

```
import numpy as np
import pandas as pd

from sklearn.datasets import load_iris
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
import matplotlib.pyplot as plt
```

```
iris = load_iris()
x = iris.data
y = iris.target
print(x)
print(y)
s = x.shape
print(s)
```

[4.1 3.5 1.4 0.2]
 [4.9 3. 1.4 0.2]
 [4.7 3.2 1.3 0.2]
 [4.6 3.1 1.5 0.2]
 [5. 3.6 1.4 0.2]
 [4.5 3.9 1.7 0.4]
 [4.6 3.4 1.4 0.3]
 [5. 3.4 1.5 0.2]
 [4.4 2.9 1.4 0.2]
 [4.9 3.1 1.5 0.1]
 [4.5 3.7 1.5 0.2]
 [4.8 3.4 1.6 0.2]
 [4.8 3. 1.4 0.1]
 [4.3 3. 1.1 0.1]
 [5.8 4. 1.2 0.1]
 [5.7 4.4 1.5 0.1]
 [5.4 3.9 1.3 0.1]
 [5.1 3.5 1.4 0.3]
 [5.7 3.8 1.7 0.3]
 [5.1 3.8 1.5 0.3]
 [5.4 3.4 1.7 0.2]
 [5.1 3.7 1.5 0.4]
 [4.6 3.6 1. 0.2]
 [5.1 3.3 1.7 0.5]
 [4.8 3.4 1.9 0.2]
 [5. 3. 1.6 0.2]
 [5. 3.4 1.6 0.4]
 [5.2 3.5 1.5 0.2]
 [5.2 3.4 1.4 0.2]
 [4.7 3.2 1.6 0.2]
 [4.8 3.1 1.6 0.2]
 [5.4 3.4 1.5 0.4]
 [5.2 4.1 1.5 0.1]
 [5.5 4.2 1.4 0.2]
 [4.9 3.1 1.5 0.2]
 [5. 3.2 1.2 0.2]
 [5.5 3.5 1.3 0.2]
 [4.9 3.6 1.4 0.1]
 [4.4 3. 1.3 0.2]
 [5.1 3.4 1.5 0.2]
 [5. 3.5 1.3 0.3]
 [4.5 2.3 1.3 0.3]
 [4.4 3.2 1.6 0.2]
 [5. 3.5 1.6 0.6]
 [5.1 3.8 1.9 0.4]
 [4.8 3. 1.4 0.3]
 [5.1 3.8 1.6 0.2]
 [4.6 3.2 1.4 0.2]
 [5.3 3.7 1.5 0.2]
 [5. 3.3 1.4 0.2]
 [7. 3.2 4.7 1.4]
 [6.4 3.2 4.5 1.5]
 [6.9 3.1 4.9 1.5]
 [5.5 2.3 4. 1.3]
 [6.5 2.8 4.6 1.5]
 [5.7 2.8 4.5 1.3]
 [6.3 3.3 4.7 1.6]
 [4.9 2.4 3.3 1. 0.1]
 [6.6 2.9 4.6 1.3]
 [5.6 2.7 3.9 1.4]
 [5. 2. 3.5 1. 0.1]
 [5.9 3. 4.2 1.5]
 [6. 2.2 4. 1. 0.1]
 [6.1 2.9 4.7 1.4]
 [6.6 2.9 3.6 1.3]
 [6.7 3.1 4.4 1.4]
 [5.6 3. 4.5 1.5]
 [5.8 2.7 4.1 1. 0.1]
 [6.2 2.2 4.5 1.5]
 [5.6 2.5 3.9 1.1]
 [5.9 3.2 4.8 1.8]
 [6.1 2.8 4. 1.3]
 [6.3 2.5 4.9 1.5]
 [6.1 2.8 4.7 1.2]
 [6.4 2.9 4.3 1.3]
 [6.6 3. 4.4 1.4]
 [6.8 2.8 4.8 1.4]
 [6.7 3. 5. 1.7]
 [6. 2.9 4.5 1.5]
 [5.7 2.6 3.5 1. 0.1]
 [5.5 2.4 3.8 1. 0.1]
 [5.5 2.4 3.7 1.1]
 [5.8 2.7 3.9 1.2]
 [6. 2.7 5.1 1.6]
 [5.4 3. 4.5 1.5]
 [6. 3.4 4.5 1.6]
 [6.7 3.1 4.7 1.5]
 [6.3 2.3 4.4 1.3]
 [5.6 3. 4.1 1.3]
 [5.5 2.5 4. 1.3]
 [5.5 2.6 4.4 1.2]

```
target_names = iris.target_names
print(target_names)
```

```
['setosa' 'versicolor' 'virginica']
```

Loading [MathJax]/extensions/Safe.js

[-1.02184904e+00 3.28414053e-01 -1.45390138e+00 -1.31544430e+00]
[-4.16009689e-01 1.01900435e+00 -1.39706395e+00 -1.31544430e+00]
[-1.14301691e+00 1.24920112e+00 -1.34022653e+00 -1.44707648e+00]
