Diabetic Retinopathy Detection

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Project Guide

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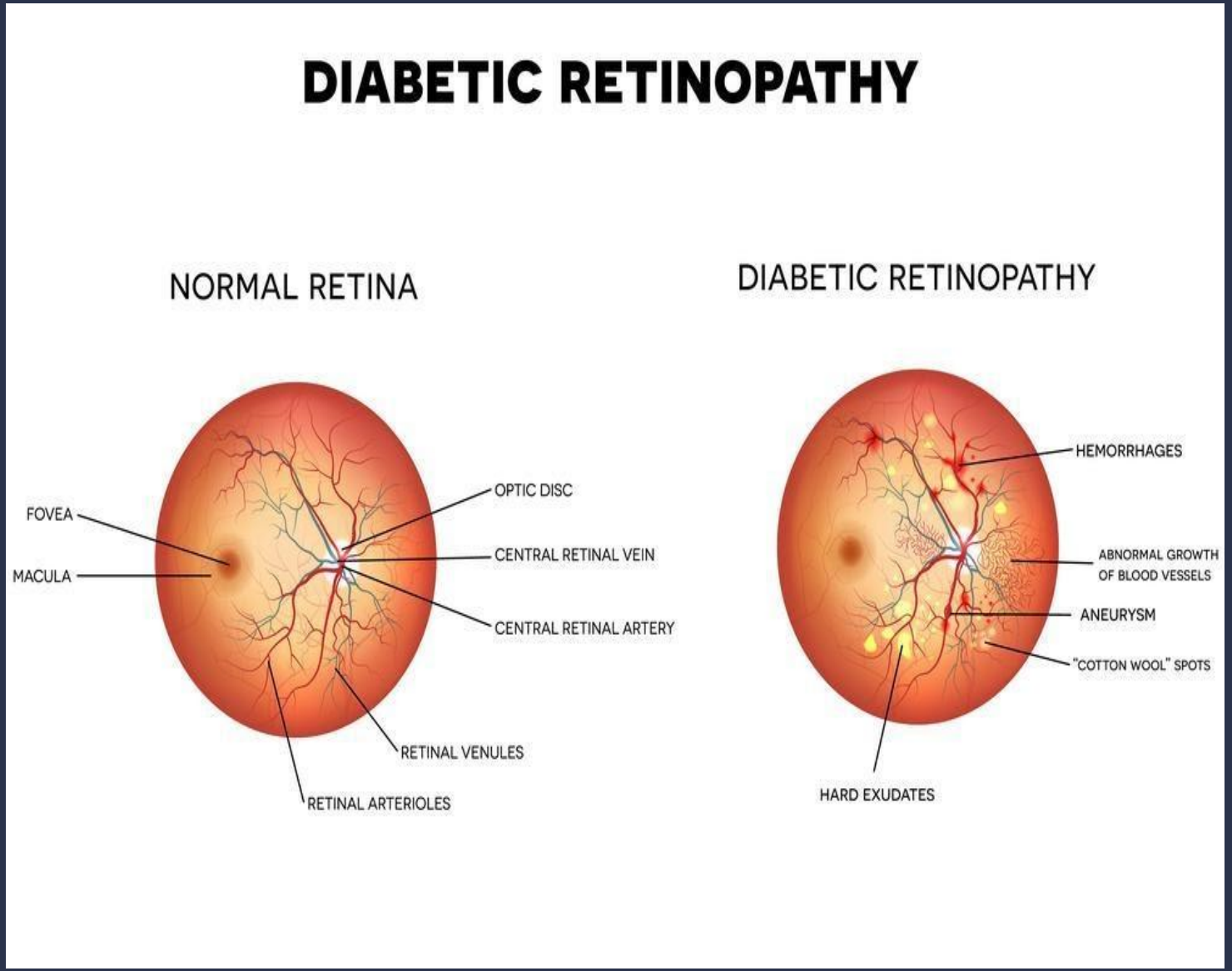
Overview

- Problem Definition
- Motivation/Scope
- Dataset Collection and Description
- Literature Review : Existing systems, Methodologies and Algorithms
- System Architecture
- Design Specifications
- Software and Hardware Requirements
- Implementation- Analysis of IP algorithms & Classification Algorithms
- Demonstration
- Research Paper Publication Status

What is Retinopathy?



Motivation/ Scope

- The current state of DR screening is based on assessment of color fundus photographs by a retina specialist leaving a large proportion of patients undiagnosed and therefore receiving medical help too late.
- The objective is to bring portable, easy to administer, reliable, retinal screening to primary doctors' offices and health clinics.
- Initial retinal images taken with mobile cameras allow a first screening and first emergency decisions about the patient in hard to reach areas where there may be an absence of any ophthalmologist.

Literature Survey

Characteristics	PAPER 1	PAPER 2	PAPER 3	PAPER 4	PAPER 5
Dataset	Live dataset using fundus lens	Dataset from Kaggle	Images taken from a hospital	Already existing dataset.	Already existing dataset.
Methodology	Image processing and Deep Learning	Image processing and Deep Learning	Images processing and Machine Learning	Images processing and Machine Learning	Image processing and Deep Learning
Algorithms	ANN Grayscale, Resizing, DWT	MobileNets - Neural network Model. Averaging, Resizing	SVM,CNN CLAHE, Adaptive Threshold method	SVM ,KNN Gaussian Blur, DWT	SVM Segmentation, Averaging, AHE
Accuracy	~63%	73.3	89.4%	~82%	79.3%

Data Collection and Working

Mount the Fundus camera

Use the auxiliary plus lens and the camera in the initial external eye view position.

Focus by eye on the monitor/screen and take the picture.

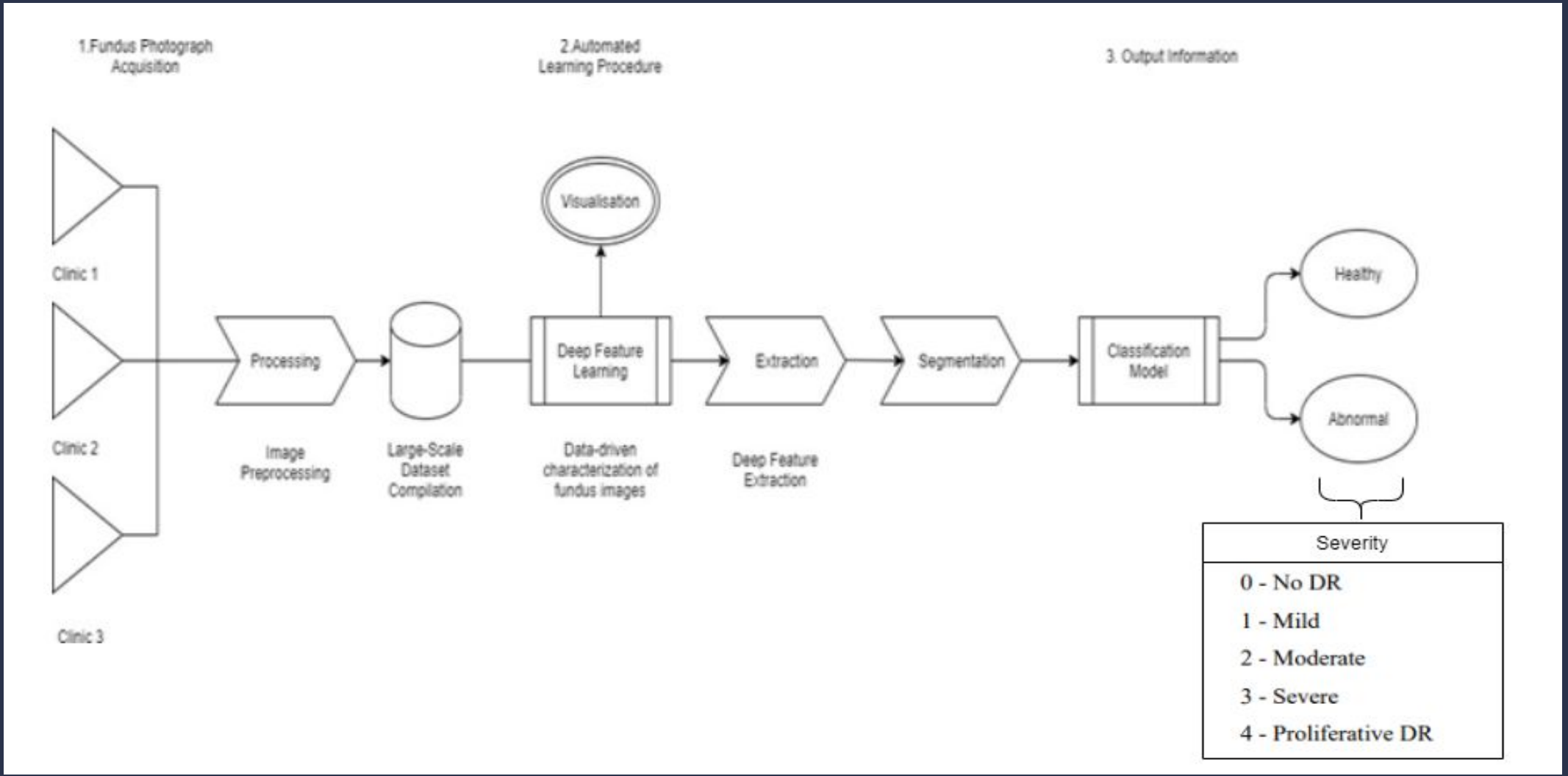
Images are then processed by our system, after which the results identify the patient as DR or Non-DR. If DR is present, severity level is predicted.

