Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of Iris dataset from 4 features to 2

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler

df = pd.read_csv('./iris.csv')
print(df)
```

```
     sepal_length  sepal_width  petal_length  petal_width    species
0             5.1          3.5           1.4          0.2     setosa
1             4.9          3.0           1.4          0.2     setosa
2             4.7          3.2           1.3          0.2     setosa
3             4.6          3.1           1.5          0.2     setosa
4             5.0          3.6           1.4          0.2     setosa
..            ...          ...           ...          ...        ...
145           6.7          3.0           5.2          2.3  virginica
146           6.3          2.5           5.0          1.9  virginica
147           6.5          3.0           5.2          2.0  virginica
148           6.2          3.4           5.4          2.3  virginica
149           5.9          3.0           5.1          1.8  virginica

[150 rows x 5 columns]
```

```
feature = df[['sepal_length','sepal_width', 'petal_length',
'petal_width']]
print(feature)
```

```
     sepal_length  sepal_width  petal_length  petal_width
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
..            ...          ...           ...          ...
145           6.7          3.0           5.2          2.3
146           6.3          2.5           5.0          1.9
147           6.5          3.0           5.2          2.0
148           6.2          3.4           5.4          2.3
149           5.9          3.0           5.1          1.8

[150 rows x 4 columns]
```

```
target = df['species']
print(target)
```

```
0         setosa
1         setosa
2         setosa
3         setosa
4         setosa
         ...
145    virginica
146    virginica
147    virginica
148    virginica
149    virginica
Name: species, Length: 150, dtype: object
```

```
stda = StandardScaler()
stand = stda.fit_transform(feature)
print(stand)
```

```
[[-9.00681170e-01  1.03205722e+00 -1.34127240e+00 -1.31297673e+00]
 [-1.14301691e+00 -1.24957601e-01 -1.34127240e+00 -1.31297673e+00]
 [-1.38535265e+00  3.37848329e-01 -1.39813811e+00 -1.31297673e+00]
 [-1.50652052e+00  1.06445364e-01 -1.28440670e+00 -1.31297673e+00]
 [-1.02184904e+00  1.26346019e+00 -1.34127240e+00 -1.31297673e+00]
 [-5.37177559e-01  1.95766909e+00 -1.17067529e+00 -1.05003079e+00]
 [-1.50652052e+00  8.00654259e-01 -1.34127240e+00 -1.18150376e+00]
 [-1.02184904e+00  8.00654259e-01 -1.28440670e+00 -1.31297673e+00]
 [-1.74885626e+00 -3.56360566e-01 -1.34127240e+00 -1.31297673e+00]
 [-1.14301691e+00  1.06445364e-01 -1.28440670e+00 -1.44444970e+00]
 [-5.37177559e-01  1.49486315e+00 -1.28440670e+00 -1.31297673e+00]
 [-1.26418478e+00  8.00654259e-01 -1.22754100e+00 -1.31297673e+00]
 [-1.26418478e+00 -1.24957601e-01 -1.34127240e+00 -1.44444970e+00]
 [-1.87002413e+00 -1.24957601e-01 -1.51186952e+00 -1.44444970e+00]
 [-5.25060772e-02  2.18907205e+00 -1.45500381e+00 -1.31297673e+00]
 [-1.73673948e-01  3.11468391e+00 -1.28440670e+00 -1.05003079e+00]
 [-5.37177559e-01  1.95766909e+00 -1.39813811e+00 -1.05003079e+00]
 [-9.00681170e-01  1.03205722e+00 -1.34127240e+00 -1.18150376e+00]
 [-1.73673948e-01  1.72626612e+00 -1.17067529e+00 -1.18150376e+00]
 [-9.00681170e-01  1.72626612e+00 -1.28440670e+00 -1.18150376e+00]
 [-5.37177559e-01  8.00654259e-01 -1.17067529e+00 -1.31297673e+00]
 [-9.00681170e-01  1.49486315e+00 -1.28440670e+00 -1.05003079e+00]
 [-1.50652052e+00  1.26346019e+00 -1.56873522e+00 -1.31297673e+00]
 [-9.00681170e-01  5.69251294e-01 -1.17067529e+00 -9.18557817e-01]
 [-1.26418478e+00  8.00654259e-01 -1.05694388e+00 -1.31297673e+00]
 [-1.02184904e+00 -1.24957601e-01 -1.22754100e+00 -1.31297673e+00]
 [-1.02184904e+00  8.00654259e-01 -1.22754100e+00 -1.05003079e+00]
 [-7.79513300e-01  1.03205722e+00 -1.28440670e+00 -1.31297673e+00]
 [-7.79513300e-01  8.00654259e-01 -1.34127240e+00 -1.31297673e+00]
 [-1.38535265e+00  3.37848329e-01 -1.22754100e+00 -1.31297673e+00]
 [-1.26418478e+00  1.06445364e-01 -1.22754100e+00 -1.31297673e+00]
 [-5.37177559e-01  8.00654259e-01 -1.28440670e+00 -1.05003079e+00]
 [-7.79513300e-01  2.42047502e+00 -1.28440670e+00 -1.44444970e+00]
```