[-1.74885626e+00 -1.31979479e-01 -1.39706395e+00 -1.31544430e+00]
[-9.00681170e-01 7.88807586e-01 -1.28338910e+00 -1.31544430e+00]
[-1.02184904e+00 1.01900435e+00 -1.39706395e+00 -1.18381211e+00]
[-1.62768839e+00 -1.74335684e+00 -1.39706395e+00 -1.18381211e+00]
[-1.74885626e+00 3.28414053e-01 -1.39706395e+00 -1.31544430e+00]
[-1.02184904e+00 1.01900435e+00 -1.22655167e+00 -7.88915558e-01]
[-9.00681170e-01 1.70959465e+00 -1.05603939e+00 -1.05217993e+00]
[-1.26418478e+00 -1.31979479e-01 -1.34022653e+00 -1.18381211e+00]
[-9.00681170e-01 1.70959465e+00 -1.22655167e+00 -1.31544430e+00]
[-1.50652052e+00 3.28414053e-01 -1.34022653e+00 -1.31544430e+00]
[-6.58345429e-01 1.47939788e+00 -1.28338910e+00 -1.31544430e+00]
[-1.02184904e+00 5.58610819e-01 -1.34022653e+00 -1.31544430e+00]
[1.40150837e+00 3.28414053e-01 5.35408562e-01 2.64141916e-01]
[6.74501145e-01 3.28414053e-01 4.21733708e-01 3.95774101e-01]
[1.28034050e+00 9.82172869e-02 6.49083415e-01 3.95774101e-01]
[-4.16009689e-01 -1.74335684e+00 1.37546573e-01 1.32509732e-01]
[7.95669016e-01 -5.92373012e-01 4.78571135e-01 3.95774101e-01]
[-1.73673948e-01 -5.92373012e-01 4.21733708e-01 1.32509732e-01]
[5.53333275e-01 5.58610819e-01 5.35408562e-01 5.27406285e-01]
[-1.14301691e+00 -1.51316008e+00 -2.60315415e-01 -2.62386821e-01]
[9.16836886e-01 -3.62176246e-01 4.78571135e-01 1.32509732e-01]
[-7.79513300e-01 -8.22569778e-01 8.07091462e-02 2.64141916e-01]
[-1.02184904e+00 -2.43394714e+00 -1.46640561e-01 -2.62386821e-01]
[6.86617933e-02 -1.31979479e-01 2.51221427e-01 3.95774101e-01]
[1.89829664e-01 -1.97355361e+00 1.37546573e-01 -2.62386821e-01]
[3.10997534e-01 -3.62176246e-01 5.35408562e-01 2.64141916e-01]
[-2.94841818e-01 -3.62176246e-01 -8.98031345e-02 1.32509732e-01]
[1.03800476e+00 9.82172869e-02 3.64896281e-01 2.64141916e-01]
[-2.94841818e-01 -1.31979479e-01 4.21733708e-01 3.95774101e-01]
[-5.25060772e-02 -8.22569778e-01 1.94384000e-01 -2.62386821e-01]
[4.32165405e-01 -1.97355361e+00 4.21733708e-01 3.95774101e-01]
[-2.94841818e-01 -1.28296331e+00 8.07091462e-02 -1.30754636e-01]
[6.86617933e-02 3.28414053e-01 5.92245988e-01 7.90670654e-01]
[3.10997534e-01 -5.92373012e-01 1.37546573e-01 1.32509732e-01]
[5.53333275e-01 -1.28296331e+00 6.49083415e-01 3.95774101e-01]
[3.10997534e-01 -5.92373012e-01 5.35408562e-01 8.77547895e-04]