Dataset Overview

- Data set consists of images divided in 5 categories: Normal,Mild NPDR,Moderate NPDR, Severe NPDR,Proliferative
- 300 -Training, 90- Testing images
- Images were taken from Aditya Jyot Eye Hospital at Wadala
- Images are the actual retinal images taken from a fundus camera

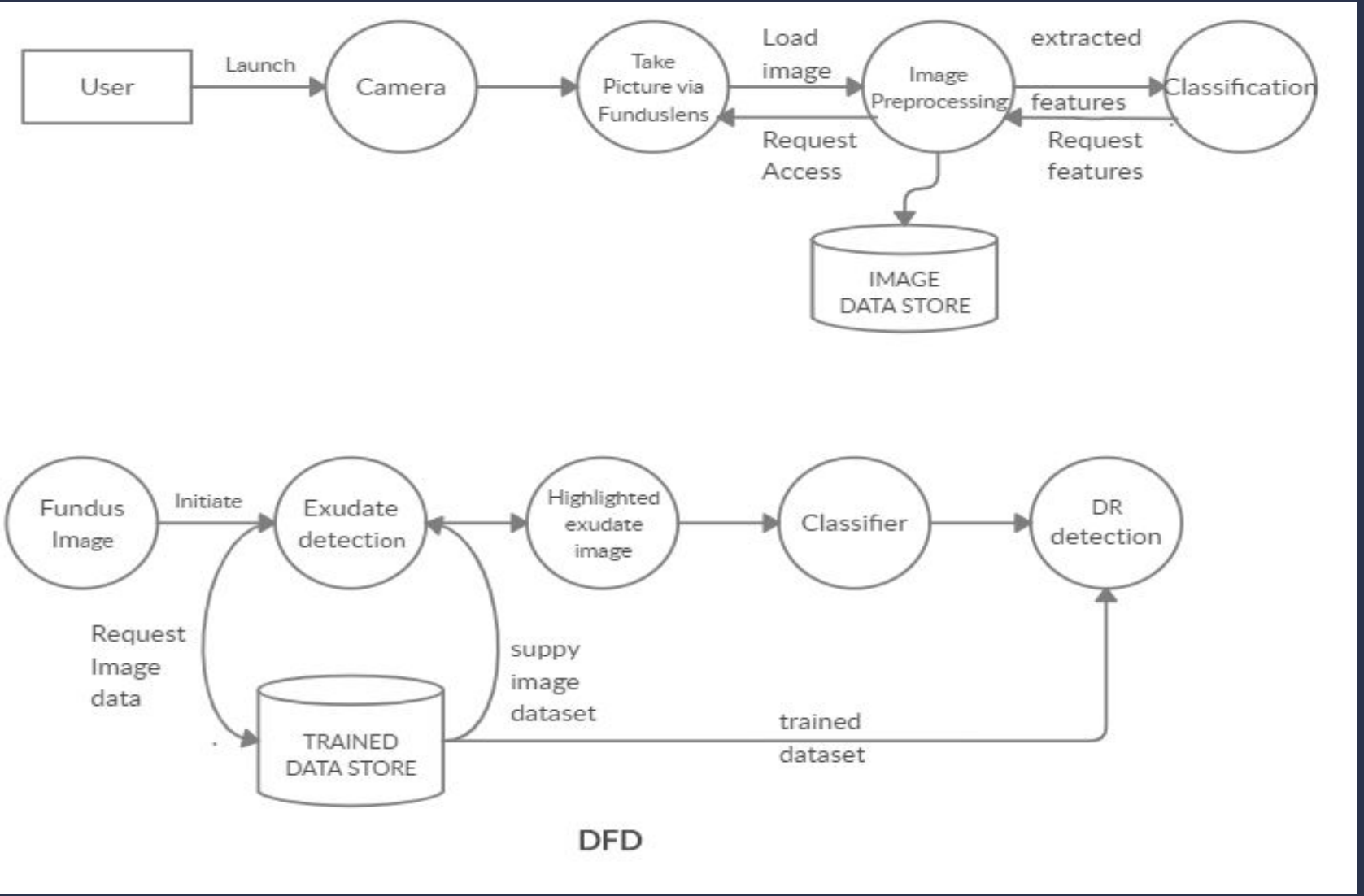


SYSTEM ARCHITECTURE



DESIGN SPECIFICATIONS

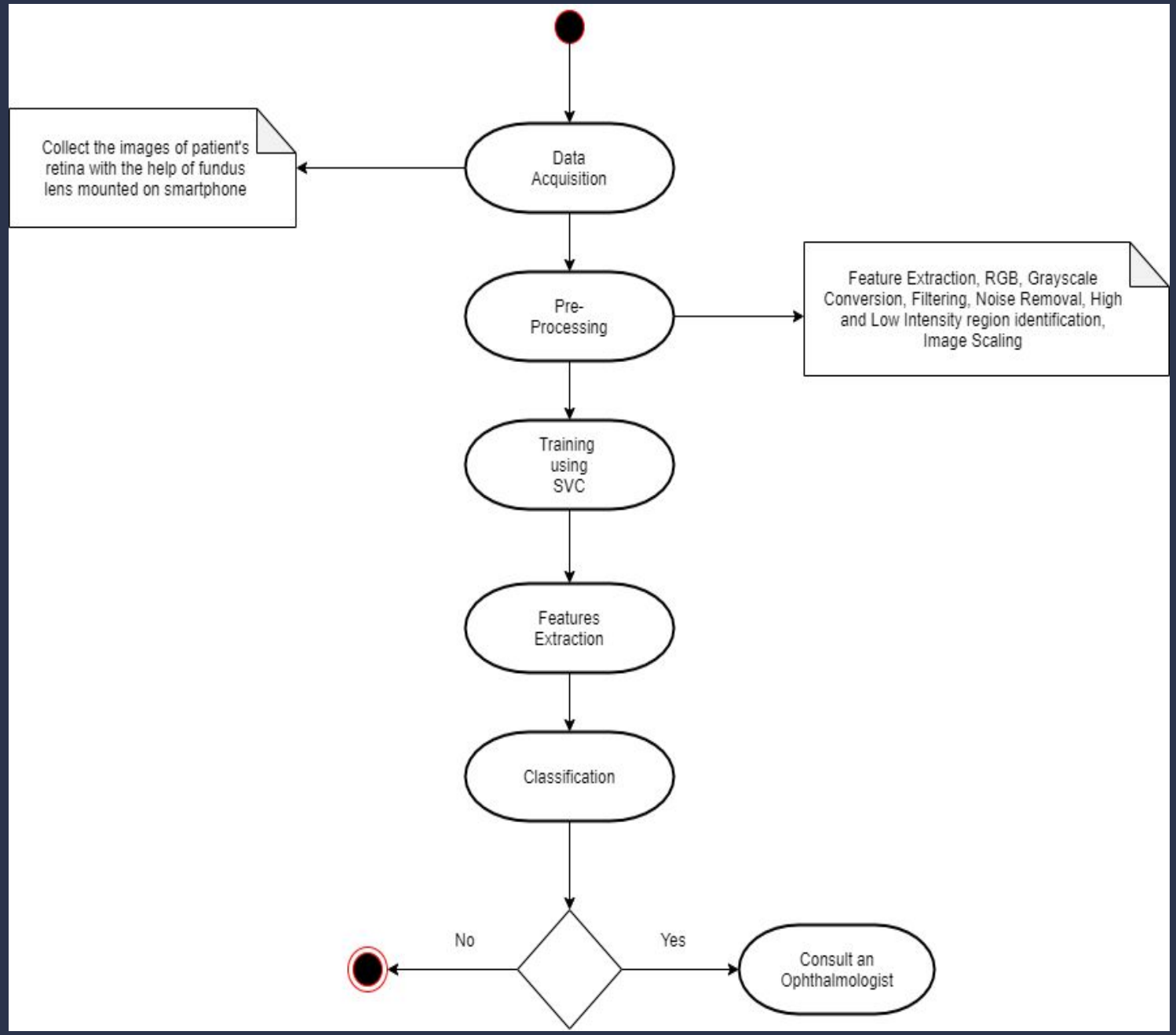
Data Flow Diagram (DFD)



