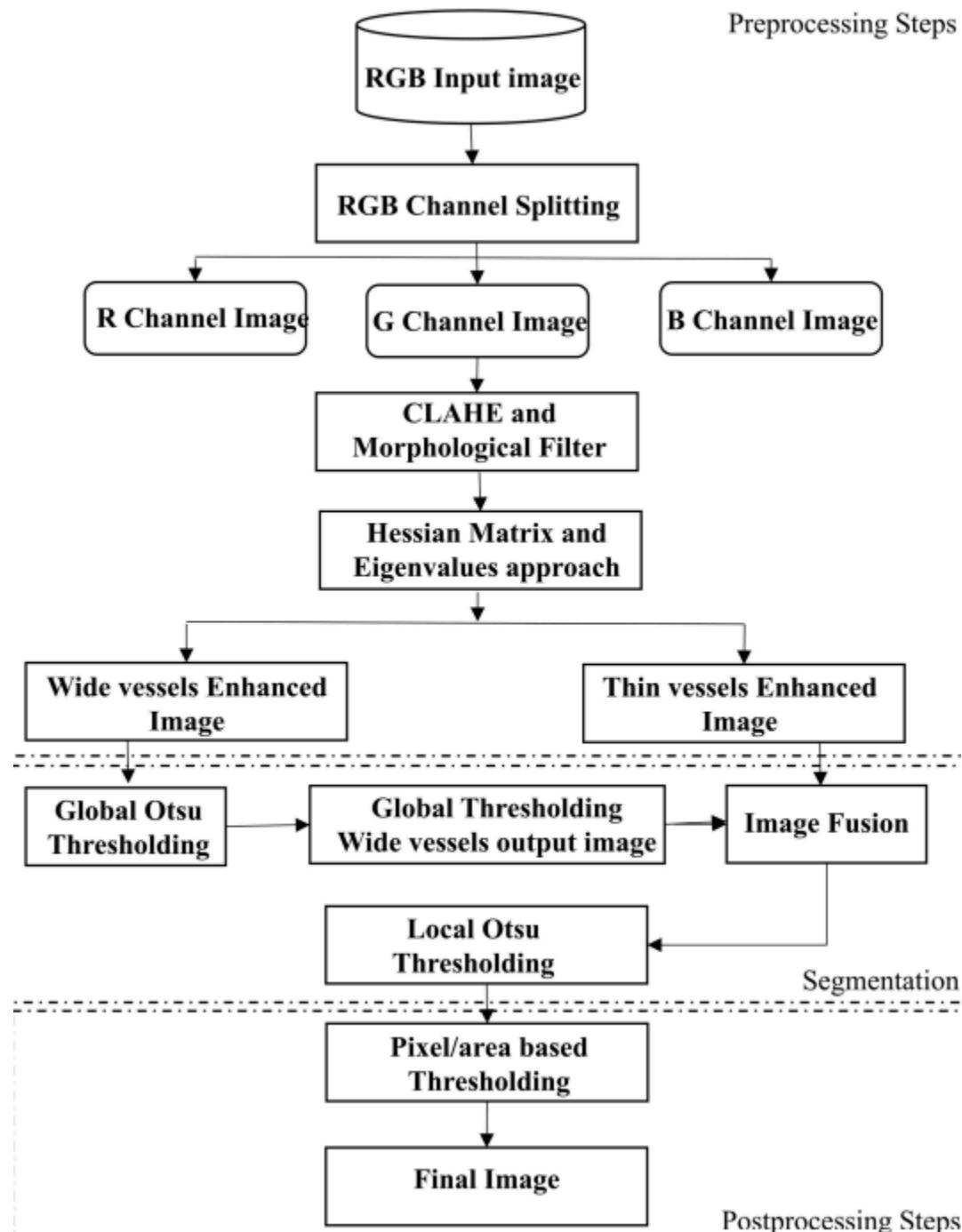


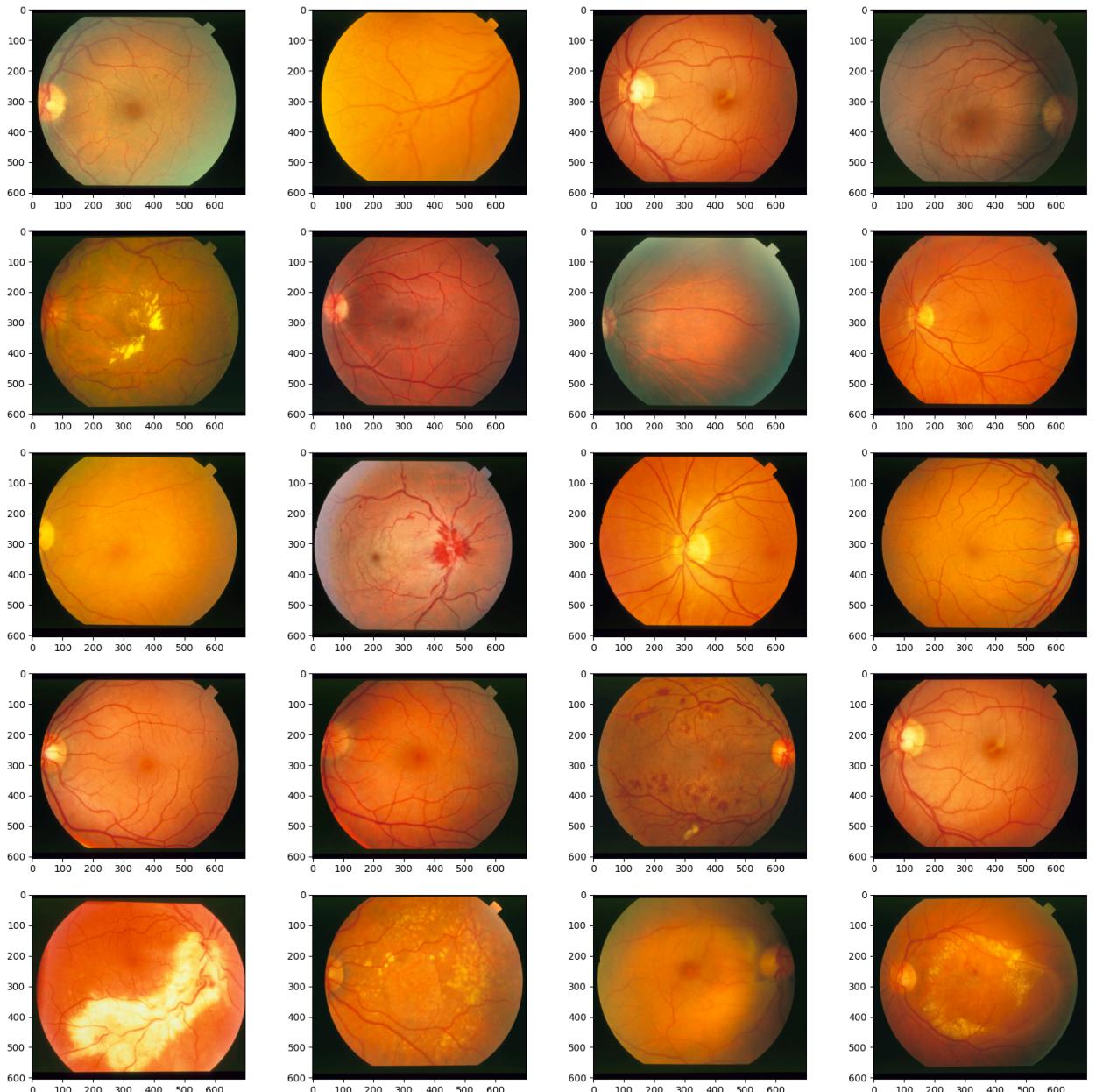
Enhancing Ocular Disease Diagnosis in Fundus