[6.74501145e-01 -3.62176246e-01 3.08058854e-01 1.32509732e-01]
[9.16836886e-01 -1.31979479e-01 3.64896281e-01 2.64141916e-01]
[1.15917263e+00 -5.92373012e-01 5.92245988e-01 2.64141916e-01]
[1.03800476e+00 -1.31979479e-01 7.05920842e-01 6.59038469e-01]
[1.89829664e-01 -3.62176246e-01 4.21733708e-01 3.95774101e-01]
[-1.73673948e-01 -1.05276654e+00 -1.46640561e-01 -2.62386821e-01]
[-4.16009689e-01 -1.51316008e+00 2.38717193e-02 -1.30754636e-01]
[-4.16009689e-01 -1.51316008e+00 -3.29657076e-02 -2.62386821e-01]
[-5.25060772e-02 -8.22569778e-01 8.07091462e-02 8.77547895e-04]
[1.89829664e-01 -8.22569778e-01 7.62758269e-01 5.27406285e-01]
[-5.37177559e-01 -1.31979479e-01 4.21733708e-01 3.95774101e-01]
[1.89829664e-01 7.88807586e-01 4.21733708e-01 5.27406285e-01]
[1.03800476e+00 9.82172869e-02 5.35408562e-01 3.95774101e-01]
[5.53333275e-01 -1.74335684e+00 3.64896281e-01 1.32509732e-01]
[-2.94841818e-01 -1.31979479e-01 1.94384000e-01 1.32509732e-01]
[-4.16009689e-01 -1.28296331e+00 1.37546573e-01 1.32509732e-01]
[-4.16009689e-01 -1.05276654e+00 3.64896281e-01 8.77547895e-04]
[3.10997534e-01 -1.31979479e-01 4.78571135e-01 2.64141916e-01]
[-5.25060772e-02 -1.05276654e+00 1.37546573e-01 8.77547895e-04]
[-1.02184904e+00 -1.74335684e+00 -2.60315415e-01 -2.62386821e-01]
[-2.94841818e-01 -8.22569778e-01 2.51221427e-01 1.32509732e-01]
[-1.73673948e-01 -1.31979479e-01 2.51221427e-01 8.77547895e-04]
[-1.73673948e-01 -3.62176246e-01 2.51221427e-01 1.32509732e-01]
[4.32165405e-01 -3.62176246e-01 3.08058854e-01 1.32509732e-01]
[-9.00681170e-01 -1.28296331e+00 -4.30827696e-01 -1.30754636e-01]
[-1.73673948e-01 -5.92373012e-01 1.94384000e-01 1.32509732e-01]
[5.53333275e-01 5.58610819e-01 1.27429511e+00 1.71209594e+00]
[-5.25060772e-02 -8.22569778e-01 7.62758269e-01 9.22302838e-01]
[1.52267624e+00 -1.31979479e-01 1.21745768e+00 1.18556721e+00]
[5.53333275e-01 -3.62176246e-01 1.04694540e+00 7.90670654e-01]
[7.95669016e-01 -1.31979479e-01 1.16062026e+00 1.31719939e+00]
[2.12851559e+00 -1.31979479e-01 1.61531967e+00 1.18556721e+00]
[-1.14301691e+00 -1.28296331e+00 4.21733708e-01 6.59038469e-01]
[1.76501198e+00 -3.62176246e-01 1.44480739e+00 7.90670654e-01]
[1.03800476e+00 -1.28296331e+00 1.16062026e+00 7.90670654e-01]
[1.64384411e+00 1.24920112e+00 1.33113254e+00 1.71209594e+00]
