

# Assignment 5: K-Mean and PCA(Dimension Reduction)

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**Dataset:** MNIST DATASET(Fetch data from online)

## K-Means

### Steps for implementation:

- Import the important libraries.
- Standardise the mnist dataset by dividing the 255.
- Algorithm for K-mean:
  - Initialize with k random centroid.
  - Assume the max\_iter =100.
  - Loop over max\_iter
  - Compute the distance between the dataset and old centroid.(Euclidean distance)
  - Find labels for closest cluster from the above distances
  - Compute the current centroid for the labels.
  - If old centroid!=current centroid then break else repeat.
- At last we get the centroid of the dataset of k

### Analysing the centroid:

- I have used k range from 1 to 7.
- I compare my computed centroid with sklearn computed centroid.
- I get the very same centroid.

Centers of Centroids for k=2

[[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]]

Centers of Centroids for k=3

[[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]]

Centers of Centroids for k=4

[[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]]

Centers of Centroids for k=5

[[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]

[0. 0. 0. ... 0. 0. 0.]]

Centers of Centroids for k=6

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[[0. 0. 0. ... 0. 0. 0.]  
[0. 0. 0. ... 0. 0. 0.]  
[0. 0. 0. ... 0. 0. 0.]  
[0. 0. 0. ... 0. 0. 0.]  
[0. 0. 0. ... 0. 0. 0.]  
[0. 0. 0. ... 0. 0. 0.]]
```

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## PCA(Dimension Reduction)

### Steps for implementation:

- Import the important libraries.
- Algorithm for PCA:
  - Calculate the mean of the dataset.
  - Mean centering
  - Find the covariance of the dataset
  - Find the eigenvalues and eigenvectors
  - Sort the eigenvalues in decreasing order.
  - Take 1 n\_component(Good eigenvector having greater eigenvalues)
  - Plot the Eigenvalues

### Analysis:

- Following are the plot between Eigenvalues VS number of features(784)



