

Segmentation of Vessels in Retinal Images

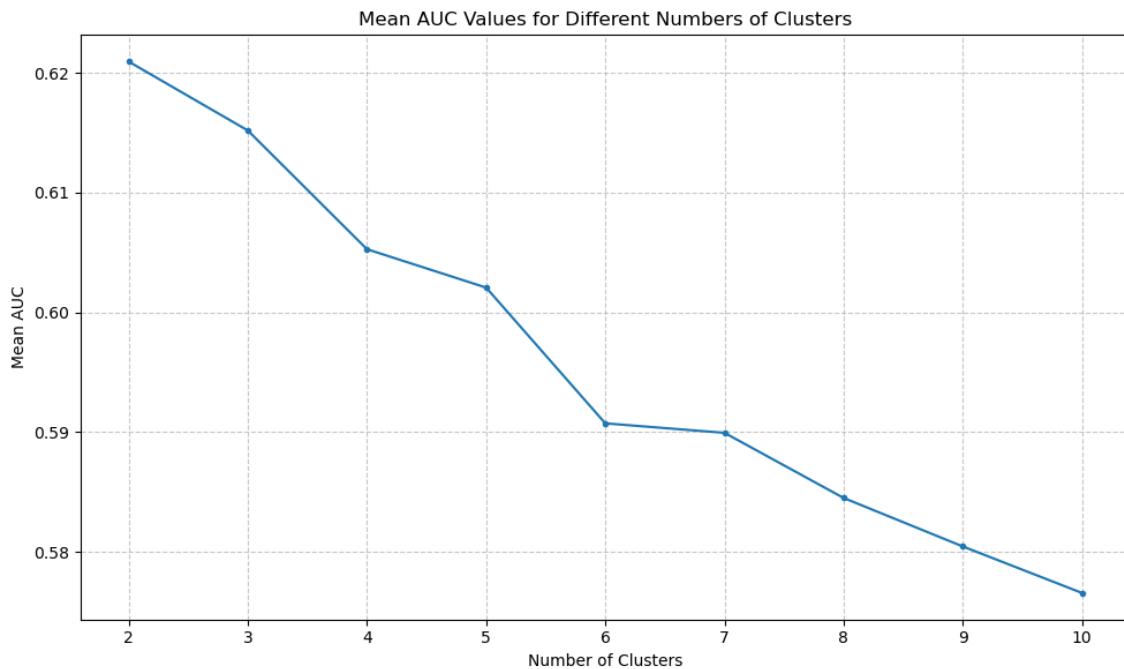
Team Members: Shiyu Wang, Enhao He, Jiacheng Ma, Joe Wang