[7.95669016e-01 3.28414053e-01 7.62758269e-01 1.05393502e+00]
[6.74501145e-01 -8.22569778e-01 8.76433123e-01 9.22302838e-01]
[1.15917263e+00 -1.31979479e-01 9.90107977e-01 1.18556721e+00]
[-1.73673948e-01 -1.28296331e+00 7.05920842e-01 1.05393502e+00]
[-5.25060772e-02 -5.92373012e-01 7.62758269e-01 1.58046376e+00]
[6.74501145e-01 3.28414053e-01 8.76433123e-01 1.44883158e+00]
[7.95669016e-01 -1.31979479e-01 9.90107977e-01 7.90670654e-01]
[2.24968346e+00 1.70959465e+00 1.67215710e+00 1.31719939e+00]
[2.24968346e+00 -1.05276654e+00 1.78583195e+00 1.44883158e+00]
[1.89829664e-01 -1.97355361e+00 7.05920842e-01 3.95774101e-01]
[1.28034050e+00 3.28414053e-01 1.10378283e+00 1.44883158e+00]
[-2.94841818e-01 -5.92373012e-01 6.49083415e-01 1.05393502e+00]
[2.24968346e+00 -5.92373012e-01 1.67215710e+00 1.05393502e+00]
[5.53333275e-01 -8.22569778e-01 6.49083415e-01 7.90670654e-01]
[1.03800476e+00 5.58610819e-01 1.10378283e+00 1.18556721e+00]
[1.64384411e+00 3.28414053e-01 1.27429511e+00 7.90670654e-01]
[4.32165405e-01 -5.92373012e-01 5.92245988e-01 7.90670654e-01]
[3.10997534e-01 -1.31979479e-01 6.49083415e-01 7.90670654e-01]
[6.74501145e-01 -5.92373012e-01 1.04694540e+00 1.18556721e+00]
[1.64384411e+00 -1.31979479e-01 1.16062026e+00 5.27406285e-01]
[1.88617985e+00 -5.92373012e-01 1.33113254e+00 9.22302838e-01]
[2.49201920e+00 1.70959465e+00 1.50164482e+00 1.05393502e+00]
[6.74501145e-01 -5.92373012e-01 1.04694540e+00 1.31719939e+00]
[5.53333275e-01 -5.92373012e-01 7.62758269e-01 3.95774101e-01]
[3.10997534e-01 -1.05276654e+00 1.04694540e+00 2.64141916e-01]
[2.24968346e+00 -1.31979479e-01 1.33113254e+00 1.44883158e+00]
[5.53333275e-01 7.88807586e-01 1.04694540e+00 1.58046376e+00]
[6.74501145e-01 9.82172869e-02 9.90107977e-01 7.90670654e-01]
[1.89829664e-01 -1.31979479e-01 5.92245988e-01 7.90670654e-01]
[1.28034050e+00 9.82172869e-02 9.33270550e-01 1.18556721e+00]
[1.03800476e+00 9.82172869e-02 1.04694540e+00 1.58046376e+00]
[1.28034050e+00 9.82172869e-02 7.62758269e-01 1.44883158e+00]
[-5.25060772e-02 -8.22569778e-01 7.62758269e-01 9.22302838e-01]
[1.15917263e+00 3.28414053e-01 1.21745768e+00 1.44883158e+00]
[1.03800476e+00 5.58610819e-01 1.10378283e+00 1.71209594e+00]
[1.31979479e-01 8.19595696e-01 1.44883158e+00]

```
[ 5.53333275e-01 -1.28296331e+00  7.05920842e-01  9.22302838e-01]