DFD

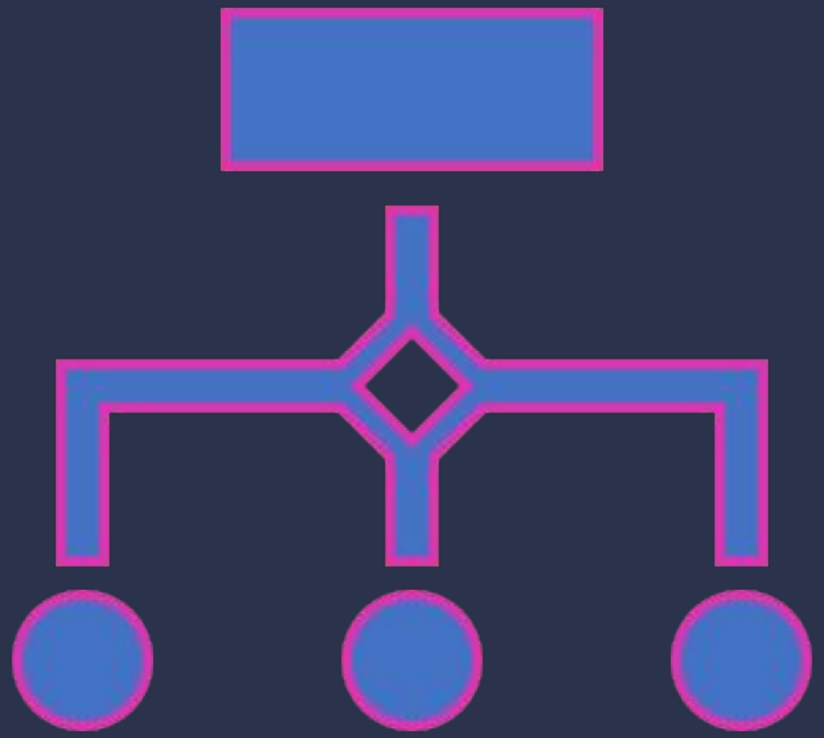
Activity Diagram

(Current Flow)



Classification of DR into Levels

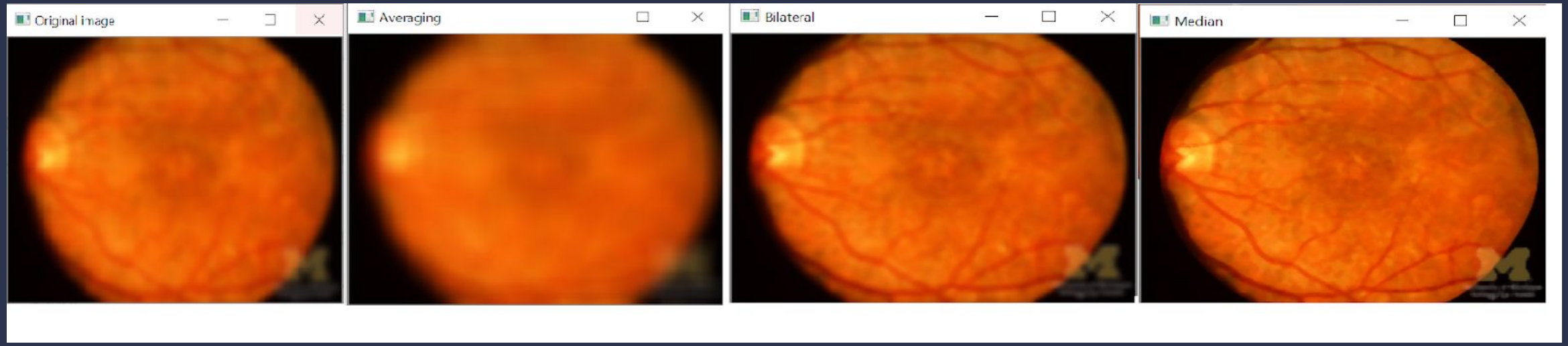
- Mild Non-Proliferative
- Moderate Non-Proliferative
- Severe Non-Proliferative.
- Proliferative.



Implementation

Analysis of IP Techniques

- Discrete Wavelet Transform
- Gaussian Filtering
- Averaging
- Resizing
- Adaptive Histogram Equalization
- Median Blurring
- Grayscale Conversion



Original Image

Averaging

It allows you to selectively smooth the image background, while leaving the bright areas untouched.

Bilateral Filtering

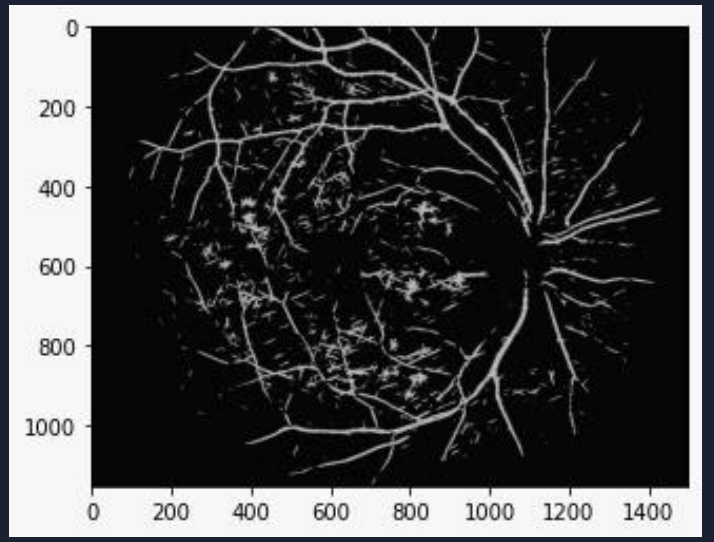
BLF replaces the dark pixels by an average of the dark pixels in its vicinity while ignoring bright pixels and *vice versa*.

Median Filtering

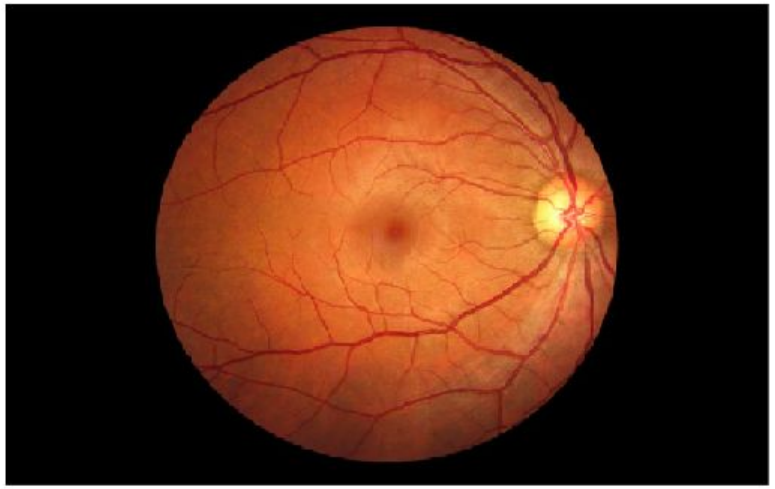
It distinguishes out-of-range isolated noise from legitimate image features such as edges and lines.