```
[-4.16009689e-01  2.65187798e+00 -1.34127240e+00 -1.31297673e+00]
[-1.14301691e+00  1.06445364e-01 -1.28440670e+00 -1.44444970e+00]
[-1.02184904e+00  3.37848329e-01 -1.45500381e+00 -1.31297673e+00]
[-4.16009689e-01  1.03205722e+00 -1.39813811e+00 -1.31297673e+00]
[-1.14301691e+00  1.06445364e-01 -1.28440670e+00 -1.44444970e+00]
[-1.74885626e+00 -1.24957601e-01 -1.39813811e+00 -1.31297673e+00]
[-9.00681170e-01  8.00654259e-01 -1.28440670e+00 -1.31297673e+00]
[-1.02184904e+00  1.03205722e+00 -1.39813811e+00 -1.18150376e+00]
[-1.62768839e+00 -1.74477836e+00 -1.39813811e+00 -1.18150376e+00]
[-1.74885626e+00  3.37848329e-01 -1.39813811e+00 -1.31297673e+00]
[-1.02184904e+00  1.03205722e+00 -1.22754100e+00 -7.87084847e-01]
[-9.00681170e-01  1.72626612e+00 -1.05694388e+00 -1.05003079e+00]
[-1.26418478e+00 -1.24957601e-01 -1.34127240e+00 -1.18150376e+00]
[-9.00681170e-01  1.72626612e+00 -1.22754100e+00 -1.31297673e+00]
[-1.50652052e+00  3.37848329e-01 -1.34127240e+00 -1.31297673e+00]
[-6.58345429e-01  1.49486315e+00 -1.28440670e+00 -1.31297673e+00]
[-1.02184904e+00  5.69251294e-01 -1.34127240e+00 -1.31297673e+00]
[ 1.40150837e+00  3.37848329e-01  5.35295827e-01  2.64698913e-01]
[ 6.74501145e-01  3.37848329e-01  4.21564419e-01  3.96171883e-01]
[ 1.28034050e+00  1.06445364e-01  6.49027235e-01  3.96171883e-01]
[-4.16009689e-01 -1.74477836e+00  1.37235899e-01  1.33225943e-01]
[ 7.95669016e-01 -5.87763531e-01  4.78430123e-01  3.96171883e-01]
[-1.73673948e-01 -5.87763531e-01  4.21564419e-01  1.33225943e-01]
[ 5.53333275e-01  5.69251294e-01  5.35295827e-01  5.27644853e-01]
[-1.14301691e+00 -1.51337539e+00 -2.60824029e-01 -2.61192967e-01]
[ 9.16836886e-01 -3.56360566e-01  4.78430123e-01  1.33225943e-01]
[-7.79513300e-01 -8.19166497e-01  8.03701950e-02  2.64698913e-01]
[-1.02184904e+00 -2.43898725e+00 -1.47092621e-01 -2.61192967e-01]
[ 6.86617933e-02 -1.24957601e-01  2.50967307e-01  3.96171883e-01]
[ 1.89829664e-01 -1.97618132e+00  1.37235899e-01 -2.61192967e-01]
[ 3.10997534e-01 -3.56360566e-01  5.35295827e-01  2.64698913e-01]
[-2.94841818e-01 -3.56360566e-01 -9.02269170e-02  1.33225943e-01]
[ 1.03800476e+00  1.06445364e-01  3.64698715e-01  2.64698913e-01]
[-2.94841818e-01 -1.24957601e-01  4.21564419e-01  3.96171883e-01]
[-5.25060772e-02 -8.19166497e-01  1.94101603e-01 -2.61192967e-01]
[ 4.32165405e-01 -1.97618132e+00  4.21564419e-01  3.96171883e-01]
[-2.94841818e-01 -1.28197243e+00  8.03701950e-02 -1.29719997e-01]
[ 6.86617933e-02  3.37848329e-01  5.92161531e-01  7.90590793e-01]
[ 3.10997534e-01 -5.87763531e-01  1.37235899e-01  1.33225943e-01]
[ 5.53333275e-01 -1.28197243e+00  6.49027235e-01  3.96171883e-01]
[ 3.10997534e-01 -5.87763531e-01  5.35295827e-01  1.75297293e-03]
[ 6.74501145e-01 -3.56360566e-01  3.07833011e-01  1.33225943e-01]
[ 9.16836886e-01 -1.24957601e-01  3.64698715e-01  2.64698913e-01]
[ 1.15917263e+00 -5.87763531e-01  5.92161531e-01  2.64698913e-01]
[ 1.03800476e+00 -1.24957601e-01  7.05892939e-01  6.59117823e-01]
[ 1.89829664e-01 -3.56360566e-01  4.21564419e-01  3.96171883e-01]
[-1.73673948e-01 -1.05056946e+00 -1.47092621e-01 -2.61192967e-01]
[-4.16009689e-01 -1.51337539e+00  2.35044910e-02 -1.29719997e-01]
[-4.16009689e-01 -1.51337539e+00 -3.33612130e-02 -2.61192967e-01]
```

