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BE CMPN B

https://github.com/KhushilBhimani2004/Machine-Learning/blob/main/ML_Exp_9.ipynb

```

1 import numpy as np
2 import matplotlib.pyplot as plt
3 from sklearn.datasets import load_digits
4 from sklearn.preprocessing import StandardScaler
5 from sklearn.decomposition import PCA
6

```

```

1 digits = load_digits()
2 X = digits.data # Features (pixel values)
3 y = digits.target # Target labels (digits 0-9)
4
5 print("Dataset Shape:", X.shape)
6 print("Number of Classes:", len(np.unique(y)))
7

```

```

Dataset Shape: (1797, 64)
Number of Classes: 10

```

```

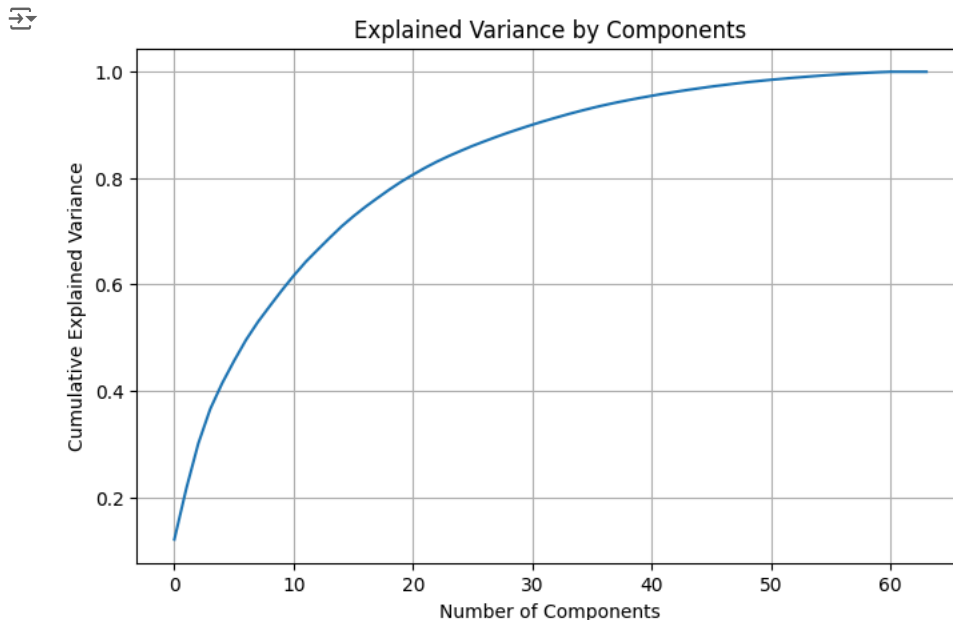
1 scaler = StandardScaler()
2 X_standardized = scaler.fit_transform(X)
3

```

```

1 pca = PCA()
2 pca.fit(X_standardized)
3
4 # Plot the explained variance
5 plt.figure(figsize=(8, 5))
6 plt.plot(np.cumsum(pca.explained_variance_ratio_))
7 plt.xlabel('Number of Components')
8 plt.ylabel('Cumulative Explained Variance')
9 plt.title('Explained Variance by Components')
10 plt.grid()
11 plt.show()
12

```



```

1 pca_2d = PCA(n_components=2)
2 X_pca_2d = pca_2d.fit_transform(X_standardized)
3