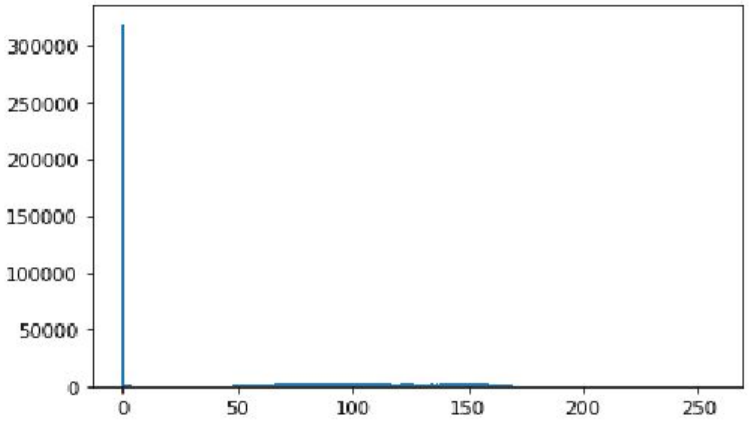
Gaussian Filtering

- Most effective for removing noise
- It softened the image so the features such as veins and exudates stand out more clearly.
- Produced a rationally symmetric image.
- Enhanced image structures at different scales



Histogram Equalization

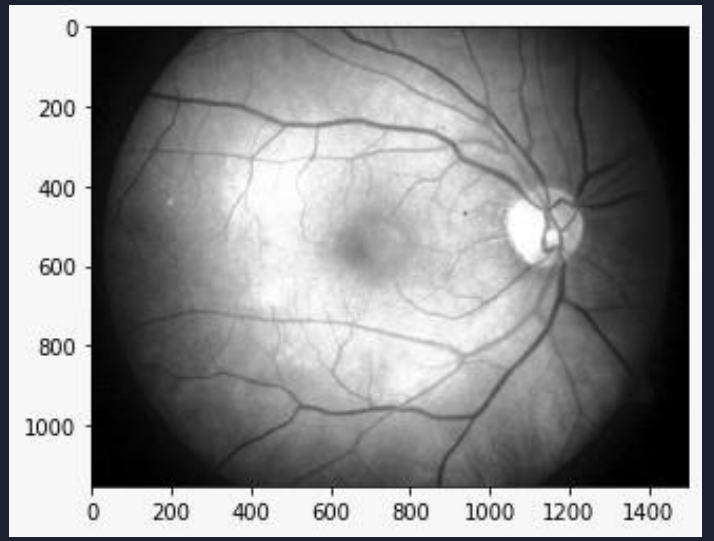




Adaptive Histogram Equalization

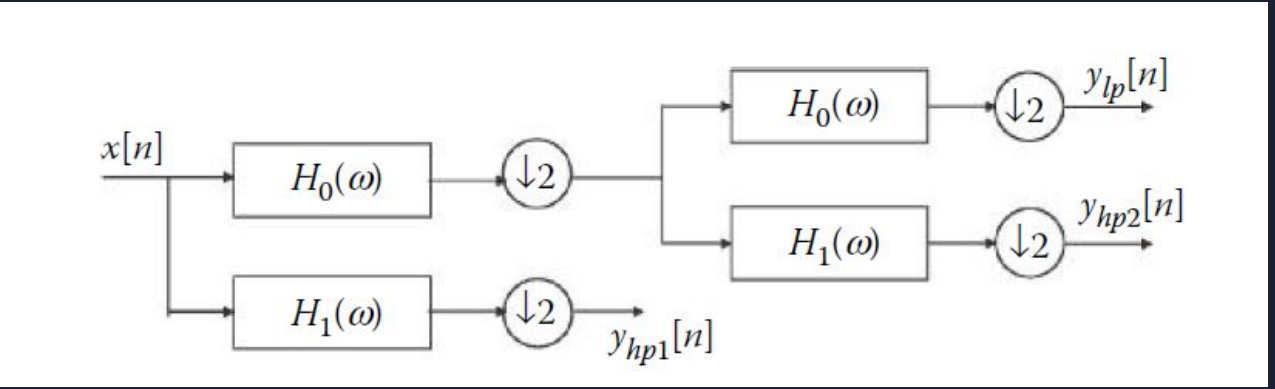
- Improved contrast in images.
- Adaptive Histogram Equalization differed from ordinary histogram equalization as the adaptive method computed several histograms, each corresponding to a distinct section of the image
- It provided better improvement in the local contrast and enhanced the definitions of edges in each region of an image.

*rejected Histogram Equalization over AHE

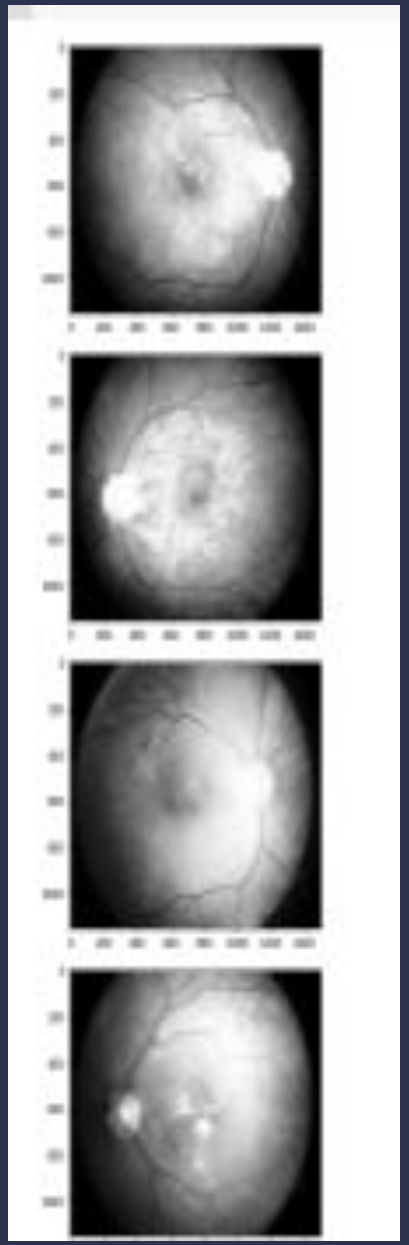


Discrete Wavelet Transform

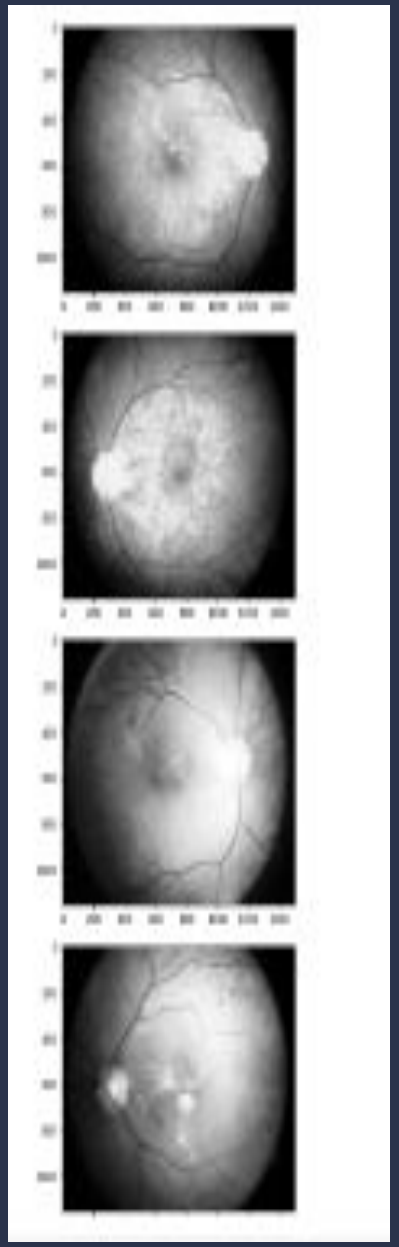
- The discrete wavelet transform (DWT) is a computerized technique to compute fast wavelet transform of a signal.
- It is any wavelet transform for which the wavelets are discretely sampled.
- It captures both frequency and location information.
- It is used for signal coding, to represent a discrete signal in a more redundant form.



