Comp448 HW1 - Q4 Report

Pseudocode Of Design

```
Function VesselSegmentation(image):
    # Preprocess the input image
    preprocessed_image = PreprocessImage(image)

    # Enhance vessels using morphological operations
    enhanced_vessels = EnhanceVessels(preprocessed_image)

    # Threshold the vessels using global thresholding
    thresholded_vessels = ThresholdVessels(enhanced_vessels)

    # Postprocess the vessel mask to remove noise
    segmented_vessels = PostprocessVessels(thresholded_vessels)

    # Return the segmented vessels
    return segmented_vessels
```

List of Parameters

clipLimit: Manages CLAHE's contrast enhancement. Typically, a value of 2.0 is employed to achieve modest augmentation without overly amplifying noise.

tileGridSize: Defines the CLAHE grid size. For balanced improvement throughout the image with minimal computational overhead, a grid size of (8, 8) is selected.

kernelSize: Controls the kernel's dimensions for morphological processes. A kernel size of (5, 5) finds a medium ground between eliminating noise and maintaining vessel features.

iterations: Defines how many times morphological operations must be performed. In order to successfully eliminate noise and preserve vessel integrity, two iterations are selected.

thresholdMethod: Establishes the global thresholding technique. Because it can automatically determine the best threshold for photos with different levels of contrast and illumination, the Otsu approach is used.

Discussion

For CLAHE, we empirically set parameter values such as clipLimit (2.0) and tileGridSize ((8, 8)) to maximize contrast enhancement; for morphological procedures, we selected kernelSize ((5, 5)) and iterations (2) to balance vessel enhancement and noise reduction. Furthermore, the Otsu thresholding technique was chosen due to its efficacy in global thresholding.

Visual Results (Segmentation map)
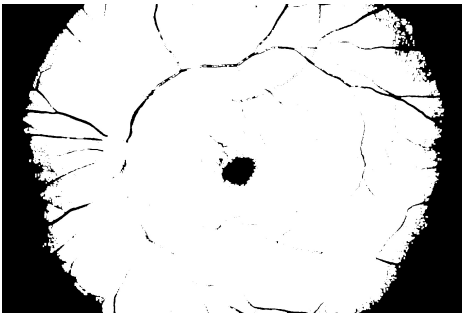
d4 image
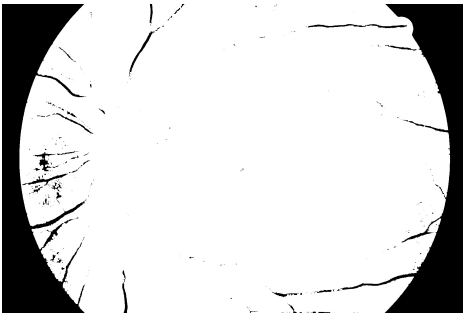
d7 image

d11 image

Table of Quantitive Metrics:

```
Image: d4_h_gold.png
Precision: nan
Recall: nan
F-score: nan
Image: d4_h.jpg
Precision: 0.1303224107397305
Recall: 0.8277081077586903
F-score: 0.22518889306575043
[ WARN:0@0.212] global loadsave.cpp:248 findDecoder imread_('fundus/d7_dr_gold_gold.png'): can't open/read file: check file path/integrity
Image: d7_dr_gold.png
Precision: nan
Recall: nan
F-score: nan
Image: d7_dr.jpg
Precision: 0.11464488973867805
Recall: 0.8917679431323091
F-score: 0.20317037735149207
[ WARN:0@0.287] global loadsave.cpp:248 findDecoder imread_('fundus/d11_g_gold_gold.png'): can't open/read file: check file path/integrity
Image: d11_g_gold.png
Precision: nan
Recall: nan
F-score: nan
Image: d11_g.jpg
Precision: 0.12427749217996702
Recall: 0.9659804510457053
F-score: 0.22022243212583428
tolgamayaoglu@Tolga-MacBook-Pro comp448hw1 %
```