Images (CSE499B)

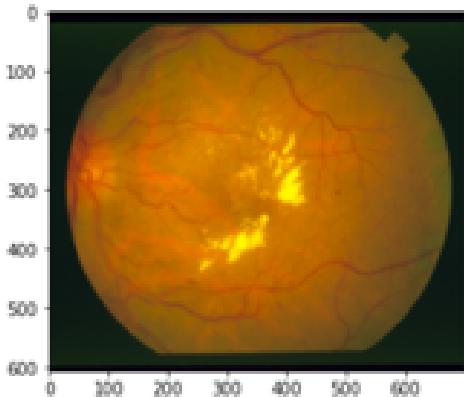
Flow Chart:



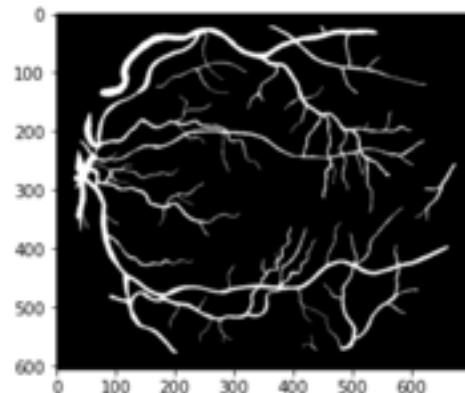
Dataset:

