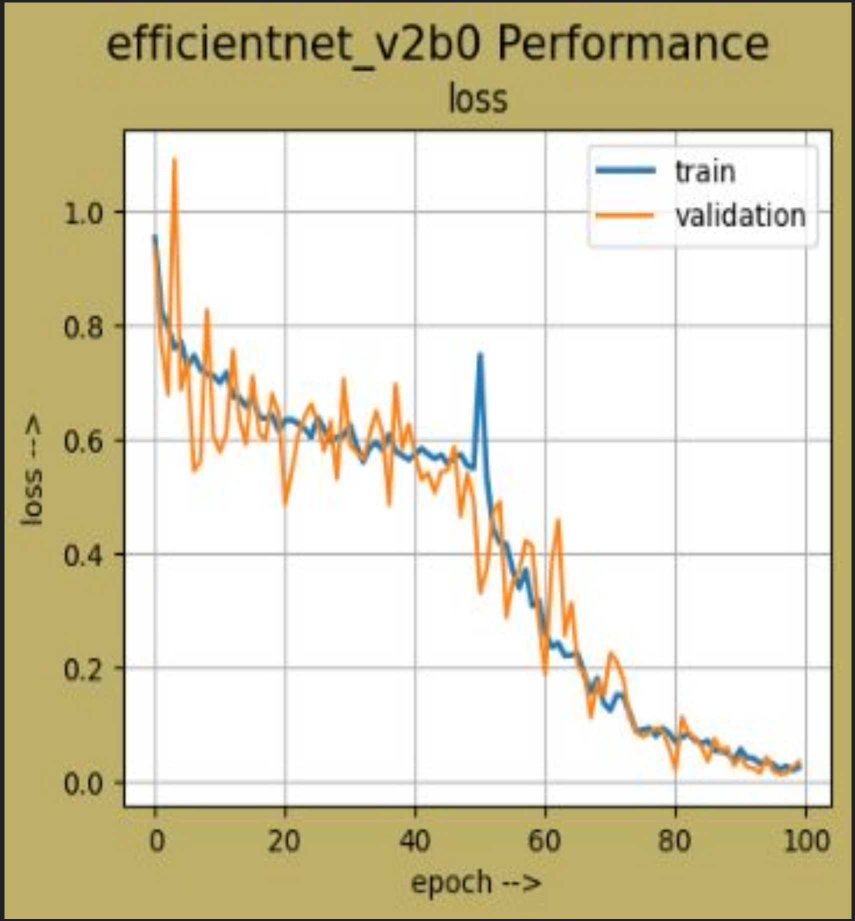
Model: "Full_Model"

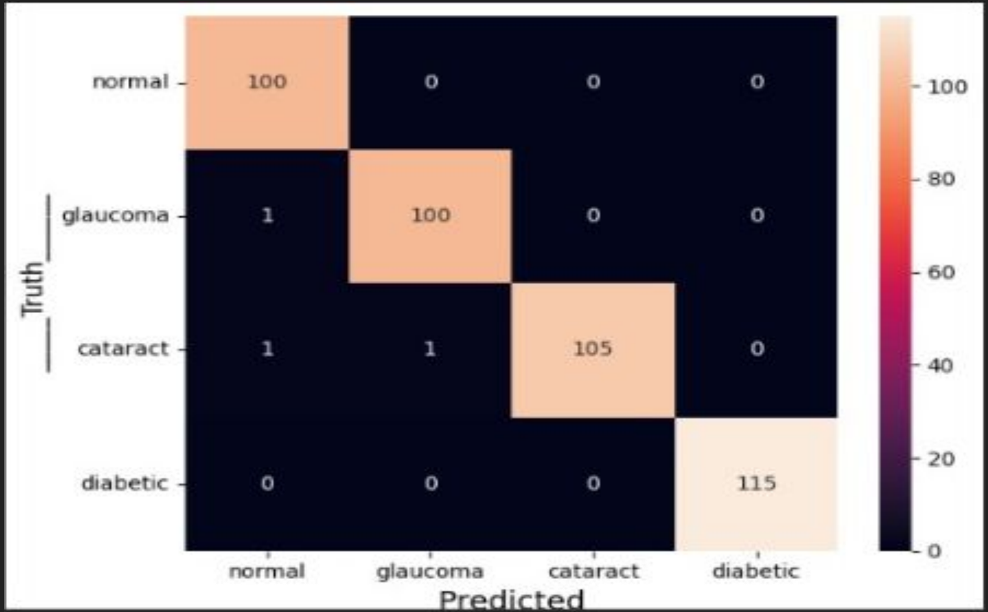
Layer (type)
Input (InputLayer)
Rescale (Rescaling)
Resize (Resizing)
Augment_Layers (Sequential)
base_Model (Sequential)
GlobalAveragePool (GlobalAveragePooling2D)
Dense1 (Dense)
Norm1 (BatchNormalization)
Dropout1 (Dropout)
Dense2 (Dense)
Norm2 (BatchNormalization)
Dropout2 (Dropout)
Output (Dense)