1 Methods

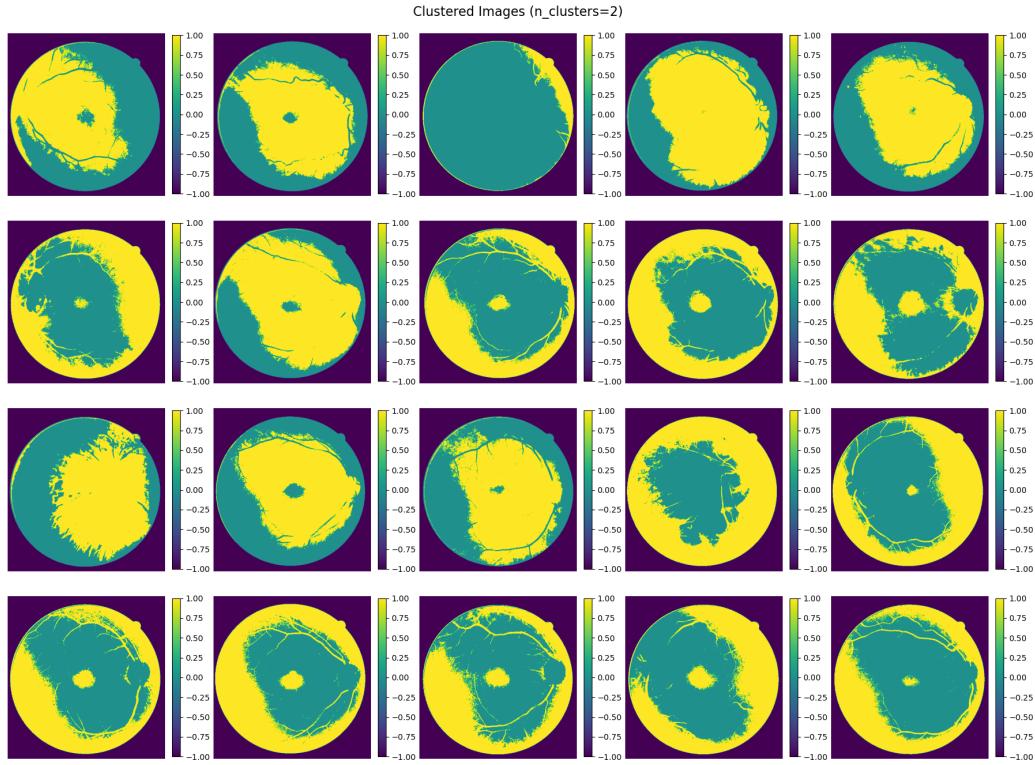
1.1 K-means Clustering

1.1.1 Find the Best “n_clusters”

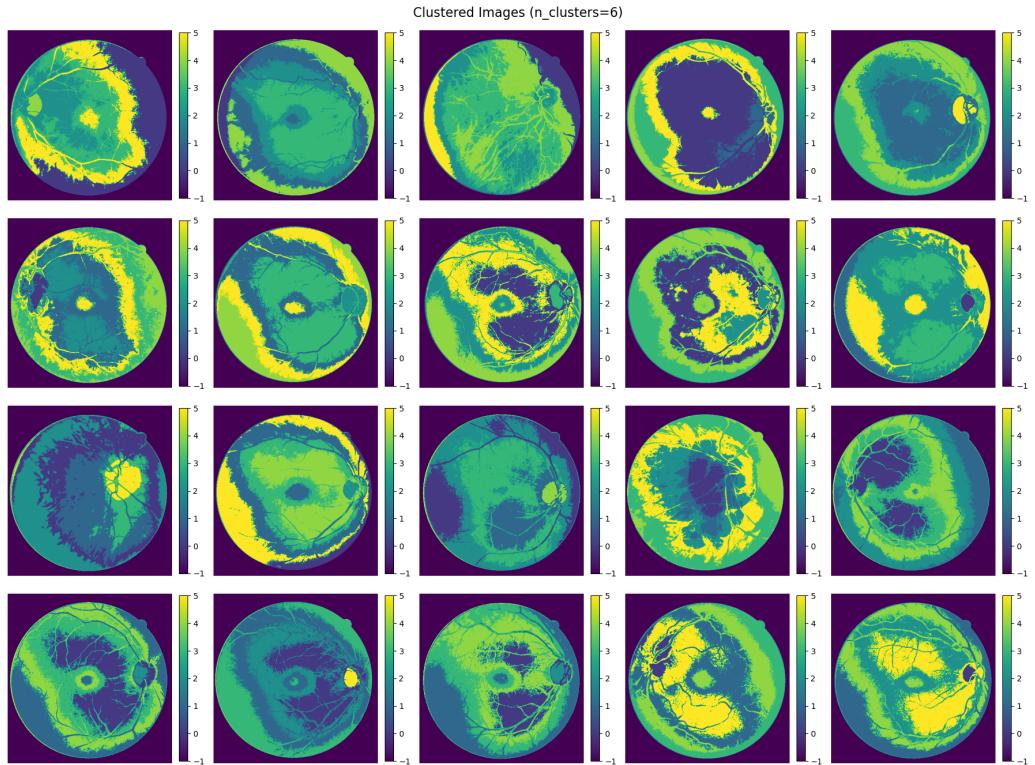
Try to decide the best numbers of clusters by comparing the mean of the AUC value of the 20 figures.