- Total 40 images
- 20 hand labeled vessel network images





Input Image

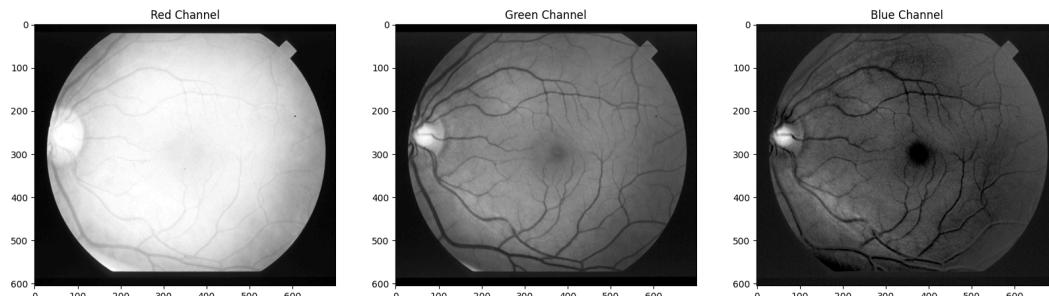


Hand labeled vessel network
Provided by experts

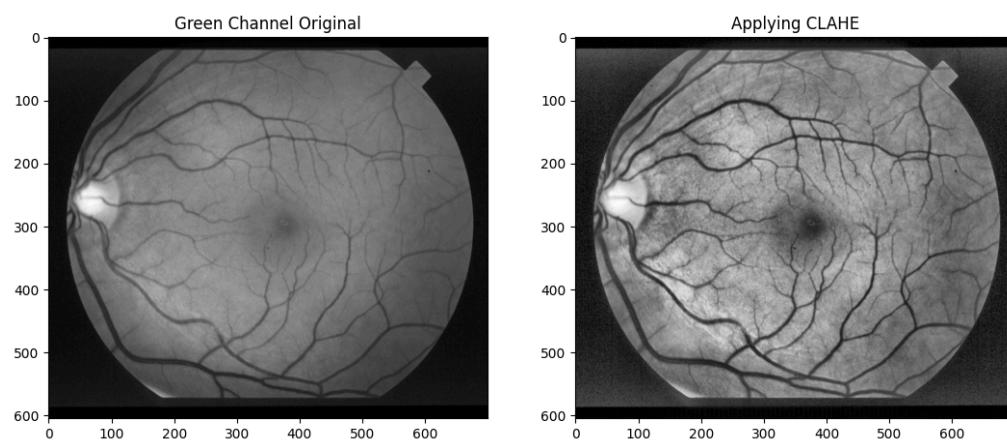
Methodology

Preprocessing:

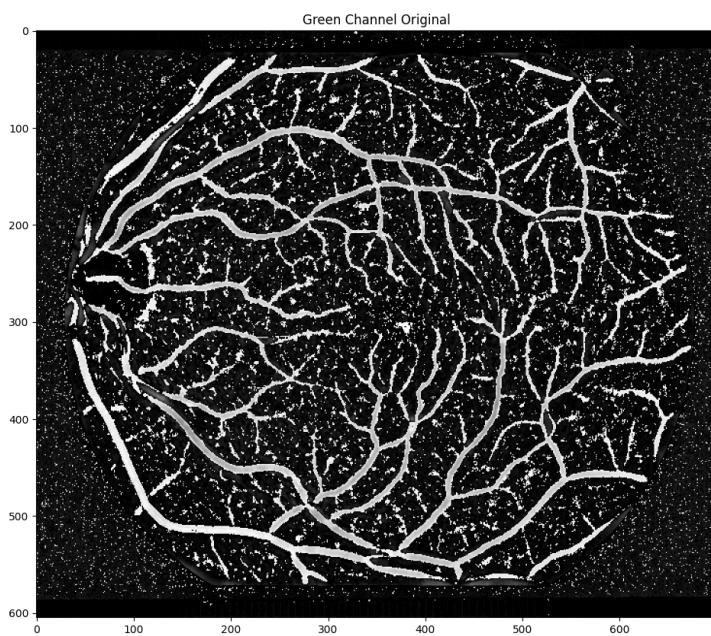
RGB splitting :



