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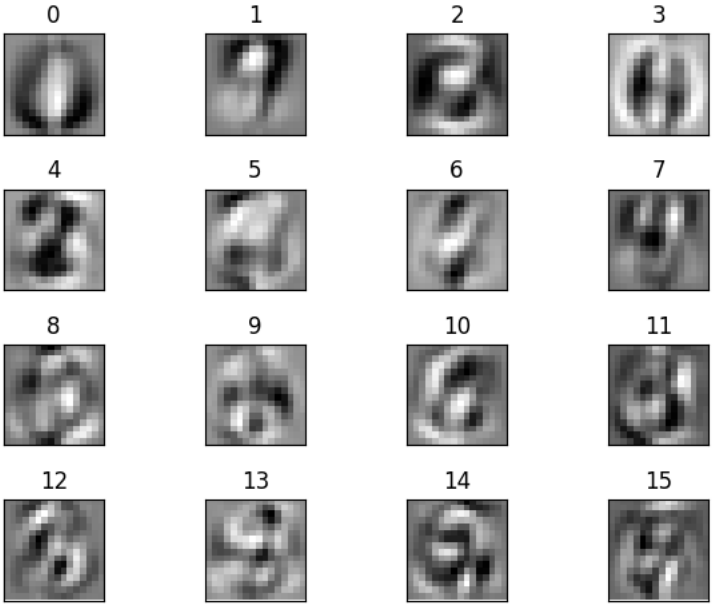
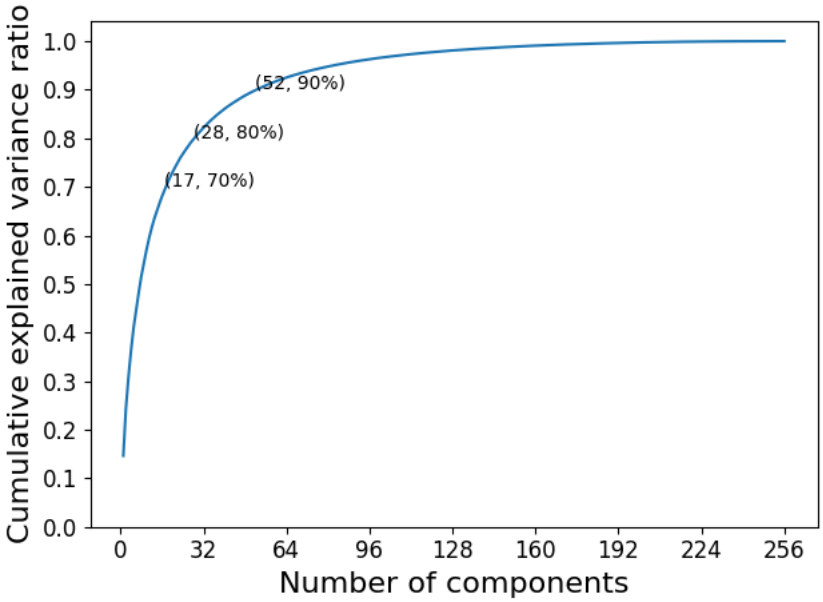
Homework #5

1. Principal Component Analysis

a.



b.



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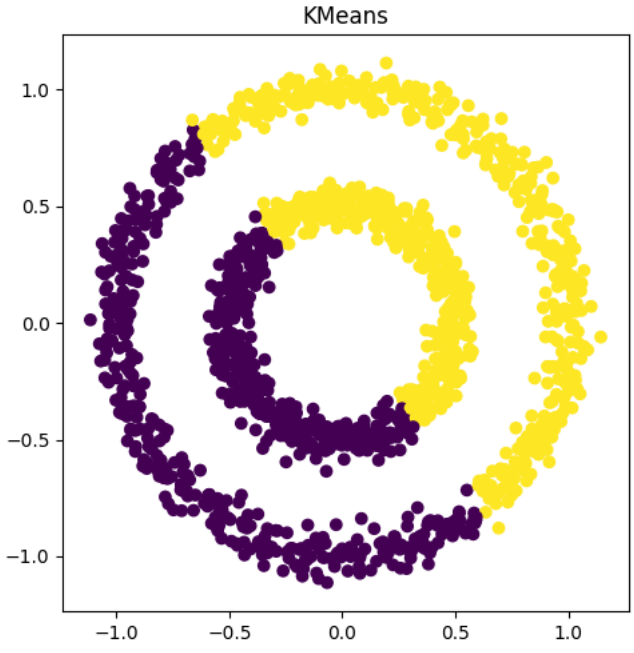
c.

k	a=0.0001	a=0.001	a=0.01	a=0.1
17	0.1133	0.1233	0.1333	0.1300
28	0.0933	0.0833	0.0967	0.0900
52	0.0800	0.0800	0.0800	0.0767
256	0.0833	0.0867	0.0700	0.0733

d.
Test error of the best pair (52, 0.1) with features selection: 0.0833
Test error of the best pair (256, 0.01) without features selection: 0.0767

Comparing to the performance of the SVM without feature selection, the test error has little difference. It shows that PCA actually does a good job. Although we reduce many dimensionalities, the performance does not change a lot.

