

1 Principal Component Analysis

a

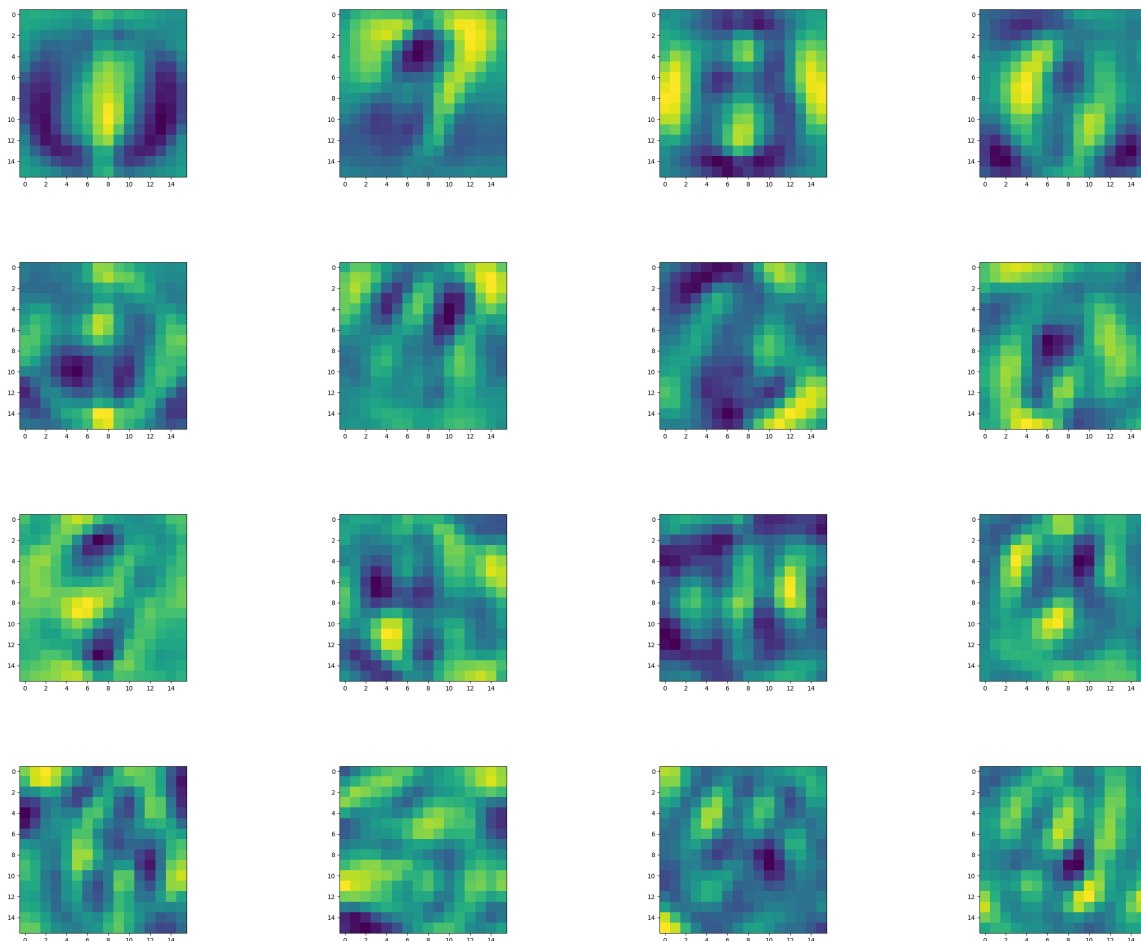


Figure 1: The top 16 eigendigits

b

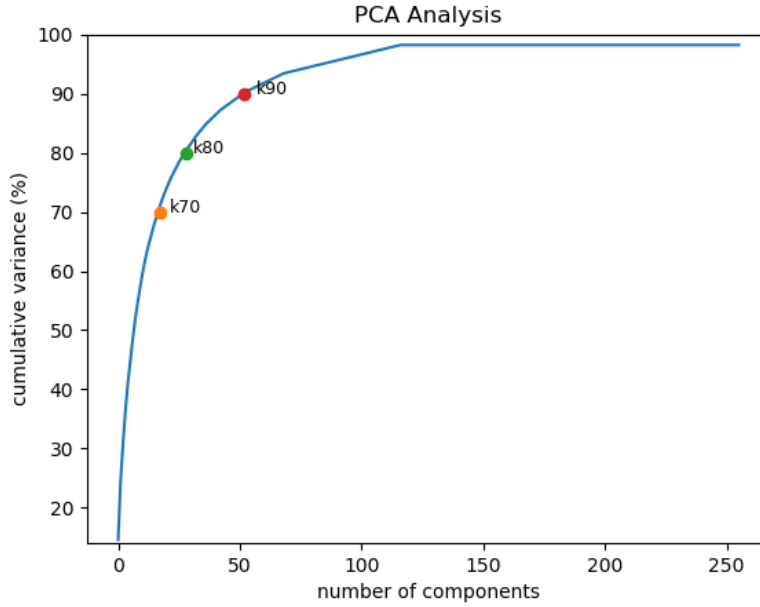


Figure 2: Plot showing cumulative variance (cumulative sum of eigenvalues) vs. number of components.