```
[-5.25060772e-02 -8.19166497e-01  8.03701950e-02  1.75297293e-03]
[ 1.89829664e-01 -8.19166497e-01  7.62758643e-01  5.27644853e-01]
[-5.37177559e-01 -1.24957601e-01  4.21564419e-01  3.96171883e-01]
[ 1.89829664e-01  8.00654259e-01  4.21564419e-01  5.27644853e-01]
[ 1.03800476e+00  1.06445364e-01  5.35295827e-01  3.96171883e-01]
[ 5.53333275e-01 -1.74477836e+00  3.64698715e-01  1.33225943e-01]
[-2.94841818e-01 -1.24957601e-01  1.94101603e-01  1.33225943e-01]
[-4.16009689e-01 -1.28197243e+00  1.37235899e-01  1.33225943e-01]
[-4.16009689e-01 -1.05056946e+00  3.64698715e-01  1.75297293e-03]
[ 3.10997534e-01 -1.24957601e-01  4.78430123e-01  2.64698913e-01]
[-5.25060772e-02 -1.05056946e+00  1.37235899e-01  1.75297293e-03]
[-1.02184904e+00 -1.74477836e+00 -2.60824029e-01 -2.61192967e-01]
[-2.94841818e-01 -8.19166497e-01  2.50967307e-01  1.33225943e-01]
[-1.73673948e-01 -1.24957601e-01  2.50967307e-01  1.75297293e-03]
[-1.73673948e-01 -3.56360566e-01  2.50967307e-01  1.33225943e-01]
[ 4.32165405e-01 -3.56360566e-01  3.07833011e-01  1.33225943e-01]
[-9.00681170e-01 -1.28197243e+00 -4.31421141e-01 -1.29719997e-01]
[-1.73673948e-01 -5.87763531e-01  1.94101603e-01  1.33225943e-01]
[ 5.53333275e-01  5.69251294e-01  1.27454998e+00  1.71090158e+00]
[-5.25060772e-02 -8.19166497e-01  7.62758643e-01  9.22063763e-01]
[ 1.52267624e+00 -1.24957601e-01  1.21768427e+00  1.18500970e+00]
[ 5.53333275e-01 -3.56360566e-01  1.04708716e+00  7.90590793e-01]
[ 7.95669016e-01 -1.24957601e-01  1.16081857e+00  1.31648267e+00]
[ 2.12851559e+00 -1.24957601e-01  1.61574420e+00  1.18500970e+00]
[-1.14301691e+00 -1.28197243e+00  4.21564419e-01  6.59117823e-01]
[ 1.76501198e+00 -3.56360566e-01  1.44514709e+00  7.90590793e-01]
[ 1.03800476e+00 -1.28197243e+00  1.16081857e+00  7.90590793e-01]
[ 1.64384411e+00  1.26346019e+00  1.33141568e+00  1.71090158e+00]
[ 7.95669016e-01  3.37848329e-01  7.62758643e-01  1.05353673e+00]
[ 6.74501145e-01 -8.19166497e-01  8.76490051e-01  9.22063763e-01]
[ 1.15917263e+00 -1.24957601e-01  9.90221459e-01  1.18500970e+00]
[-1.73673948e-01 -1.28197243e+00  7.05892939e-01  1.05353673e+00]
[-5.25060772e-02 -5.87763531e-01  7.62758643e-01  1.57942861e+00]
[ 6.74501145e-01  3.37848329e-01  8.76490051e-01  1.44795564e+00]
[ 7.95669016e-01 -1.24957601e-01  9.90221459e-01  7.90590793e-01]
[ 2.24968346e+00  1.72626612e+00  1.67260991e+00  1.31648267e+00]
[ 2.24968346e+00 -1.05056946e+00  1.78634131e+00  1.44795564e+00]
[ 1.89829664e-01 -1.97618132e+00  7.05892939e-01  3.96171883e-01]
[ 1.28034050e+00  3.37848329e-01  1.10395287e+00  1.44795564e+00]
[-2.94841818e-01 -5.87763531e-01  6.49027235e-01  1.05353673e+00]
[ 2.24968346e+00 -5.87763531e-01  1.67260991e+00  1.05353673e+00]
[ 5.53333275e-01 -8.19166497e-01  6.49027235e-01  7.90590793e-01]
[ 1.03800476e+00  5.69251294e-01  1.10395287e+00  1.18500970e+00]
[ 1.64384411e+00  3.37848329e-01  1.27454998e+00  7.90590793e-01]
[ 4.32165405e-01 -5.87763531e-01  5.92161531e-01  7.90590793e-01]
[ 3.10997534e-01 -1.24957601e-01  6.49027235e-01  7.90590793e-01]
[ 6.74501145e-01 -5.87763531e-01  1.04708716e+00  1.18500970e+00]
[ 1.64384411e+00 -1.24957601e-01  1.16081857e+00  5.27644853e-01]
[ 1.88617985e+00 -5.87763531e-01  1.33141568e+00  9.22063763e-01]
```