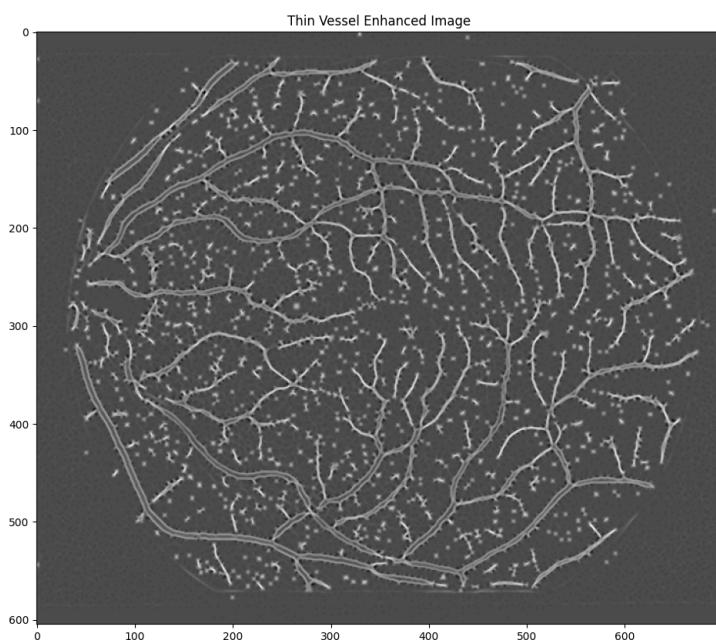
G channel > CLAHE :



Morphological filter :



Hessian Matrix :



Segmentation:

Global otsu thresholding :

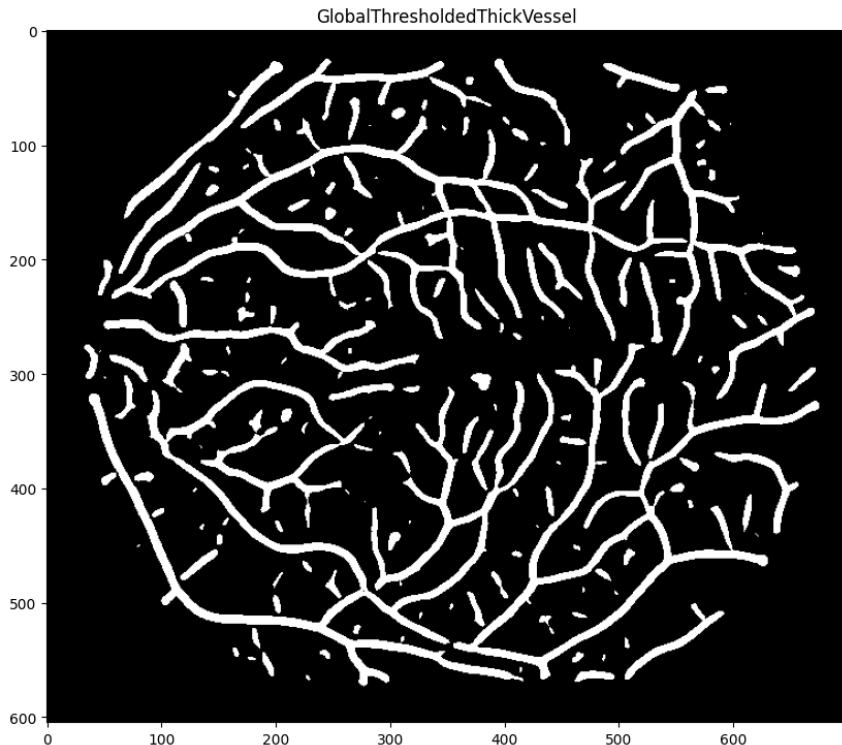
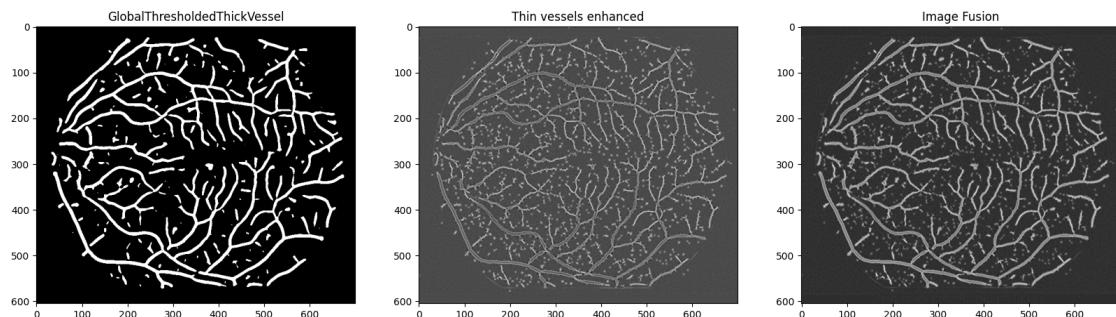
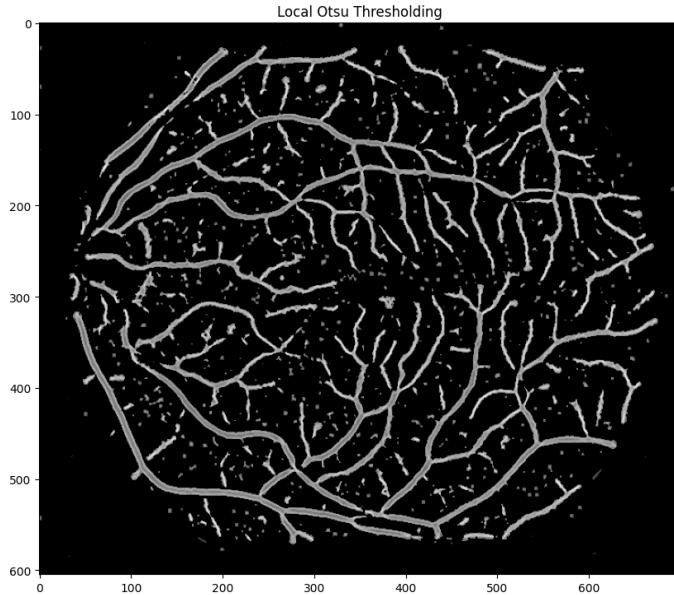