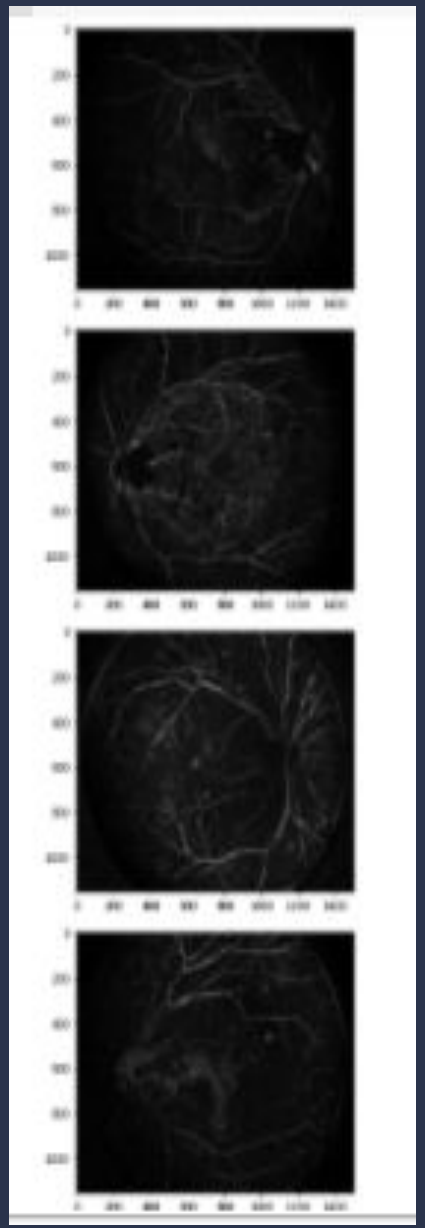
Original Image



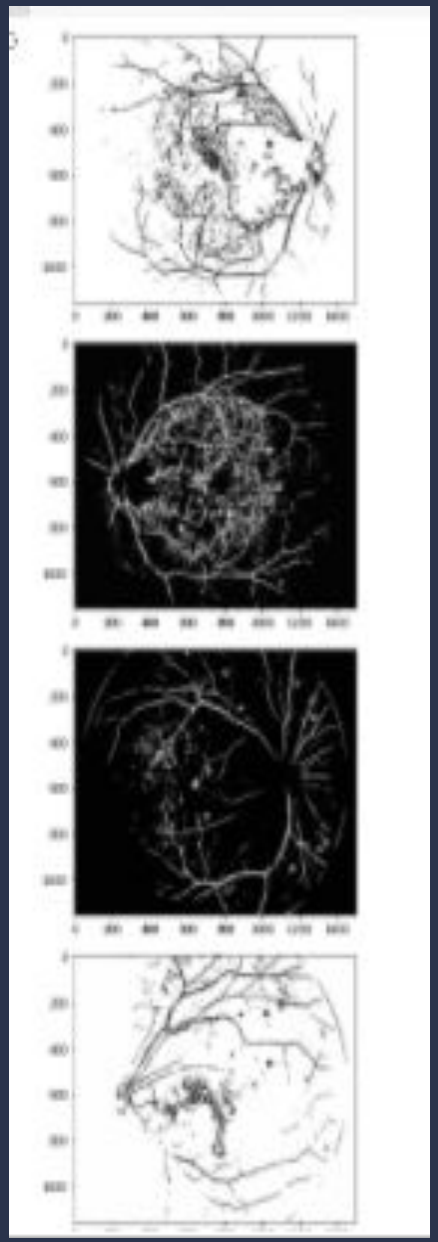
AHE



DWT

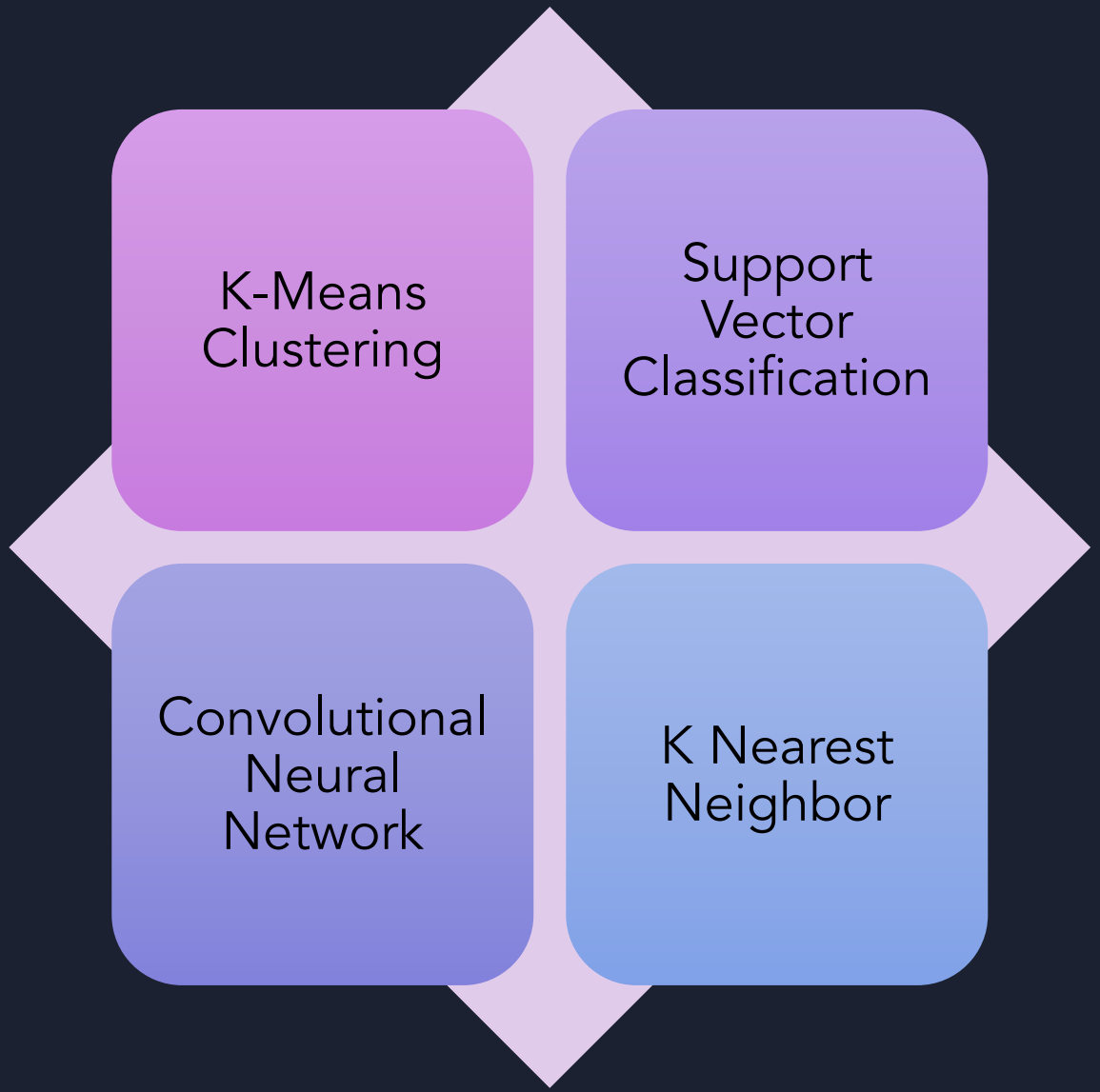


Gaussian Filtering



Segmentation

Analysis of Algorithms



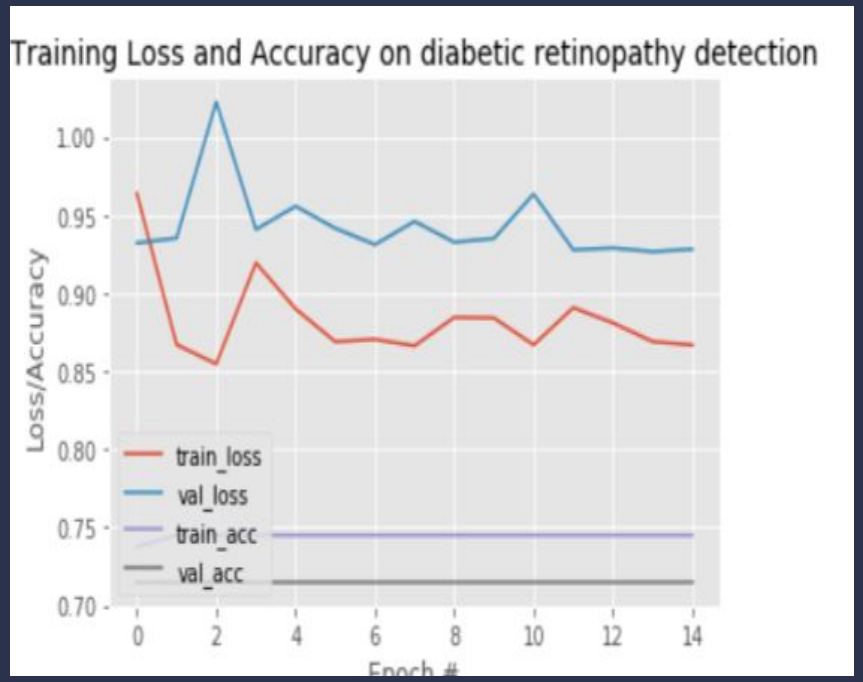
Segmentation

PARTITIONS THE IMAGE INTO VARIOUS REGIONS

SIMILARITY DETECTION APPROACH

K MEANS ALGORITHM

CNN Analysis

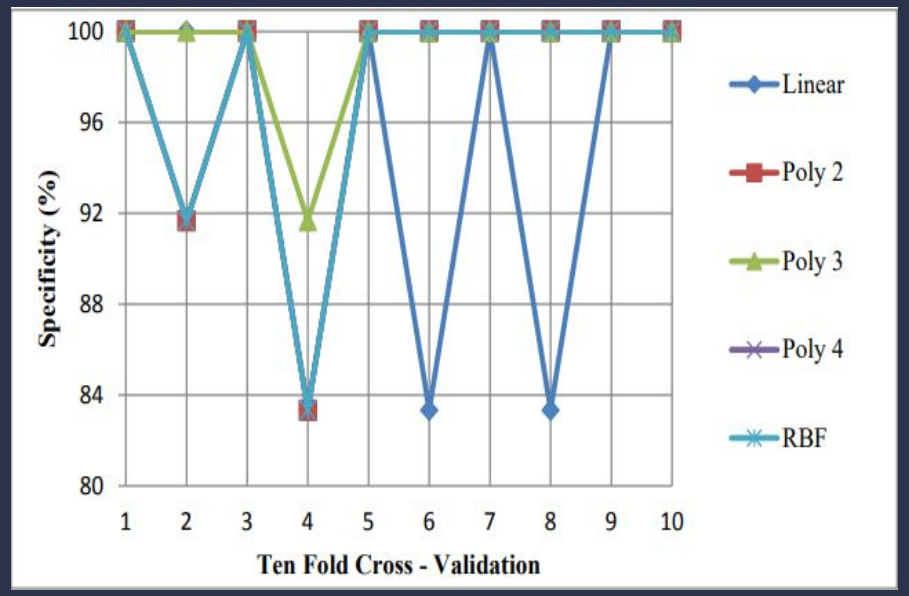


Low Accuracy

It trained same batch over and over because of less data

Network was not able to differentiate **between DR and Non DR**

SVM Analysis




```
from sklearn.metrics import accuracy_score
accuracy_score(Y,y_pred)
```