[ 7.95669016e-01 -1.31979479e-01  8.19595696e-01  1.05393502e+00]
[ 4.32165405e-01  7.88807586e-01  9.33270550e-01  1.44883158e+00]
[ 6.86617933e-02 -1.31979479e-01  7.62758269e-01  7.90670654e-01]]
```

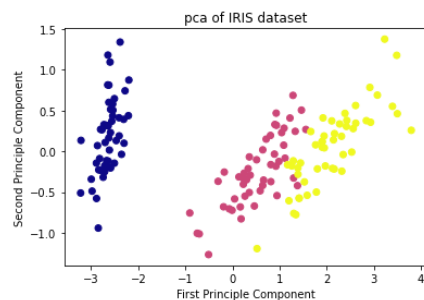
In [6]:

```
pca = PCA(n_components = 2)
x_pca = pca.fit_transform(x)
print(x_pca)
print(x_pca.shape)
```

```
[[-2.68412563  0.31939725]
 [-2.71414169 -0.17700123]
 [-2.88899057 -0.14494943]
 [-2.74534286 -0.31829898]
 [-2.72871654  0.32675451]
 [-2.28085963  0.74133045]
 [-2.82053775 -0.08946138]
 [-2.62614497  0.16338496]
 [-2.88638273 -0.57831175]
 [-2.6727558  -0.11377425]
 [-2.50694709  0.6450689 ]
 [-2.61275523  0.01472994]
 [-2.78610927 -0.235112 ]
 [-3.22380374 -0.51139459]
 [-2.64475039  1.17876464]
 [-2.38603903  1.33806233]
 [-2.62352788  0.81067951]
 [-2.64829671  0.31184914]
 [-2.19982032  0.87283904]
 [-2.5879864  0.51356031]
 [-2.31025622  0.39134594]
 [-2.54370523  0.43299606]
 [-3.21593942  0.13346807]
 [-2.30273318  0.09870885]
 [-2.35575405 -0.03728186]
 [-2.50666891 -0.14601688]
 [-2.46882007  0.13095149]
 [-2.56231991  0.36771886]
 [-2.63953472  0.31203998]
 [-2.63198939 -0.19696122]
 [-2.58739848 -0.20431849]
 [-2.4099325  0.41092426]
 [-2.64886233  0.81336382]
 [-2.59873675  1.09314576]
 [-2.63692688 -0.12132235]
 [-2.86624165  0.06936447]
 [-2.62523805  0.59937002]
 [-2.80068412  0.26864374]
 [-2.98050204 -0.48795834]
 [-2.59000631  0.22904384]
 [-2.77010243  0.26352753]
 [-2.84936871 -0.94096057]
 [-2.99740655 -0.34192606]
 [-2.40561449  0.18887143]
 [-2.20948924  0.43666314]
 [-2.71445143 -0.2502082 ]
 [-2.53814826  0.50377114]
 [-2.83946217 -0.22794557]
 [-2.54308575  0.57941002]
 [-2.70335978  0.10770608]
 [ 1.28482569  0.68516047]
 [ 0.93248853  0.31833364]
 [ 1.46430232  0.50426282]
 [ 0.18331772 -0.82795901]
 [ 1.08810326  0.07459068]
 [ 0.64166908 -0.41824687]
 [ 1.09506066  0.28346827]
 [-0.74912267 -1.00489096]
 [ 1.04413183  0.2283619 ]
 [-0.0087454  -0.72308191]
 [-0.50784088 -1.26597119]
 [ 0.51169856 -0.10398124]
 [ 0.26497651 -0.55003646]
 [ 0.98493451 -0.12481785]
 [-0.17392537 -0.25485421]
 [ 0.92786078  0.46717949]
 [ 0.66028376 -0.35296967]
 [ 0.23610499 -0.33361077]
 [ 0.94473373 -0.54314555]
 [ 0.04522698 -0.58383438]
 [ 1.11628318 -0.08461685]
 [ 0.35788842 -0.06892503]