```
 [ 2.49201920e+00  1.72626612e+00  1.50201279e+00  1.05353673e+00]
 [ 6.74501145e-01 -5.87763531e-01  1.04708716e+00  1.31648267e+00]
 [ 5.53333275e-01 -5.87763531e-01  7.62758643e-01  3.96171883e-01]
 [ 3.10997534e-01 -1.05056946e+00  1.04708716e+00  2.64698913e-01]
 [ 2.24968346e+00 -1.24957601e-01  1.33141568e+00  1.44795564e+00]
 [ 5.53333275e-01  8.00654259e-01  1.04708716e+00  1.57942861e+00]
 [ 6.74501145e-01  1.06445364e-01  9.90221459e-01  7.90590793e-01]
 [ 1.89829664e-01 -1.24957601e-01  5.92161531e-01  7.90590793e-01]
 [ 1.28034050e+00  1.06445364e-01  9.33355755e-01  1.18500970e+00]
 [ 1.03800476e+00  1.06445364e-01  1.04708716e+00  1.57942861e+00]
 [ 1.28034050e+00  1.06445364e-01  7.62758643e-01  1.44795564e+00]
 [-5.25060772e-02 -8.19166497e-01  7.62758643e-01  9.22063763e-01]
 [ 1.15917263e+00  3.37848329e-01  1.21768427e+00  1.44795564e+00]
 [ 1.03800476e+00  5.69251294e-01  1.10395287e+00  1.71090158e+00]
 [ 1.03800476e+00 -1.24957601e-01  8.19624347e-01  1.44795564e+00]
 [ 5.53333275e-01 -1.28197243e+00  7.05892939e-01  9.22063763e-01]
 [ 7.95669016e-01 -1.24957601e-01  8.19624347e-01  1.05353673e+00]
 [ 4.32165405e-01  8.00654259e-01  9.33355755e-01  1.44795564e+00]
 [ 6.86617933e-02 -1.24957601e-01  7.62758643e-01  7.90590793e-01]]
```