2. Spectral Clustering
c.



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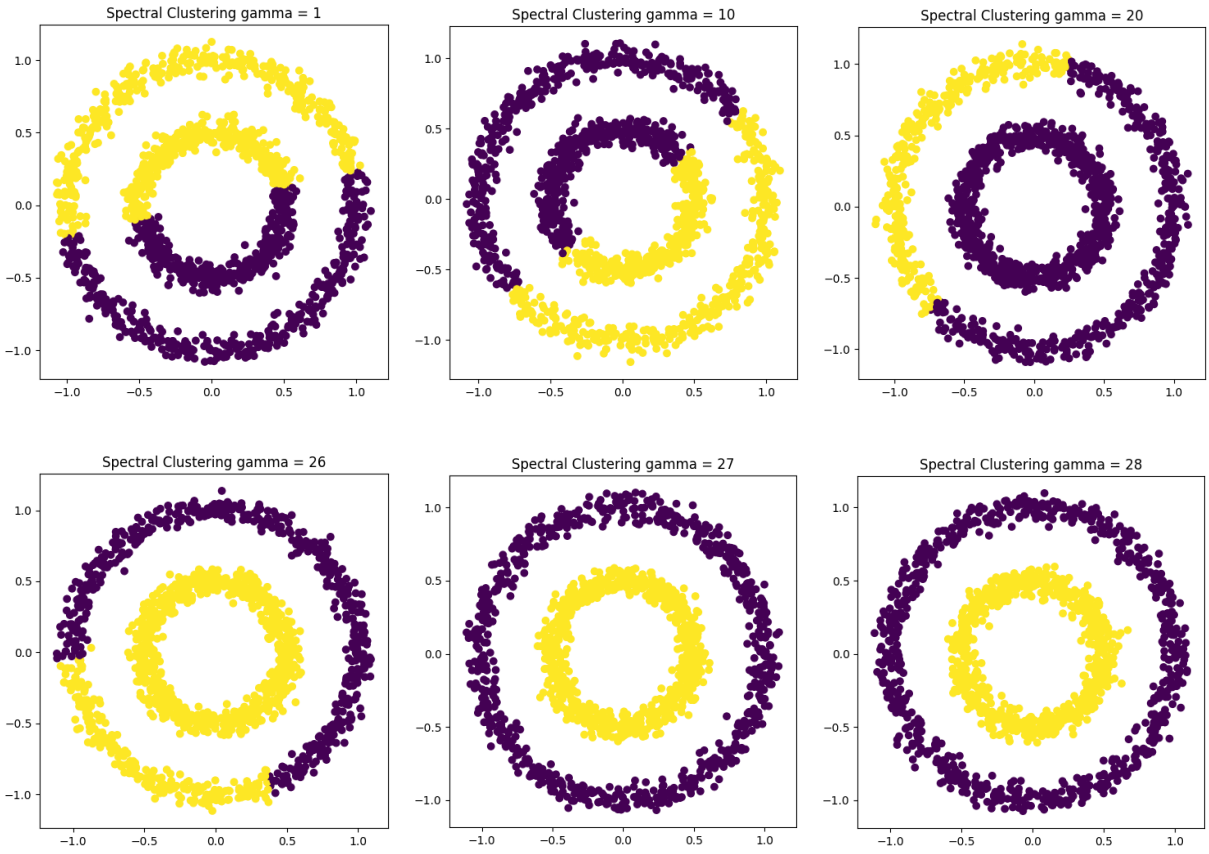
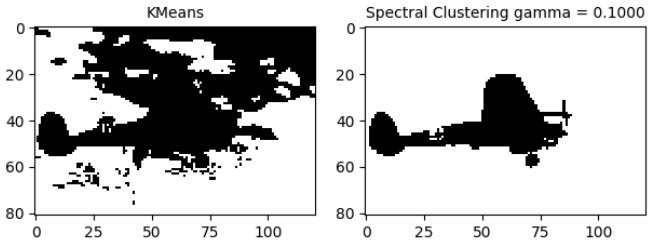
d.



When γ = 27, spectral clustering outperforms k-means clustering.

e.
The graphs show the segmented images produced by both approaches.



When γ = 0.1000, spectral clustering outperforms k-means clustering.

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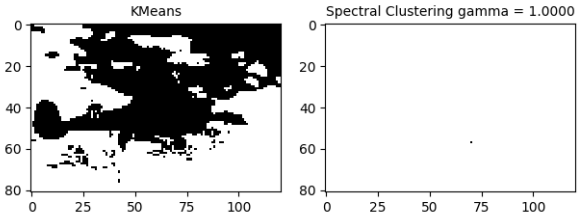

When γ = 1.0000, spectral clustering performs worse.