It would take only around 17 components to achieve 70% the total variance. Around 28 components to achieve 80% the total variance and around 52 components to achieve 90% the total variance.

c

(k_f, α)	0.0001	0.001	0.01	0.1
k_{70}	0.15	0.14	0.01166	0.12
k_{80}	0.1066	0.1	0.0966	0.1066
k_{90}	0.1	0.08	0.0766	0.0833
k_{100}	0.066	0.0733	0.0766	0.09

Table 1: validation error

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d

The error of the best (k_f, α) are $(k_{100}, \alpha = 0.0001)$, the correspond test error is 0.07666 The performance is nearly the same in terms of the error. Feature selection could substantially reduce the dimensionality of the data and so the computations required and thereby speed up the performance and running time. It may also remove noise in the dataset and facilitates the classification process. We could achieve similar results while not compromising much of the performance. (Here we could achieve 90% of the original performance using only 52 instead of 256 features. trade-off b/w # of features and performance)

Discussed with Sai Ram Chappidi

2 Spectral Clustering

c

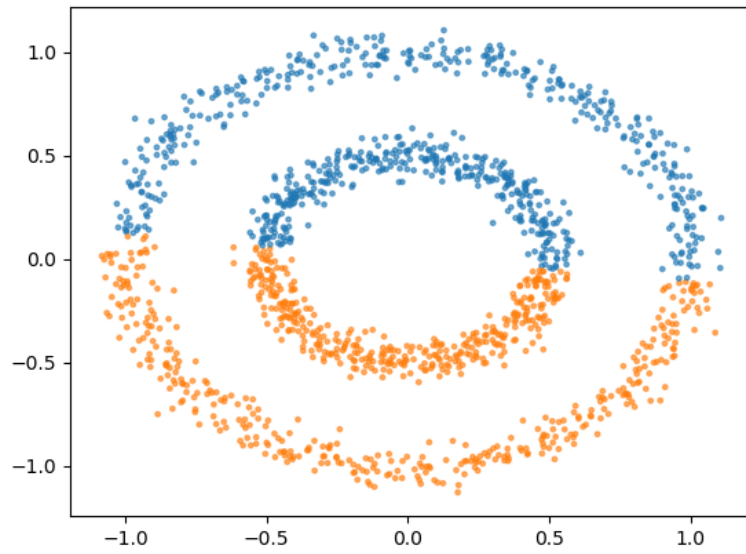


Figure 3: A scatter plot of the clusters by KMeans

d

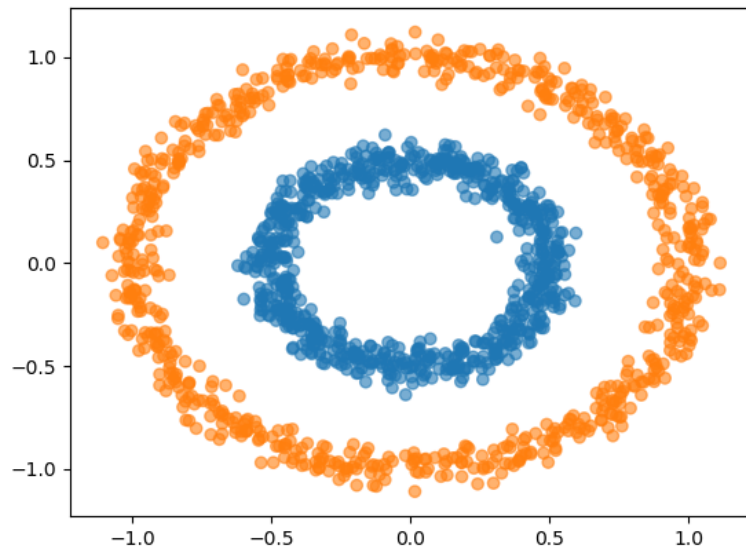


Figure 4: A scatter plot of the clusters by Spectral Clustering

Spectral Clustering outperforms K-means clustering when $\gamma \geq 23$
Discussed with Sai Ram Chappidi

e

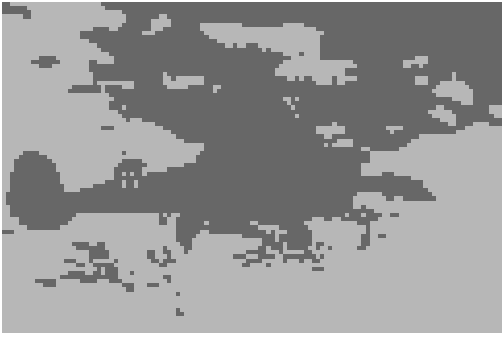


Figure 5: Segmented image by KMeans

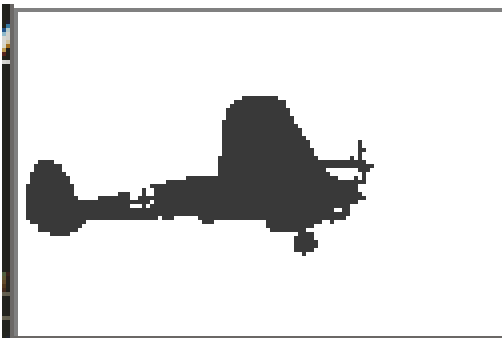


Figure 6: Segmented image by Spectral Clustering

Discussed with Sai Ram Chappidi