```
pc = PCA(n_components = 2)
Pca = pc.fit_transform(stand)
print(Pca)
```

```
[[-2.26454173e+00  5.05703903e-01]
 [-2.08642550e+00 -6.55404729e-01]
 [-2.36795045e+00 -3.18477311e-01]
 [-2.30419716e+00 -5.75367713e-01]
 [-2.38877749e+00  6.74767397e-01]
 [-2.07053681e+00  1.51854856e+00]
 [-2.44571134e+00  7.45626750e-02]
 [-2.23384186e+00  2.47613932e-01]
 [-2.34195768e+00 -1.09514636e+00]
 [-2.18867576e+00 -4.48629048e-01]
 [-2.16348656e+00  1.07059558e+00]
 [-2.32737775e+00  1.58587455e-01]
 [-2.22408272e+00 -7.09118158e-01]
 [-2.63971626e+00 -9.38281982e-01]
 [-2.19229151e+00  1.88997851e+00]
 [-2.25146521e+00  2.72237108e+00]
 [-2.20275048e+00  1.51375028e+00]
 [-2.19017916e+00  5.14304308e-01]
 [-1.89407429e+00  1.43111071e+00]
 [-2.33994907e+00  1.15803343e+00]
 [-1.91455639e+00  4.30465163e-01]
 [-2.20464540e+00  9.52457317e-01]
 [-2.77416979e+00  4.89517027e-01]
 [-1.82041156e+00  1.06750793e-01]
 [-2.22821750e+00  1.62186163e-01]
 [-1.95702401e+00 -6.07892567e-01]
```

```
[-2.05206331e+00  2.66014312e-01]
[-2.16819365e+00  5.52016495e-01]
[-2.14030596e+00  3.36640409e-01]
[-2.26879019e+00 -3.14878603e-01]
[-2.14455443e+00 -4.83942097e-01]
[-1.83193810e+00  4.45266836e-01]
[-2.60820287e+00  1.82847519e+00]
[-2.43795086e+00  2.18539162e+00]
[-2.18867576e+00 -4.48629048e-01]
[-2.21111990e+00 -1.84337811e-01]
[-2.04441652e+00  6.84956426e-01]
[-2.18867576e+00 -4.48629048e-01]
[-2.43595220e+00 -8.82169415e-01]
[-2.17054720e+00  2.92726955e-01]
[-2.28652724e+00  4.67991716e-01]
[-1.87170722e+00 -2.32769161e+00]
[-2.55783442e+00 -4.53816380e-01]
[-1.96427929e+00  4.97391640e-01]
[-2.13337283e+00  1.17143211e+00]
[-2.07535759e+00 -6.91917347e-01]
[-2.38125822e+00  1.15063259e+00]
[-2.39819169e+00 -3.62390765e-01]
[-2.22678121e+00  1.02548255e+00]
[-2.20595417e+00  3.22378453e-02]
[ 1.10399365e+00  8.63112446e-01]
[ 7.32481440e-01  5.98635573e-01]
[ 1.24210951e+00  6.14822450e-01]
[ 3.97307283e-01 -1.75816895e+00]
[ 1.07259395e+00 -2.11757903e-01]
[ 3.84458146e-01 -5.91062469e-01]
[ 7.48715076e-01  7.78698611e-01]
[-4.97863388e-01 -1.84886877e+00]
[ 9.26222368e-01  3.03308268e-02]
[ 4.96802558e-03 -1.02940111e+00]
[-1.24697461e-01 -2.65806268e+00]
[ 4.38730118e-01 -5.88812850e-02]
[ 5.51633981e-01 -1.77258156e+00]
[ 7.17165066e-01 -1.85434315e-01]
[-3.72583830e-02 -4.32795099e-01]
[ 8.75890536e-01  5.09998151e-01]
[ 3.48006402e-01 -1.90621647e-01]
[ 1.53392545e-01 -7.90725456e-01]
[ 1.21530321e+00 -1.63335564e+00]
[ 1.56941176e-01 -1.30310327e+00]
[ 7.38256104e-01  4.02470382e-01]
[ 4.72369682e-01 -4.16608222e-01]
[ 1.22798821e+00 -9.40914793e-01]
[ 6.29381045e-01 -4.16811643e-01]
[ 7.00472799e-01 -6.34939277e-02]
```