Comparisons



Model Results

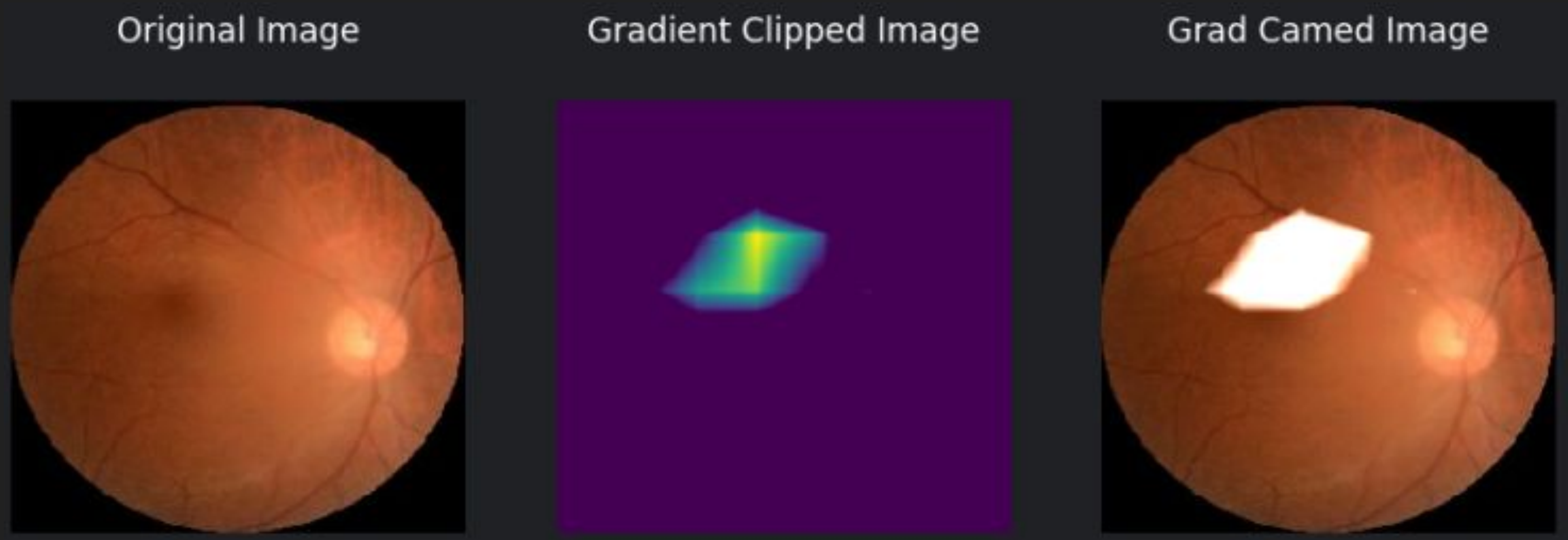




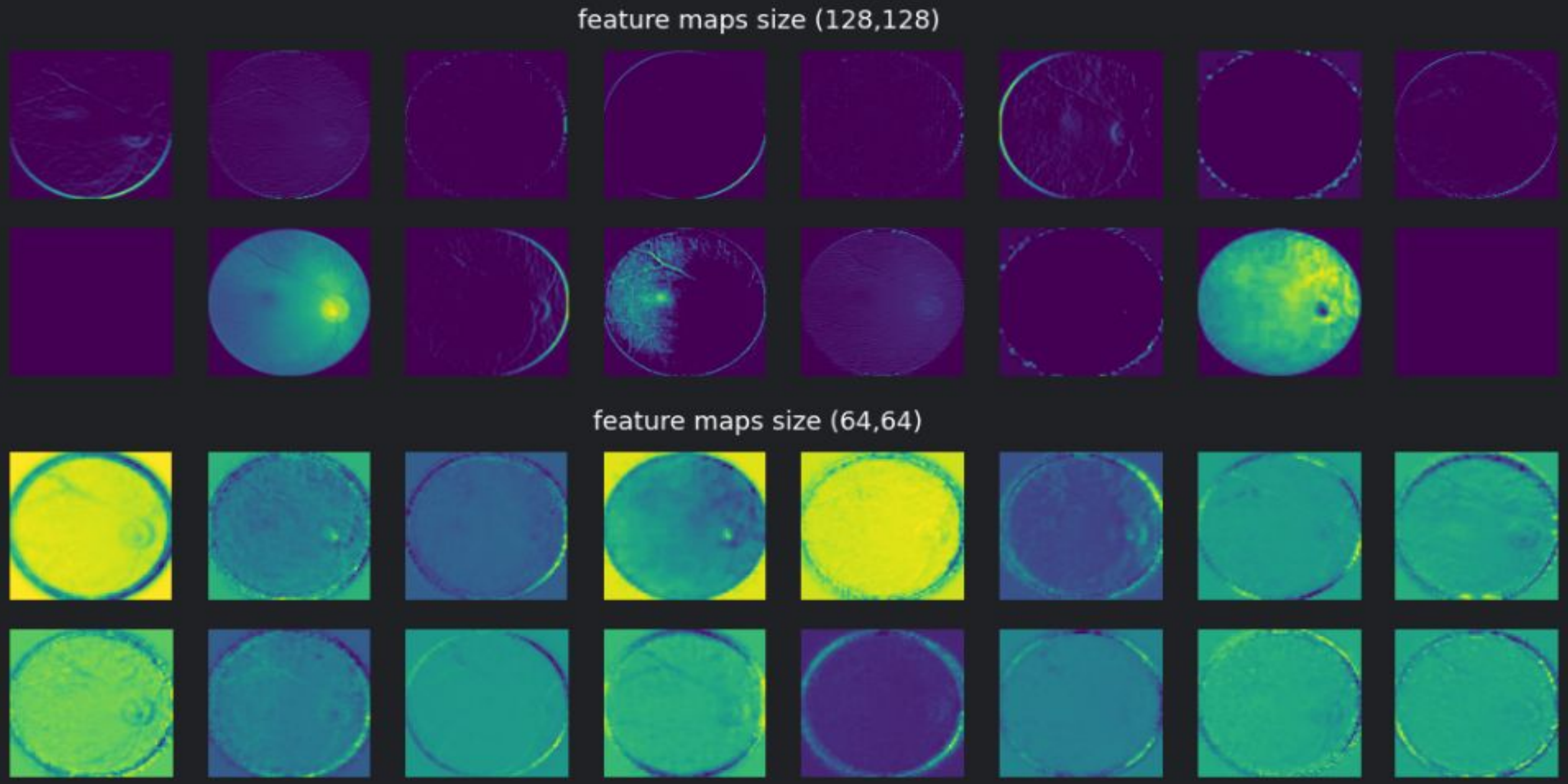
	precision	recall	f1-score	support
0	0.98	1.00	0.99	100
1	0.99	0.99	0.99	101
2	1.00	0.98	0.99	107
3	1.00	1.00	1.00	115
accuracy			0.99	423
macro avg	0.99	0.99	0.99	423
weighted avg	0.99	0.99	0.99	423

GradCam Images Using Trained Models

GradCAM (Gradient-weighted Class Activation Mapping) is a technique in computer vision that visualizes the regions of an image that are important for predicting a particular class.
GradCAM provides valuable insights into the decision-making process of deep learning models, aiding in model interpretation and understanding



Hidden Layers Feature Maps



Future Outlook

- Diverse Dataset and Eye Disease Classification: Expanding dataset diversity for improved classification accuracy.
- Advanced Preprocessing Techniques: Implementing additional preprocessing methods to refine model performance.
- Exploring Python Libraries: Utilizing diverse Python libraries to enhance functionalities.
- Defective Part Localization: Extending classification to include defect localization for precise diagnosis.
- Web Server Deployment: Deploying final models on web servers for easy access by stakeholders.
- Research Paper References: Incorporating a wider range of research papers for informed methodology.