Image fusion :

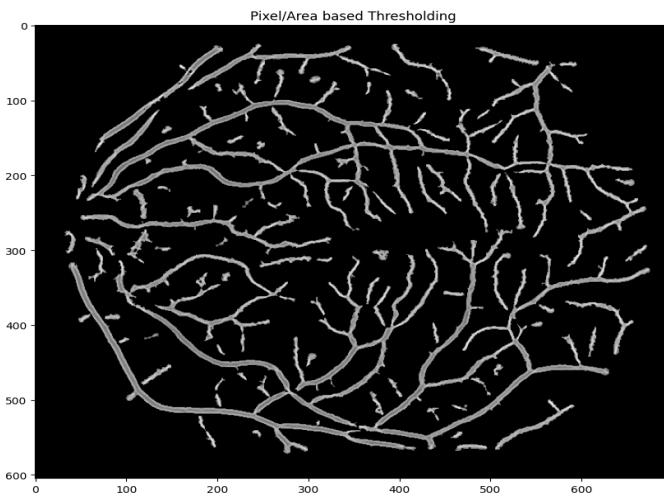


Local otsu thresholding :



Post processing:

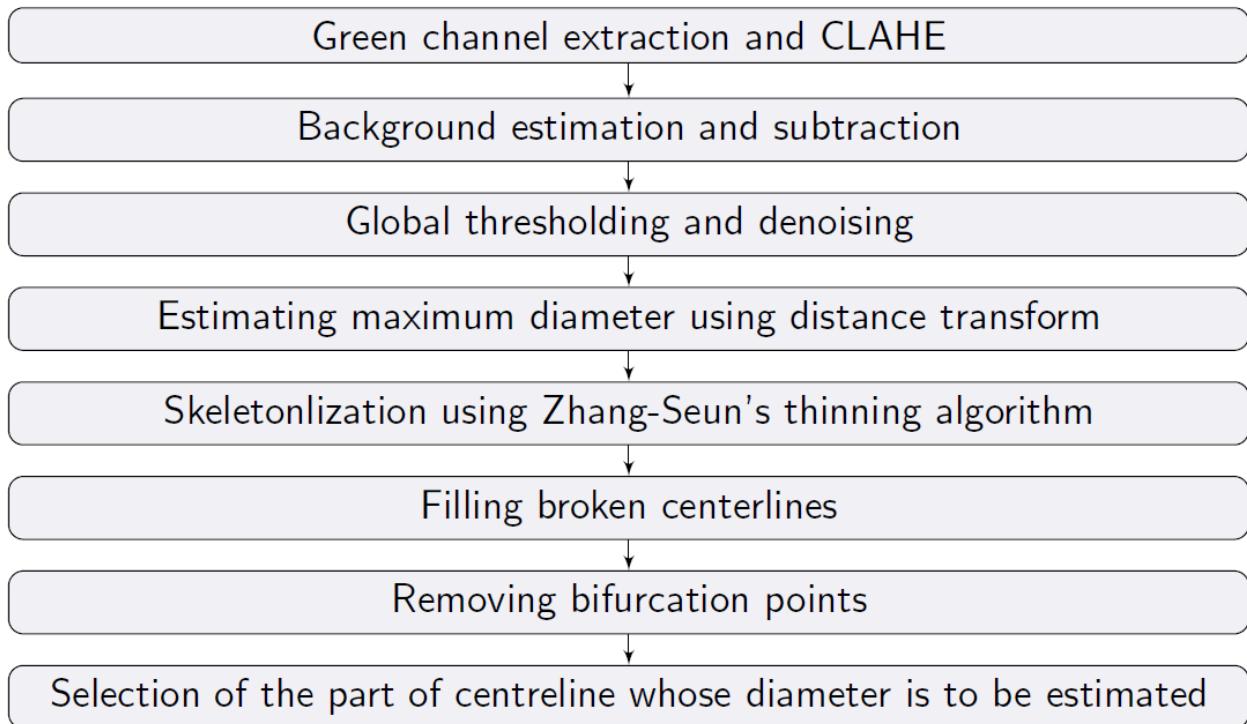
- Pixel/ area based thresholding :