```
[ 8.73536987e-01  2.50708611e-01]
[ 1.25422219e+00 -8.26200998e-02]
[ 1.35823985e+00  3.28820266e-01]
[ 6.62126138e-01 -2.24346071e-01]
[-4.72815133e-02 -1.05721241e+00]
[ 1.21534209e-01 -1.56359238e+00]
[ 1.41182261e-02 -1.57339235e+00]
[ 2.36010837e-01 -7.75923784e-01]
[ 1.05669143e+00 -6.36901284e-01]
[ 2.21417088e-01 -2.80847693e-01]
[ 4.31783161e-01  8.55136920e-01]
[ 1.04941336e+00  5.22197265e-01]
[ 1.03587821e+00 -1.39246648e+00]
[ 6.70675999e-02 -2.12620735e-01]
[ 2.75425066e-01 -1.32981591e+00]
[ 2.72335066e-01 -1.11944152e+00]
[ 6.23170540e-01  2.75426333e-02]
[ 3.30005364e-01 -9.88900732e-01]
[-3.73627623e-01 -2.01793227e+00]
[ 2.82944343e-01 -8.53950717e-01]
[ 8.90531103e-02 -1.74908548e-01]
[ 2.24356783e-01 -3.80484659e-01]
[ 5.73883486e-01 -1.53719974e-01]
[-4.57012873e-01 -1.53946451e+00]
[ 2.52244473e-01 -5.95860746e-01]
[ 1.84767259e+00  8.71696662e-01]
[ 1.15318981e+00 -7.01326114e-01]
[ 2.20634950e+00  5.54470105e-01]
[ 1.43868540e+00 -5.00105223e-02]
[ 1.86789070e+00  2.91192802e-01]
[ 2.75419671e+00  7.88432206e-01]
[ 3.58374475e-01 -1.56009458e+00]
[ 2.30300590e+00  4.09516695e-01]
[ 2.00173530e+00 -7.23865359e-01]
[ 2.26755460e+00  1.92144299e+00]
[ 1.36590943e+00  6.93948040e-01]
[ 1.59906459e+00 -4.28248836e-01]
[ 1.88425185e+00  4.14332758e-01]
[ 1.25308651e+00 -1.16739134e+00]
[ 1.46406152e+00 -4.44147569e-01]
[ 1.59180930e+00  6.77035372e-01]
[ 1.47128019e+00  2.53192472e-01]
[ 2.43737848e+00  2.55675734e+00]
[ 3.30914118e+00 -2.36132010e-03]
[ 1.25398099e+00 -1.71758384e+00]
[ 2.04049626e+00  9.07398765e-01]
[ 9.73915114e-01 -5.71174376e-01]
[ 2.89806444e+00  3.97791359e-01]
[ 1.32919369e+00 -4.86760542e-01]
```

