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COMPS – C31

ML Experiment 5

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Aim: To implement KNN Algorithm

Theory:
k-nearest Neighbor (KNN) Algo is a supervised ML Algo employed to ~~take~~ tackle classification & Regression models problems.

Distance metrics used in KNN

1) Euclidean dist

$$dist(x, X_i) = \sqrt{\sum_{j=1}^{d} (x_j - X_{ij})^2}$$

2) Manhattan Distance

$$d(x, y) = \sum_{i=1}^{n} |x_i - y_i|$$

3) Minkowski Distance

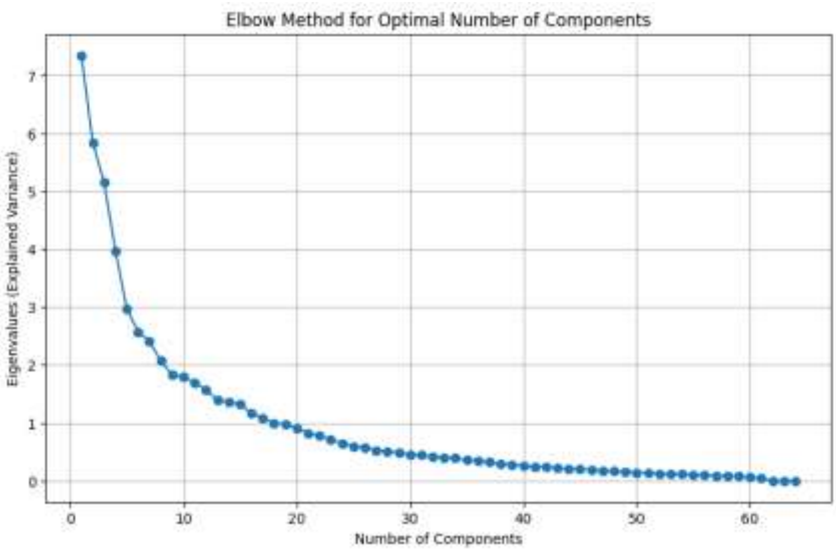
$$d(x, y) = \left(\sum_{i=1}^{n} (x_i - y_i)^p \right)^{1/p}$$

choosing the value of k
The value of k depends on input data
If input data has more outliers, a higher value of k is

Conclusion: Thus we implemented & understood KNN Algorithm.

Implementation:

```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.datasets import load_digits
from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler
digits_data = load_digits()
X = digits_data.data
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
pca = PCA()
X_pca = pca.fit_transform(X_scaled)
eigenvalues = pca.explained_variance_
plt.figure(figsize=(10, 6))
plt.plot(range(1, len(eigenvalues) + 1), eigenvalues, marker='o',
linestyle='-')
plt.title('Elbow Method for Optimal Number of Components')
plt.xlabel('Number of Components')
plt.ylabel('Eigenvalues (Explained Variance)')
plt.grid(True)
plt.show()
optimal_num_components = 10
X_reduced = X_pca[:, :optimal_num_components]
df_reduced = pd.DataFrame(X_reduced, columns=[f'PC{i}' for i in
range(1, optimal_num_components + 1)])
df_reduced['target'] = digits_data.target
df_reduced.to_csv('reduced_digits_dataset.csv', index=False)
print("Digits Wine dataset saved successfully.")
```




```
print(X_pca)
```

```
[[ 1.91421366e+00 -9.54501571e-01 -3.94603482e+00 ... -0.00000000e+00
   0.00000000e+00  8.24385469e-15]
 [ 5.88980330e-01  9.24635800e-01  3.92475494e+00 ...  8.37680823e-16
  -1.88056170e-17  3.08670512e-17]
 [ 1.30203906e+00 -3.17188827e-01  3.02333293e+00 ...  4.30699370e-16
   1.79508547e-17  2.15555254e-17]
```