Project: Task 13 - PCA Dimensionality Reduction Dataset: Sklearn Digits (Handwritten images)

1. Explained Variance Analysis We tested multiple component counts to observe how much information was preserved:

2 Components: Explained ~20-30% of variance. Good for visualization, but loses too much detail for high accuracy.

30 Components: Explained ~95% of variance. This is the "sweet spot" where we retain almost all information while reducing the dataset size by over 50% (from 64 features to 30).

**2. 2D Visualization ** By reducing the 64-pixel dimensions down to just 2 Principal Components, we visualized the dataset.

Observation: Distinct clusters formed for different digits (e.g., '0', '4', '6'), showing that PCA successfully captured the unique structural patterns of the digits even in just 2 dimensions.

3. Accuracy Comparison

Original Data (64 Features): Accuracy ~97%

PCA Data (30 Features): Accuracy ~96-97%

Conclusion: The PCA model achieved nearly the exact same accuracy as the original model but used half the features. This proves PCA effectively removed noise and redundant pixels (like the black corners of images) without losing critical information.