```
 [ 1.70424071e+00  1.01414842e+00]
 [ 1.95772766e+00  1.00333452e+00]
 [ 1.17190451e+00 -3.18896617e-01]
 [ 1.01978105e+00  6.55429631e-02]
 [ 1.78600886e+00 -1.93272800e-01]
 [ 1.86477791e+00  5.55381532e-01]
 [ 2.43549739e+00  2.46654468e-01]
 [ 2.31608241e+00  2.62618387e+00]
 [ 1.86037143e+00 -1.84672394e-01]
 [ 1.11127173e+00 -2.95986102e-01]
 [ 1.19746916e+00 -8.17167742e-01]
 [ 2.80094940e+00  8.44748194e-01]
 [ 1.58015525e+00  1.07247450e+00]
 [ 1.34704442e+00  4.22255966e-01]
 [ 9.23432978e-01  1.92303705e-02]
 [ 1.85355198e+00  6.72422729e-01]
 [ 2.01615720e+00  6.10397038e-01]
 [ 1.90311686e+00  6.86024832e-01]
 [ 1.15318981e+00 -7.01326114e-01]
 [ 2.04330844e+00  8.64684880e-01]
 [ 2.00169097e+00  1.04855005e+00]
 [ 1.87052207e+00  3.82821838e-01]
 [ 1.55849189e+00 -9.05313601e-01]
 [ 1.52084506e+00  2.66794575e-01]
 [ 1.37639119e+00  1.01636193e+00]
 [ 9.59298576e-01 -2.22839447e-02]]
```

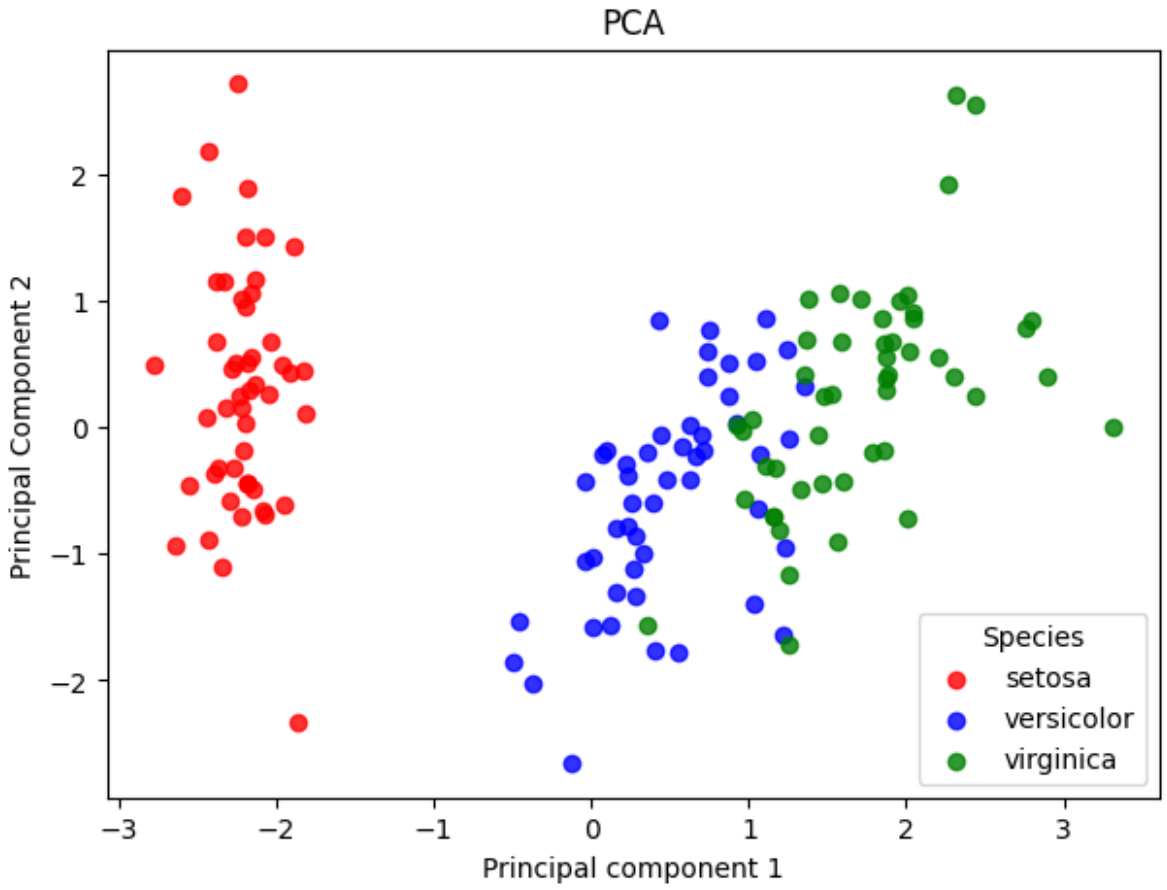
```
df_f = pd.DataFrame(data=Pca,columns = ['principal component
1','principal component 2'])
df_f['target']=target
print(df_f)
```

```
     principal component 1  principal component 2     target
0                -2.264542               0.505704     setosa
1                -2.086426              -0.655405     setosa
2                -2.367950              -0.318477     setosa
3                -2.304197              -0.575368     setosa
4                -2.388777               0.674767     setosa
..                     ...                    ...        ...
145               1.870522               0.382822  virginica
146               1.558492              -0.905314  virginica
147               1.520845               0.266795  virginica
148               1.376391               1.016362  virginica
149               0.959299              -0.022284  virginica

[150 rows x 3 columns]
```

```
target_col = df_f['target'].unique()
colors = ['red','blue','green']
```

```
plt.figure(figsize = (7,5))
for label,color in zip(target_col,colors):
    plt.scatter(df_f.loc[df_f['target'] == label,'principal component
1'],
                df_f.loc[df_f['target'] == label,'principal component
2'],
                color=color,
                label=label,
                alpha=0.8
               )
plt.legend(title='Species')
plt.xlabel('Principal component 1')
plt.ylabel('Principal Component 2')
plt.title('PCA')
plt.show()
```




```
explained_variance = pc.explained_variance_ratio_
print("Explained Variance by each Principal Component:")
print("Principal Component 1: ",explained_variance[0])
print("Principal Component 2: ",explained_variance[1])
print("Total Variance Retained: ",sum(explained_variance))
```

```
Explained Variance by each Principal Component:
Principal Component 1:  0.7277045209380135
Principal Component 2:  0.23030523267680633
Total Variance Retained:  0.9580097536148199
```