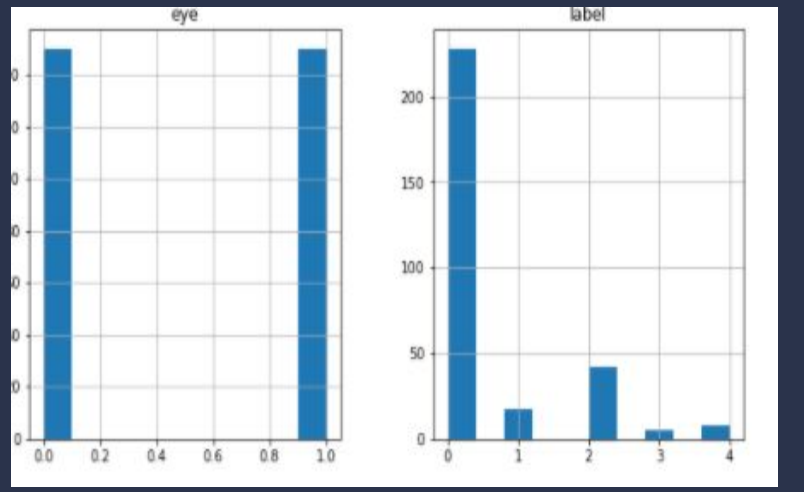
```
0.9438202247191011
```

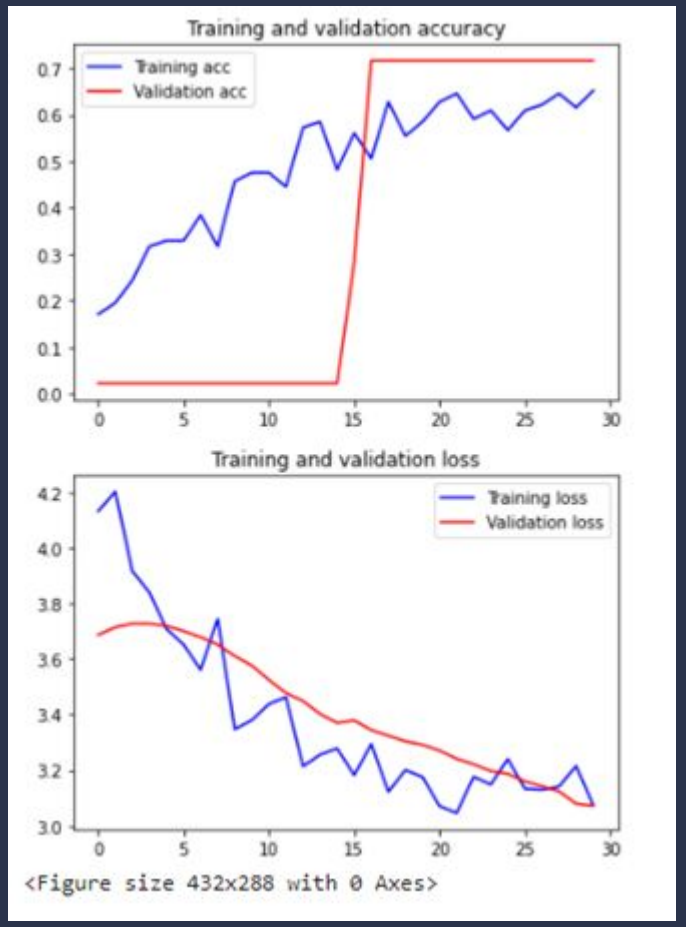
High Accuracy

"Rbf" kernel had maximum Accuracy

Model was able to differentiate **between DR and Non DR images**

Severity detection

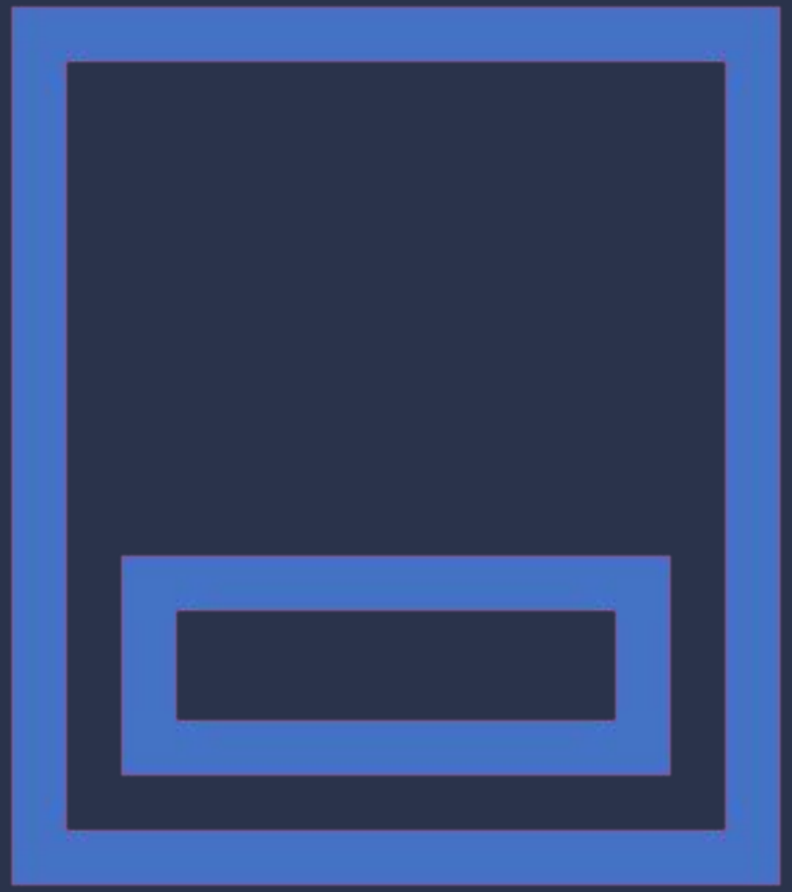




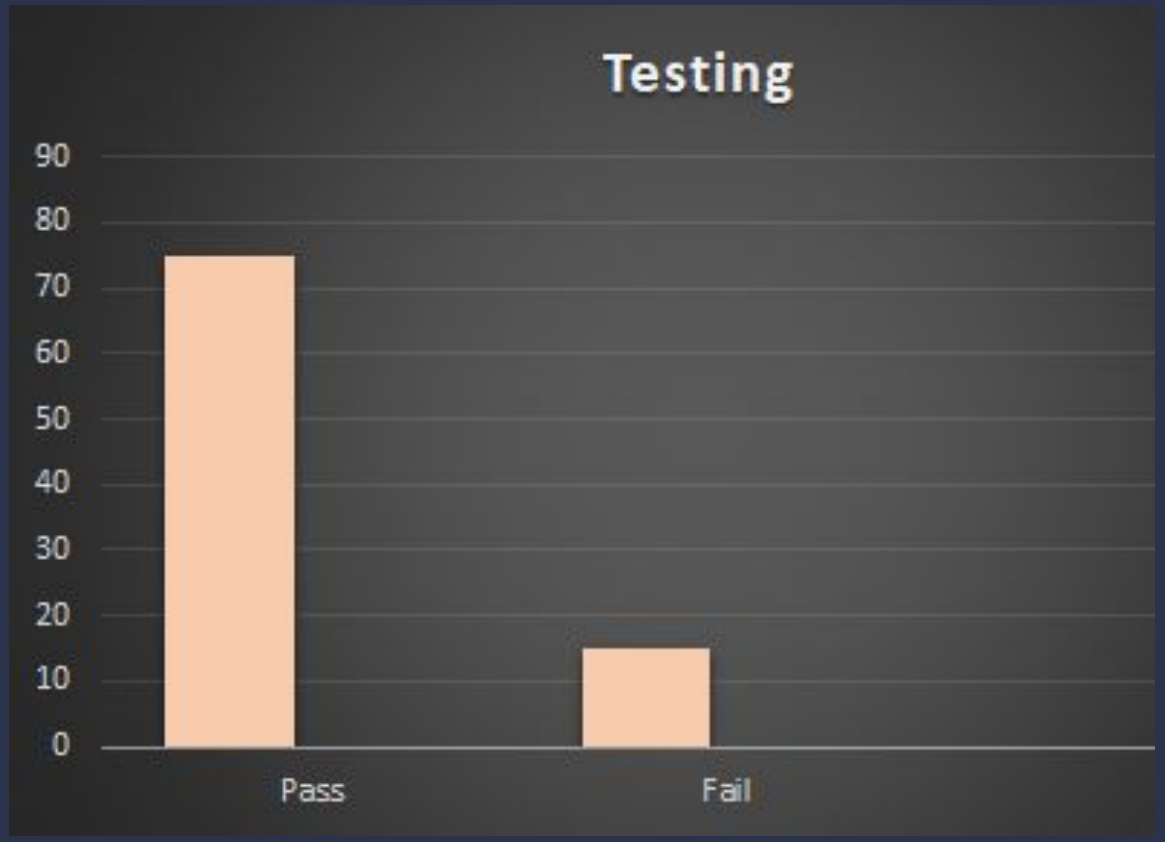

```
[[0.507326   0.19509982 0.2114867  0.05499221 0.0310952 ]
 [0.5232818  0.19933285 0.18078978 0.06141635 0.03517921]
 [0.51628155 0.2007876  0.2052138  0.04679843 0.03091857]
 [0.4910919  0.20349878 0.22236514 0.04795152 0.03509268]
 [0.49375233 0.21009366 0.21352178 0.04846888 0.03416338]
 [0.50027174 0.20343864 0.21989743 0.04789121 0.02850093]
 [0.48094258 0.21734026 0.21554627 0.05695172 0.02921925]
 [0.50881004 0.18306902 0.22242483 0.04932028 0.03637569]
 [0.5469381  0.19836885 0.16103469 0.06058951 0.03306893]
 [0.49105206 0.2107157  0.2190611  0.04779958 0.03137144]
 [0.48737234 0.2094518  0.22218294 0.05159434 0.02939852]
 [0.5088448  0.20769912 0.20389977 0.05003176 0.02952448]
 [0.5206798  0.19893198 0.19607794 0.05442707 0.02988321]
 [0.4833143  0.21616782 0.22268799 0.0488681  0.02896188]
 [0.47254977 0.23064539 0.19457819 0.0650822  0.03714438]
 [0.49770993 0.19953145 0.21621887 0.04840791 0.03813187]
 [0.49857113 0.19631992 0.22315958 0.05106536 0.03088395]
 [0.47563797 0.25772634 0.15826961 0.0674705  0.0408956 ]
```