- Comparative Analysis: Comparing results with existing research for validation and improvement insights.

Conclusion

- Exceptional model performance: Achieved over 99% accuracy on all test, train, and validation data without overfitting.

- Effective strategy: Transfer learning combined with fine-tuning proved successful in training pretrained models.

- Vital role of augmentation and preprocessing: Contributed significantly to enhancing model performance

References

- Dataset :
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- Research Papers
  - [2] B.Şener ,E. Sumer , Classification of Eye Disease from Retinal Images Using Deep Learning,December 2023 [Research Paper] .Available: https://www.researchgate.net/publication/376140342_Classification_of_Eye_Disease_from_Retinal_Images_Using_Deep_Learning . [Accessed 20 Feb ,2024]

  - [3] A. Shamsan,Dr. E. Senan Automatic Classification of Colour Fundus Images for Prediction Eye Disease Types Based on Hybrid Features ,11 May,2023 [Research Paper]. Available : https://www.mdpi.com/2075-4418/13/10/1706.[Accessed 21 Feb, 2024]

  - [4] Dr.T. Nazir, Dr. A. Irtaza,Retinal Image Analysis for Diabetes-Based Eye Disease Detection Using Deep Learning,5 Sept 2020 [Research Paper]. Available : https://www.mdpi.com/2076-3417/10/18/6185 .[Accessed 26 Feb, 2024]