 [ 1.29818388 -0.32778731]
 [ 0.92172892 -0.18273779]
 [ 0.71485333  0.14905594]
 [ 0.90017437  0.32850447]
 [ 1.33202444  0.24444088]
 [ 1.55780216  0.26749545]
 [ 0.81329065 -0.1633503 ]
 [-0.30558378 -0.36826219]
 [-0.06812649 -0.70517213]
 [-0.18962247 -0.68028676]
 [ 0.13642871 -0.31403244]
 [ 1.38002644 -0.42095429]
 [ 0.58800644 -0.48428742]
 [ 0.80685831  0.19418231]
 [ 1.22069088  0.40761959]
 [ 0.81509524 -0.37203706]
 [ 0.24595768 -0.2685244 ]
 [ 0.16641322 -0.68192672]
 [ 0.46480029 -0.67071154]
 [ 0.8908152  -0.03446444]
 [ 0.23054802 -0.40438585]
 [-0.70453176 -1.01224823]
 [ 0.35698149 -0.50491009]
 [ 0.33193448 -0.21265468]
 [ 0.37621565 -0.29321893]
 [ 0.64257601  0.01773819]
 [-0.90646986 -0.75609337]
 [-0.34889781 -0.34889781]]
```

```
[ 2.53119273 -0.00984911]
[ 1.41523588 -0.57491635]
[ 2.61667602  0.34390315]
[ 1.97153105 -0.1797279 ]
[ 2.35000592 -0.04026095]
[ 3.39703874  0.55083667]
[ 0.52123224 -1.19275873]
[ 2.93258707  0.3555    ]
[ 2.32122882 -0.2438315 ]
[ 2.91675097  0.78279195]
[ 1.66177415  0.24222841]
[ 1.80340195 -0.21563762]
[ 2.1655918   0.21627559]
[ 1.34616358 -0.77681835]
[ 1.58592822 -0.53964071]
[ 1.90445637  0.11925069]
[ 1.94968906  0.04194326]
[ 3.48705536  1.17573933]
[ 3.79564542  0.25732297]
[ 1.30079171 -0.76114964]
[ 2.42781791  0.37819601]
[ 1.19900111 -0.60609153]
[ 3.49992004  0.4606741 ]
[ 1.38876613 -0.20439933]
[ 2.2754305   0.33499061]
[ 2.61409047  0.56090136]
[ 1.25850816 -0.17970479]
[ 1.29113206 -0.11666865]
[ 2.12360872 -0.20972948]
[ 2.38800302  0.4646398 ]
[ 2.84167278  0.37526917]
[ 3.23067366  1.37416509]
[ 2.15943764 -0.21727758]
[ 1.44416124 -0.14341341]
[ 1.78129481 -0.49990168]
[ 3.07649993  0.68808568]
[ 2.14424331  0.1400642 ]
[ 1.90509815  0.04930053]
[ 1.16932634 -0.16499026]
[ 2.10761114  0.37228787]
[ 2.31415471  0.18365128]
[ 1.9222678   0.40920347]
[ 1.41523588 -0.57491635]
[ 2.56301338  0.2778626 ]
[ 2.41874618  0.3047982 ]
[ 1.94410979  0.1875323 ]
[ 1.52716661 -0.37531698]
[ 1.76434572  0.07885885]
[ 1.90094161  0.11662796]
[ 1.39018886 -0.28266094]]
(150, 2)
```

```
In [7]: plt.scatter(x_pca[:, 0], x_pca[:, 1], c=y, cmap='plasma')
plt.xlabel('First Principle Component')
plt.ylabel('Second Principle Component')
plt.title('pca of IRIS dataset')
plt.show()
```



```
In [ ]:
```