Accuracy: ~83.3 %

Demonstration



Testing Results



Total Test Cases : 90

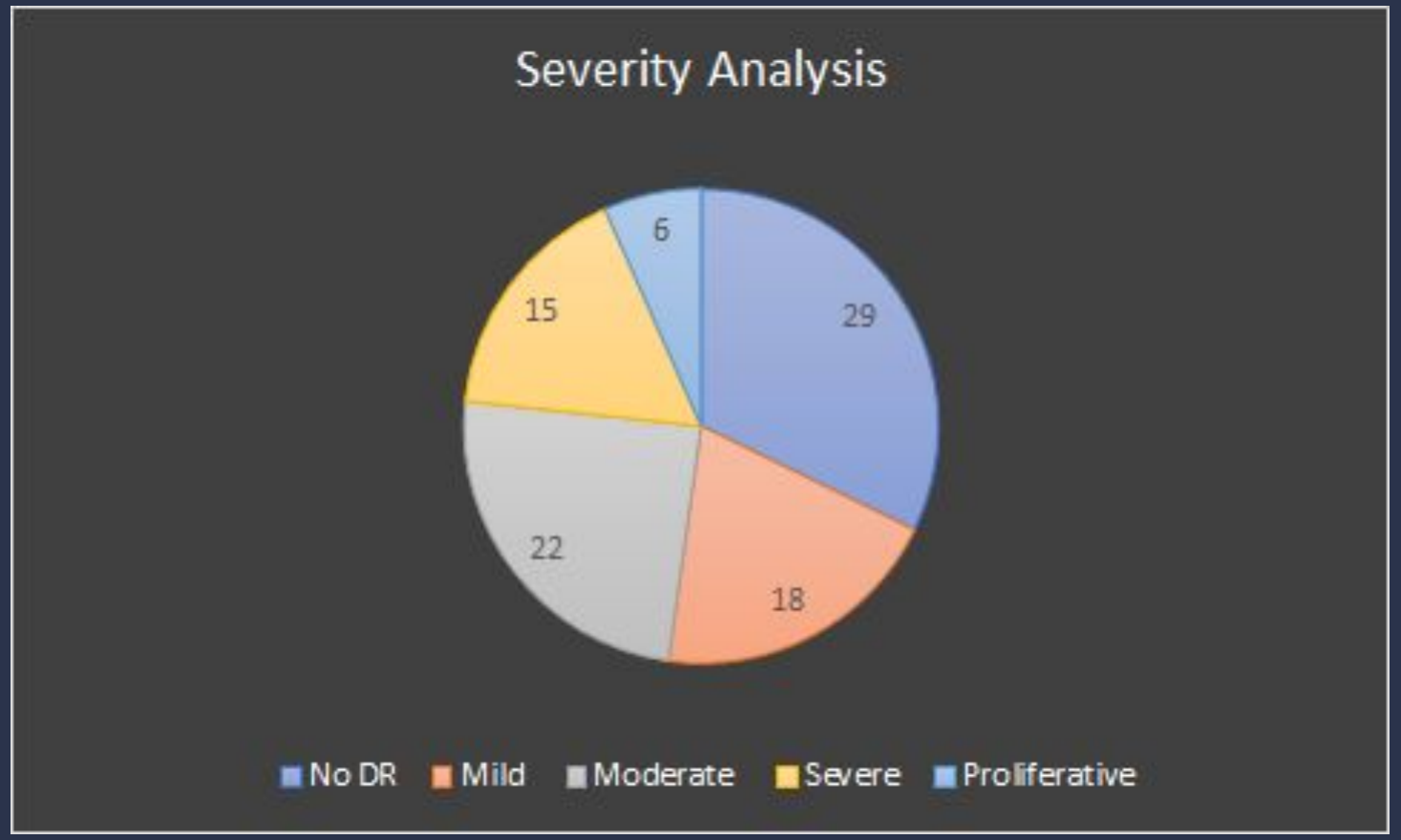
Pass : 75

Fail : 15

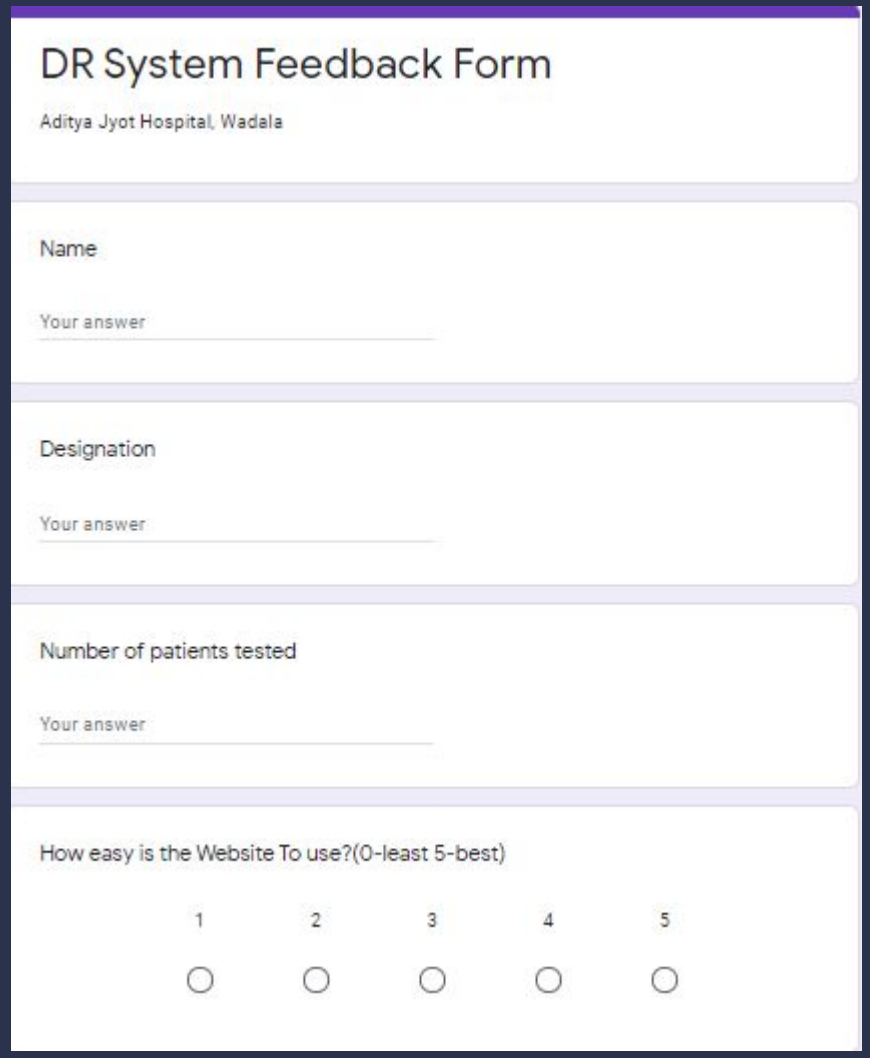
Testing Methods Used

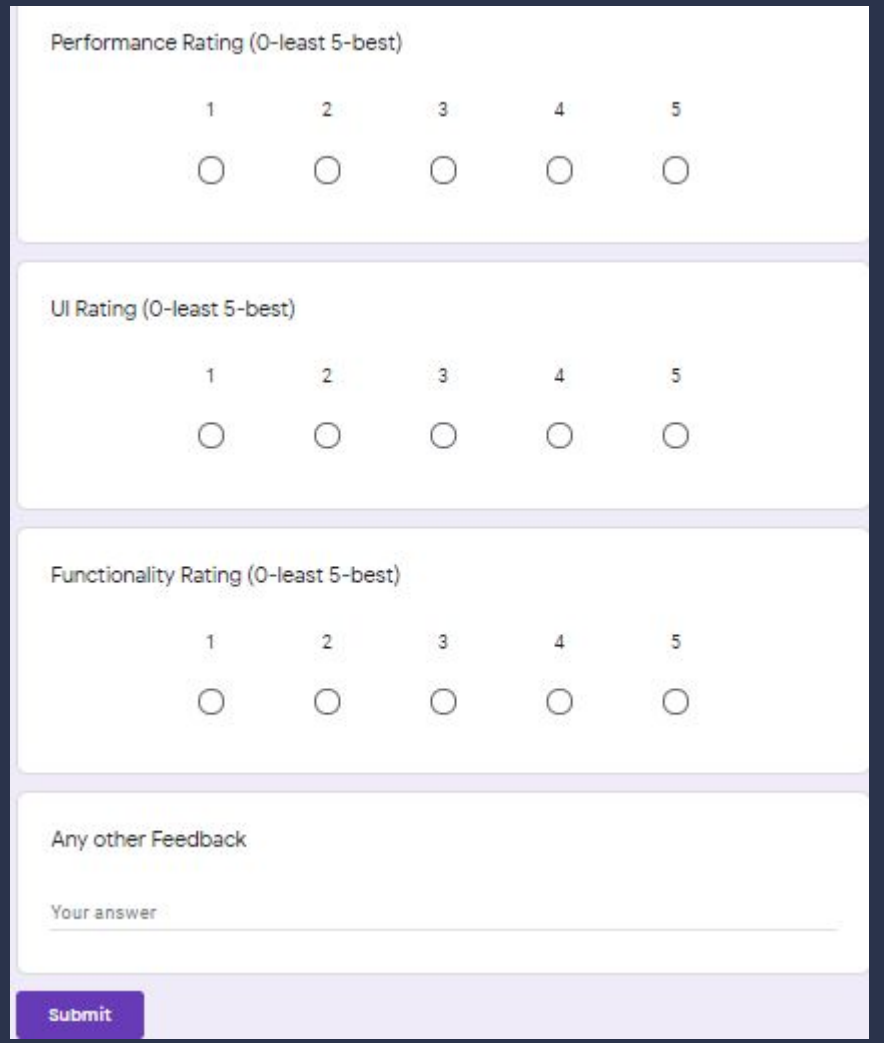
- Functionality Test
- Integration Test
