Experiment 9 - Principal Component Analysis

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1 Experiment Details

1.1 Submitted By

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[ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
%matplotlib inline
```

```
/home/volt/.local/lib/python3.10/site-packages/scipy/__init__.py:146:
UserWarning: A NumPy version >=1.16.5 and <1.23.0 is required for this version
of SciPy (detected version 1.24.3
  warnings.warn(f"A NumPy version >={np_minversion} and <{np_maxversion}"
```

[ ]:
```
iris = load_iris()
df = pd.DataFrame(data=iris.data, columns=iris.feature_names)
df.head()
```

[ ]:
```
   sepal length (cm)  sepal width (cm)  petal length (cm)  petal width (cm)
0                5.1               3.5                1.4               0.2
1                4.9               3.0                1.4               0.2
2                4.7               3.2                1.3               0.2
3                4.6               3.1                1.5               0.2
4                5.0               3.6                1.4               0.2
```

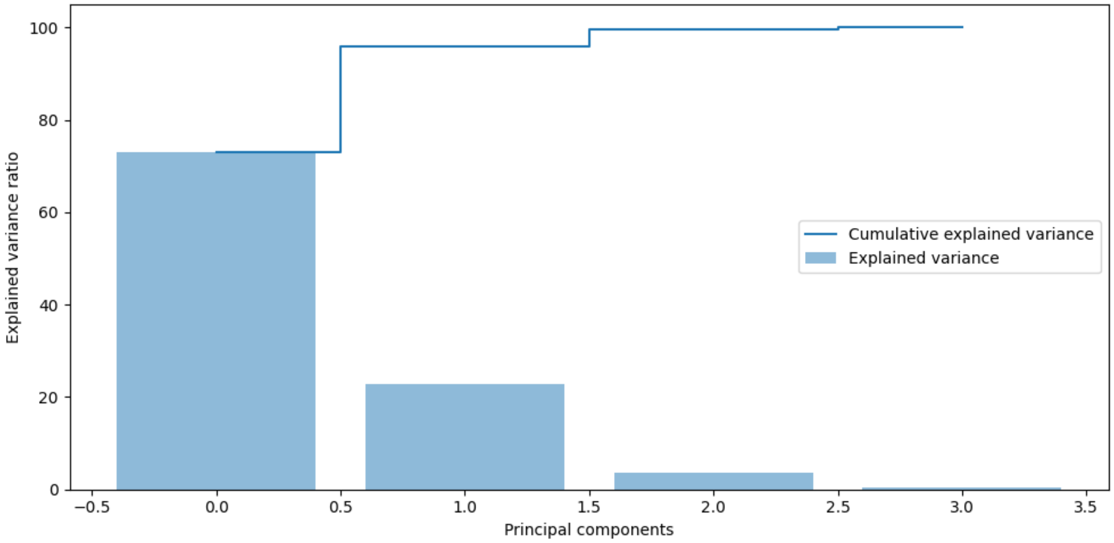
[ ]:
```
scaler = StandardScaler()
df_scaled = scaler.fit_transform(df)
```

[ ]:
```
covariance_matrix = np.cov(df_scaled.T)
```

[ ]:
```
eig_vals, eig_vecs = np.linalg.eig(covariance_matrix)
eig_pairs = [(np.abs(eig_vals[i]), eig_vecs[:,i]) for i in range(len(eig_vals))]
eig_pairs.sort(reverse=True)
```

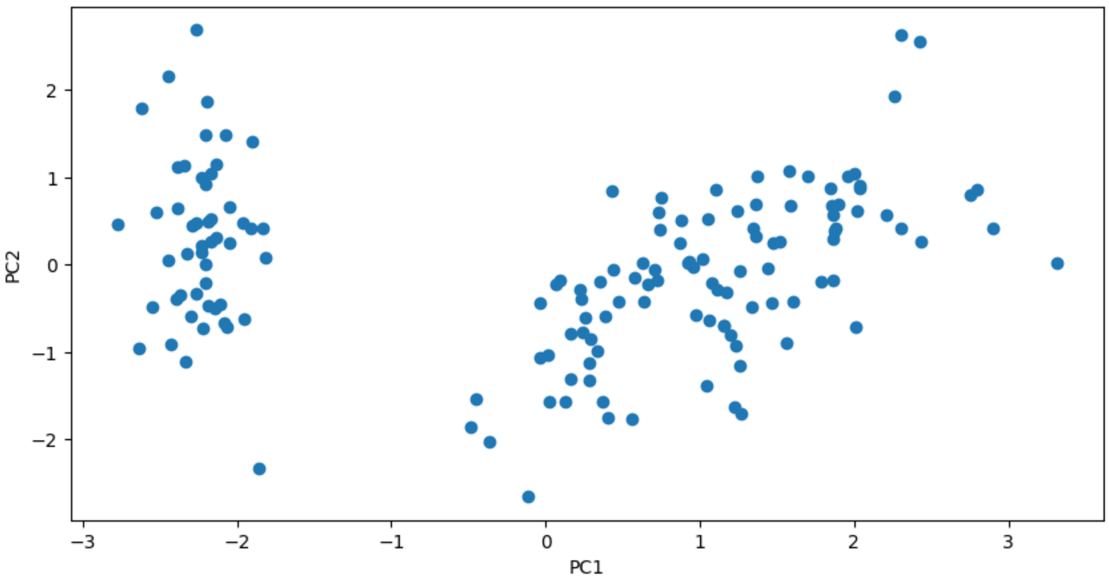
```
[ ]: total = sum(eig_vals)
     var_exp = [(i / total)*100 for i in sorted(eig_vals, reverse=True)]
     cum_var_exp = np.cumsum(var_exp)
```

```
[ ]: plt.figure(figsize=(10, 5))
     plt.bar(range(len(var_exp)), var_exp, alpha=0.5, align='center',␣
       ↪label='Explained variance')
     plt.step(range(len(cum_var_exp)), cum_var_exp, where='mid', label='Cumulative␣
       ↪explained variance')
     plt.ylabel('Explained variance ratio')
     plt.xlabel('Principal components')
     plt.legend(loc='best')
     plt.tight_layout()
     plt.show()
```



```
[ ]: pca = PCA(n_components=2)
     df_pca = pca.fit_transform(df_scaled)
```

```
[ ]: plt.figure(figsize=(10, 5))
     plt.scatter(df_pca[:,0], df_pca[:,1])
     plt.xlabel('PC1')
     plt.ylabel('PC2')
     plt.show()
```


PC2
2
1
0
−1
−2
−3
−2
−1
0
1
2
3
PC1