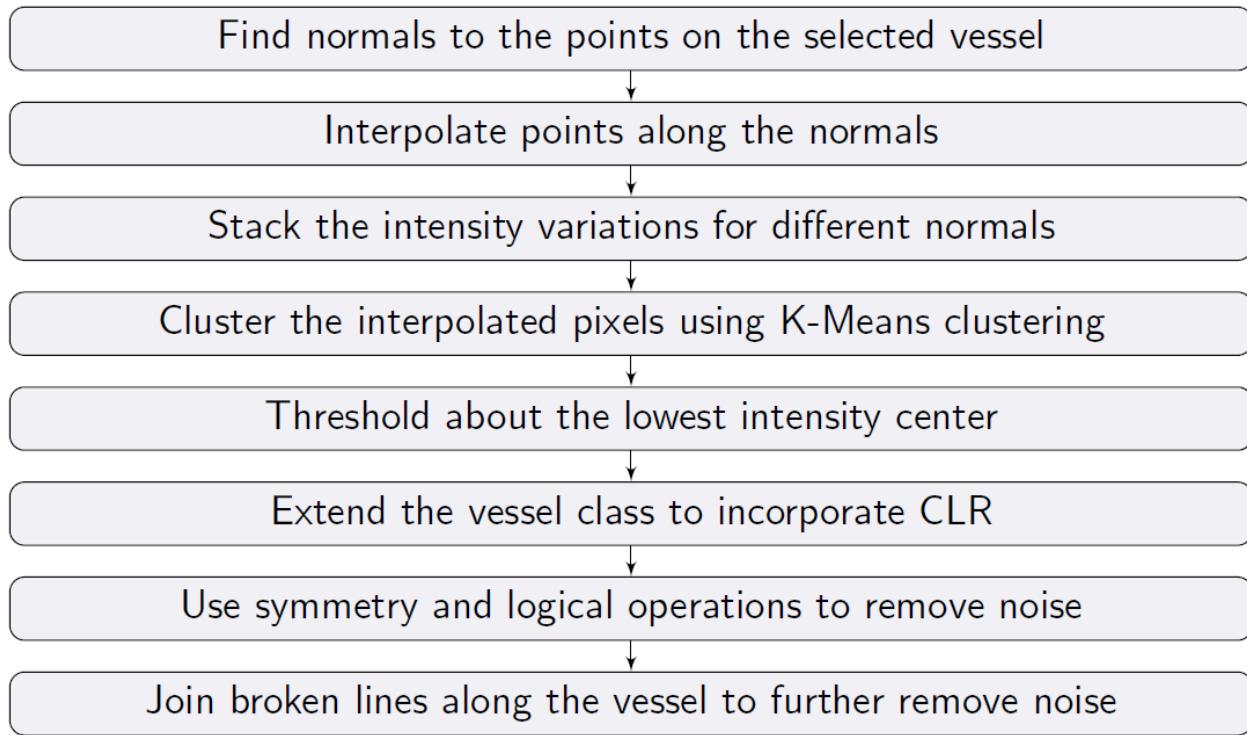
- Performance Analysis

Vessel Segmentation with vessel diameter estimation

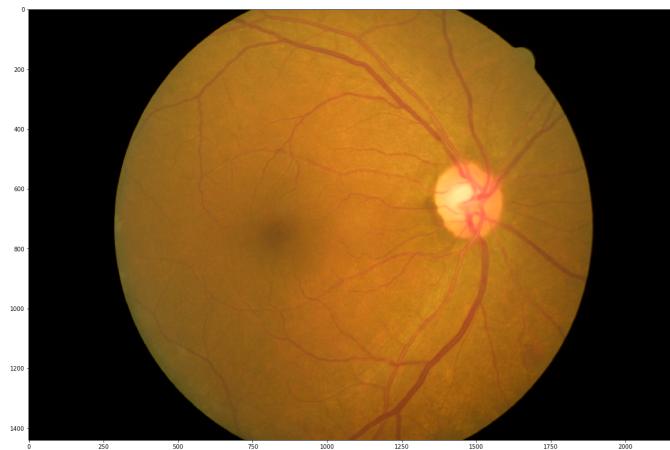
Flow Chart: Retinal vessel segmentation



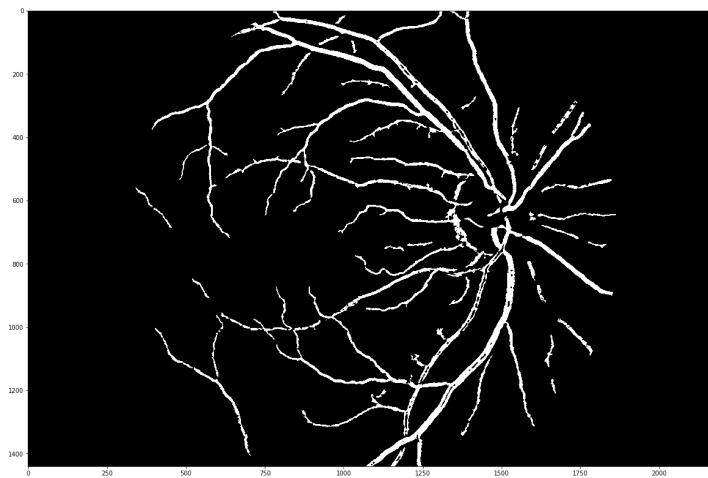
Flow Chart: Diameter estimation



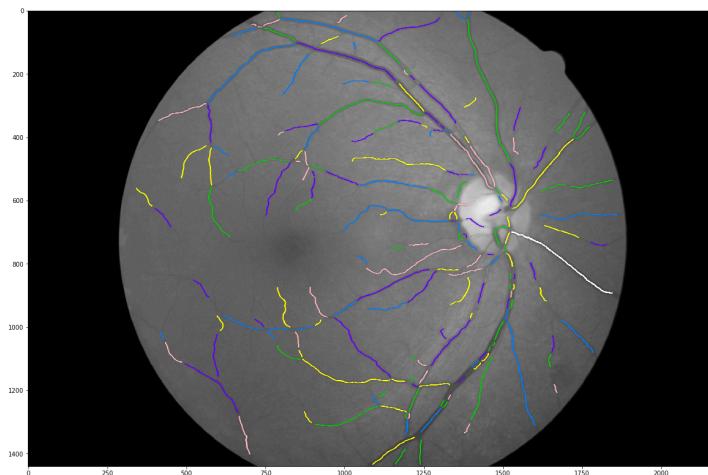
Input Image:



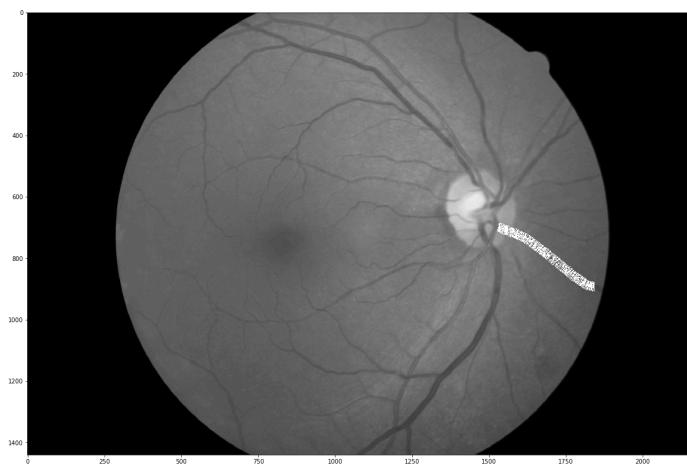
Segmented image:



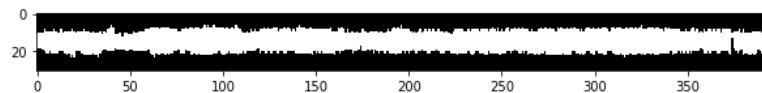
Centreline Map:



Interpolation normal to the centreline:



Diameters from clustered variation:



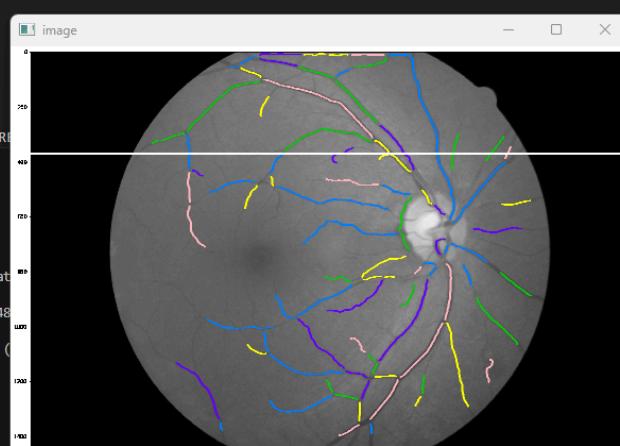
Visualization:

```
18     #Creating mask for restricting FOV
19     _, mask = cv2.threshold(g, 10, 255, cv2.THRESH_BINARY)
20     kernel = cv2.getStructuringElement(cv2.MORPH_ELLIPSE, (15, 15))
21     mask = cv2.erode(mask, kernel, iterations=3)
22
23     # CLAHE and background estimation
24     clahe = cv2.createCLAHE(clipLimit = 3, tileGridSize=(9,9))
25     g_cl = clahe.apply(g)
26     g_c11 = cv2.medianBlur(g_cl, 5)
27     bg = cv2.GaussianBlur(g_c11, (55, 55), 0)
28
29     # Background subtraction
30     norm = np.float32(bg) - np.float32(g_c11)
31     norm = norm*(norm>0)
32
33     # Thresholding for segmentation
34     _, t = cv2.threshold(norm, t, 255, cv2.THRESH_BINARY)
```