- UI test
- Usability Test

Severity Analysis

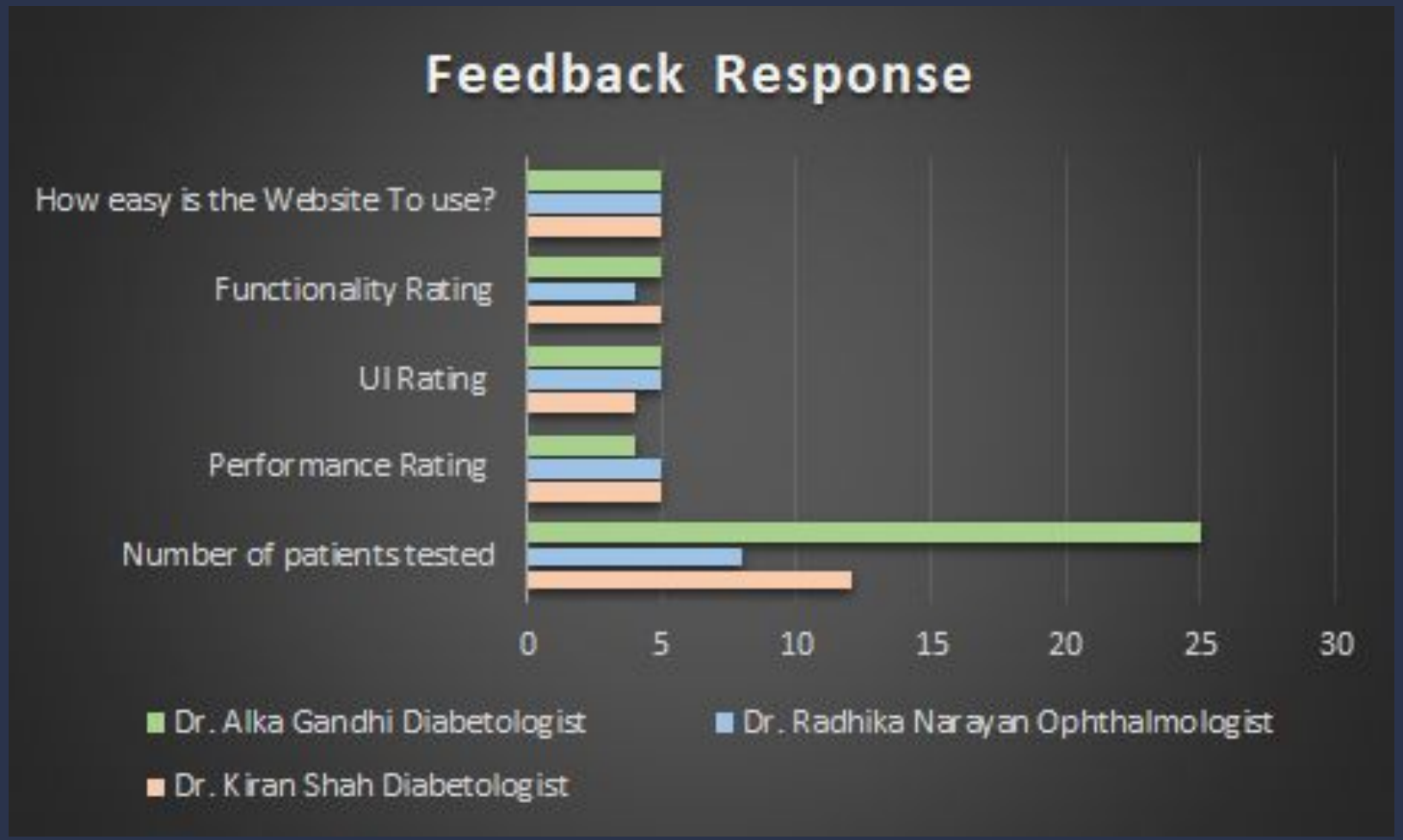


Feedback Form





Response Analysis



Paper Publication

PUBLICATION	STATUS
IJAMTES *(paper 1)*	Published
DJ ASCII	Accepted
GUCON IEEE International Conference *(paper 2)*	Submitted

Thankyou