```

```

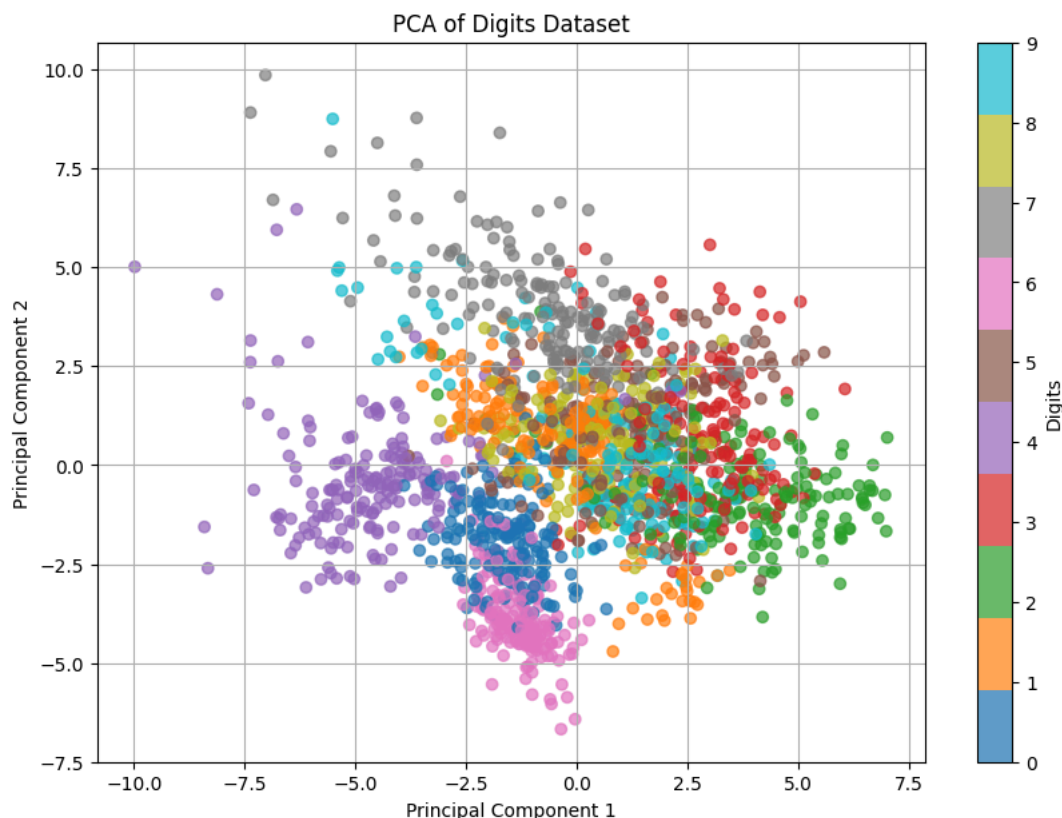
1 plt.figure(figsize=(10, 7))
2 scatter = plt.scatter(X_pca_2d[:, 0], X_pca_2d[:, 1], c=y, cmap='tab10', alpha=0.7)
3 plt.title('PCA of Digits Dataset')
4 plt.xlabel('Principal Component 1')
5 plt.ylabel('Principal Component 2')

```

```

6 plt.colorbar(scatter, ticks=range(10), label='Digits')
7 plt.grid()
8 plt.show()
9

```



```

1 print("Explained Variance Ratio by Principal Component:")
2 for i, var in enumerate(pca.explained_variance_ratio_):
3     print(f"Component {i+1}: {var:.4f}")
4

```



Explained Variance Ratio by Principal Component:

```

Component 1: 0.1203
Component 2: 0.0956
Component 3: 0.0844
Component 4: 0.0650
Component 5: 0.0486
Component 6: 0.0421
Component 7: 0.0394
Component 8: 0.0339
Component 9: 0.0300
Component 10: 0.0293
Component 11: 0.0278
Component 12: 0.0258
Component 13: 0.0228
Component 14: 0.0223
Component 15: 0.0217
Component 16: 0.0191
Component 17: 0.0178
Component 18: 0.0164
Component 19: 0.0160
Component 20: 0.0149
Component 21: 0.0135
Component 22: 0.0127
Component 23: 0.0117
Component 24: 0.0106
Component 25: 0.0098
Component 26: 0.0094
Component 27: 0.0086
Component 28: 0.0084
Component 29: 0.0080
Component 30: 0.0075
Component 31: 0.0073
Component 32: 0.0069
Component 33: 0.0065
Component 34: 0.0064
Component 35: 0.0059
Component 36: 0.0057
Component 37: 0.0052
Component 38: 0.0048
Component 39: 0.0045
Component 40: 0.0042

```

Component 41: 0.0041
Component 42: 0.0040
Component 43: 0.0036
Component 44: 0.0034
Component 45: 0.0033
Component 46: 0.0031
Component 47: 0.0029
Component 48: 0.0028
Component 49: 0.0026
Component 50: 0.0023
Component 51: 0.0022
Component 52: 0.0020
Component 53: 0.0020
Component 54: 0.0018
Component 55: 0.0017
Component 56: 0.0016
Component 57: 0.0015