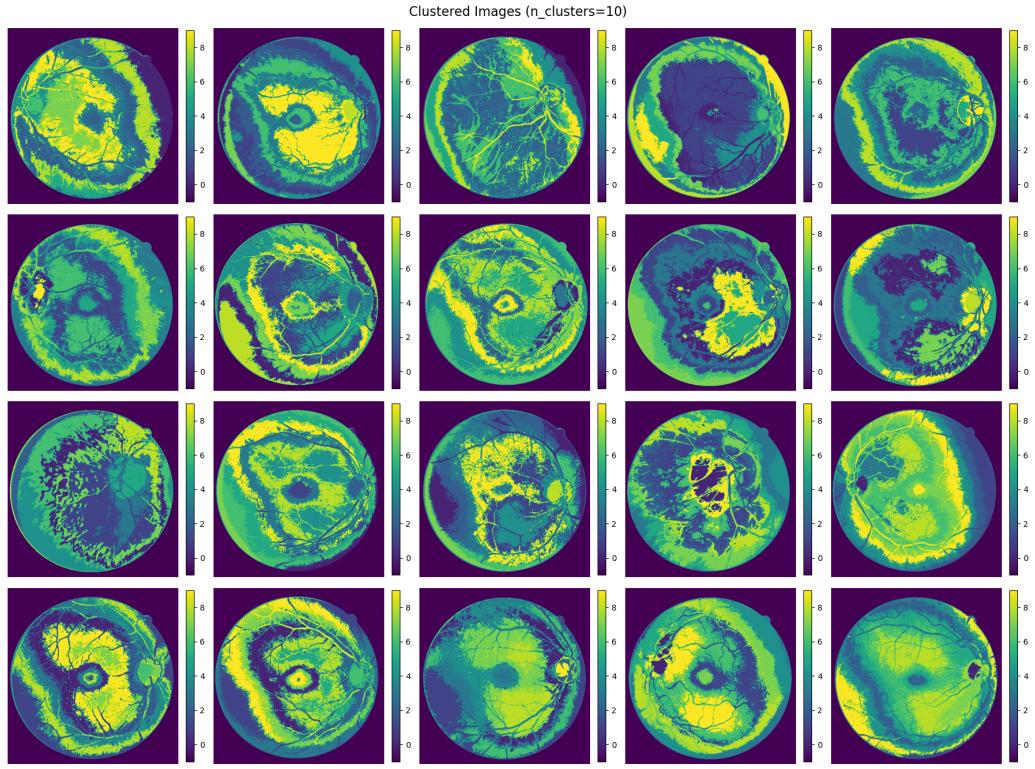


The line is descending. At least 2. But 2 doesn't perform well.



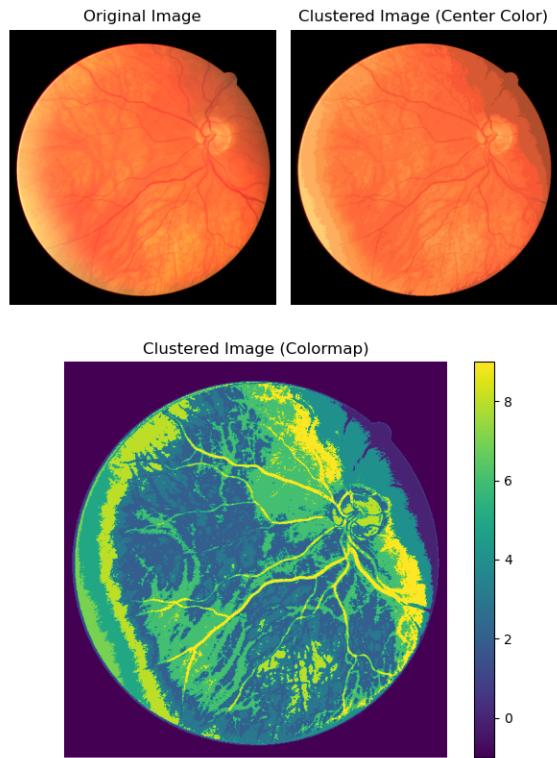
Then we increase the n_clusters.