PROBLEMS 6 OUTPUT DEBUG CONSOLE TERMINAL PORTS

Microsoft Windows [Version 10.0.22621.3447]
(c) Microsoft Corporation. All rights reserved.

E:\Retinal-vessel-segmentation-and-vessel-diameter-estimation>
SIZE IS : (779, 1166, 3)
Maximum diameter: 20.5044002532959 at the point: (732, 348)
Select the vessel and press Q after selection.
In how many parts you want to divide the selected vessel (



Select the required part and press Q.
Average diameter length: 7.504201680672269
Median diameter length: 7.0
Standard deviation: 0.00729779573915052

E:\Retinal-vessel-segmentation-and-vessel-diameter-estimation>
* History restored

Microsoft Windows [Version 10.0.22621.3447]
(c) Microsoft Corporation. All rights reserved.

E:\Retinal-vessel-segmentation-and-vessel-diameter-estimation-CSE499B-master>python main.py
SIZE IS : (779, 1166, 3)
Maximum diameter: 20.5044002532959 at the point: (732, 348)
Select the vessel and press Q after selection.

```

116     cv2.drawContours(cl, [c], 0, 0, -1)
117
118
119     # Centerline superimposed on green channel
120     colors = [(100, 0, 150), (102, 0, 255), (0, 128, 255), (255, 255, 0), (10, 200, 10)]
121     colbgr = [(193, 182, 255), (255, 0, 102), (255, 100, 100)]
122
123     im = g.copy()
124     im = cv2.cvtColor(im, cv2.COLOR_GRAY2BGR)
125     thc = cl
126     thh = thc.copy()

PROBLEMS 6 OUTPUT DEBUG CONSOLE TERMINAL PORTS

Microsoft Windows [Version 10.0.22621.3447]
(c) Microsoft Corporation. All rights reserved.

E:\Retinal-vessel-segmentation-and-vessel-diameter-estimation-CSE499B>python main.py
(myenv) E:\Retinal-vessel-segmentation-and-vessel-diameter-estimation-CSE499B>
SIZE IS : (779, 1166, 3)
Maximum diameter: 20.5044002532959 at the point: (732, 348)
Select the vessel and press Q after selection.
In how many parts you want to divide the selected vessel (Please enter an integer <=5): 3
Select the required part and press Q.
Average diameter length: 6.821138211382114
Median diameter length: 7.0
Standard deviation: 0.004640076349999139

```



Presentation last modified: 1h ago

The screenshot shows a development environment with several open windows. On the left, a code editor displays Python code for contour selection and drawing. The code includes imports for cv2 and numpy, and defines functions for selecting contours and drawing them with a bounding box. It also handles mouse events for selection and button down for division. The code editor has tabs for PROBLEMS, OUTPUT, TERMINAL, PORTS, SEARCH ERROR, and GITLENS, with the TERMINAL tab currently active.

The TERMINAL window shows the following output:

```
(myenv) C:\Users\User\retinalBloodVesselDiameterProject>python main.py
SIZE IS : (779, 1166, 3)
Maximum diameter: 20.5044002532959 at the point: (732, 348)
Select the vessel and press Q after selection.
In how many parts you want to divide the selected vessel (Please enter an integer <=5): 3
Select the required part and press Q.
```

A separate window titled "image1" is visible on the right, showing a black image frame with a small white crosshair at the center, indicating the selection point for the vessel analysis.

Result:

```
(myenv) E:\Retinal-vessel-segmentation-and-vessel-diameter-estimation-CSE499B-master>python main.py  
SIZE IS : (779, 1166, 3)  
Maximum diameter: 20.5044002532959 at the point: (732, 348)  
Select the vessel and press Q after selection.  
In how many parts you want to divide the selected vessel (Please enter an integer <=5): 3  
Select the required part and press Q.  
Average diameter length: 6.821138211382114  
Median diameter length: 7.0  
Standard deviation: 0.004640076349999139
```