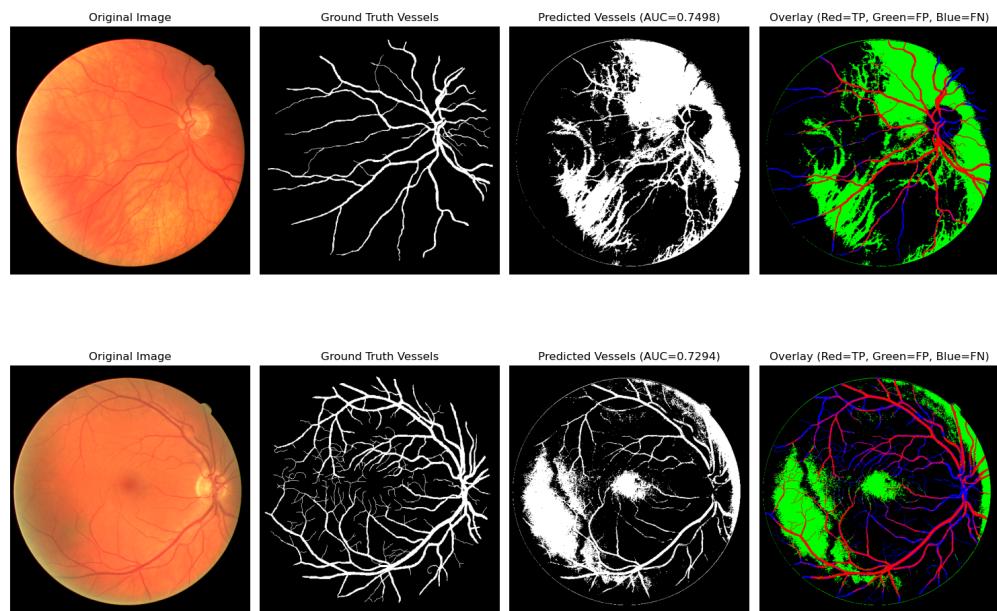
We finally choose 10 because of its performance, but there still are some problems: the vessels' pixel are contained in many different clusters.

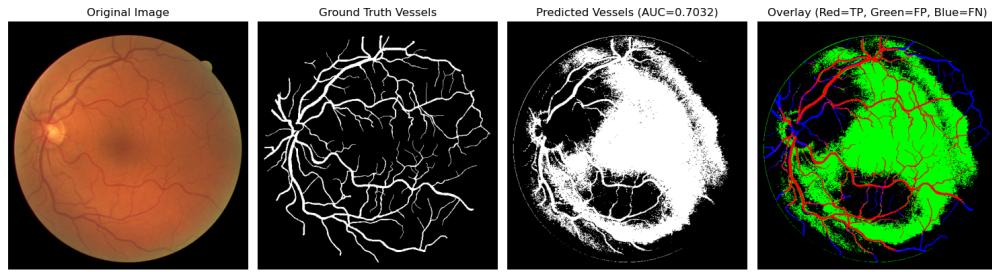
Here is a special case:



1.1.2 Use the Optimized K-means Algorithm

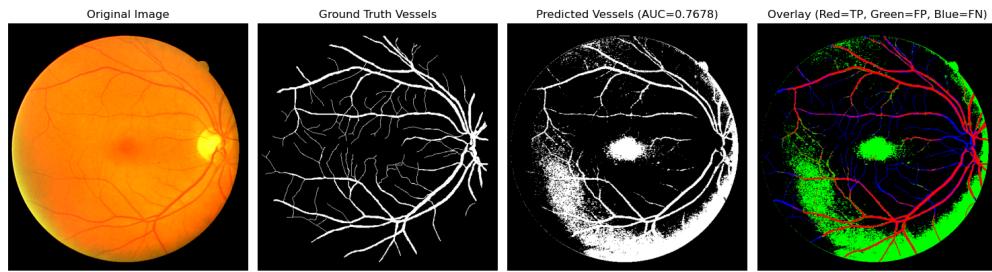
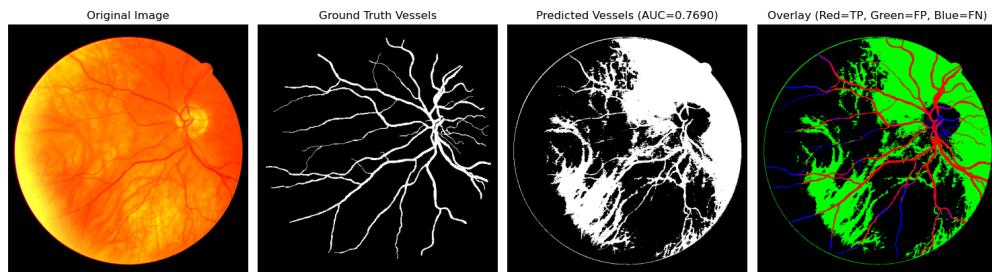
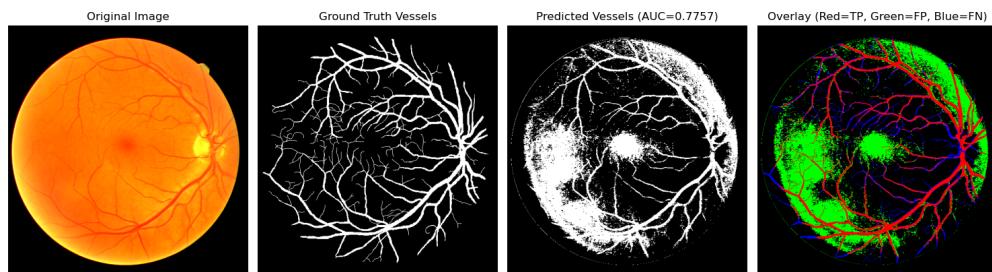
The best three examples are:





1.1.3 Use the Optimized K-means Algorithm with the Image Augmentation

The best three examples are:



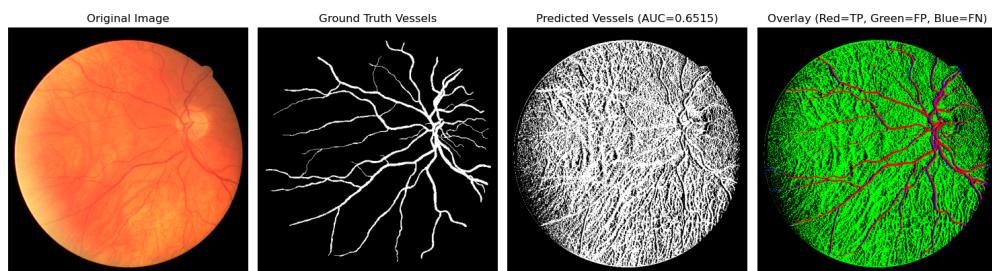
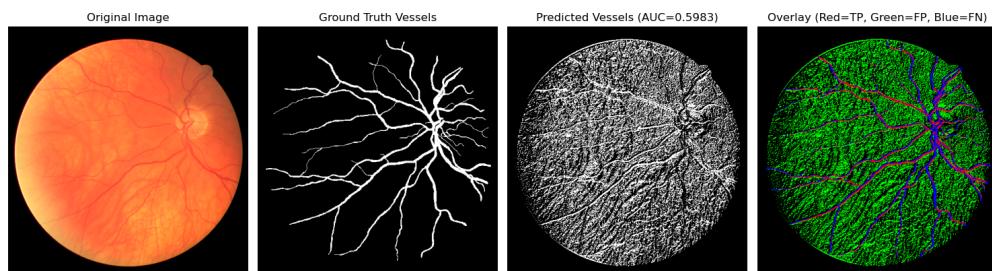
1.1.4 Performance Comparison

Table 1: Performance Comparison: Before and After Image Augmentation

Metric	Classic KMeans	Optimized KMeans
Accuracy	0.8575 → 0.8758	0.7266 → 0.7673
Sensitivity	0.2366 → 0.3024	0.6042 → 0.6493
Specificity	0.9165 → 0.9304	0.7385 → 0.7789
F1	0.2278 → 0.3047	0.2782 → 0.3292
Auc	0.5766 → 0.6164	0.6714 → 0.7141

1.1.5 Direction-enhanced KMeans Clustering

The best examples with merging the top 3 and 5 clusters are:



After applying the image augmentation:

