# 降维：高维数据可视化

## 1、调用库和模块

```
from sklearn.decomposition import PCA # 降维 - 主成分分析
from sklearn.datasets import load_iris
import pandas as pd
import matplotlib.pyplot as plt
```

## 2、提取数据集

```
iris = load_iris()
```

```
X = iris.data
y = iris.target
```

```
X.shape
pd.DataFrame(X)
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

| | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| **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 × 4 columns

## 3、建模

```
pca = PCA(n_components=2) # 实例化
pca_model = pca.fit(X) # 拟合模型
```

```
X_dr = pca_model.transform(X)
X_dr.shape
X_dr
```

```
array([[-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],
       [ 0.29900084, -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]])
```

```
# X_dr =  PCA(n_components=2).fit_transform(X)
```

## 4、可视化

```
# X_dr[y==2,0]  # ---- 过滤
```

```
# plt显示中文
plt.rcParams['font.sans-serif'] = ['KaiTi']
plt.rcParams['axes.unicode_minus'] = False
```

```
iris.target_names
```

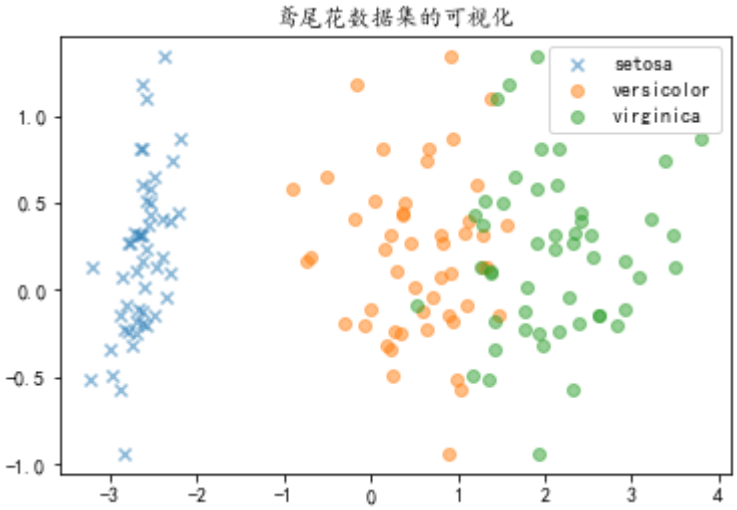
```
array(['setosa', 'versicolor', 'virginica'], dtype='<U10')
```

```
plt.figure()

plt.scatter(X_dr[y==0,0],X_dr[y==0,1],label=iris.target_names[0],marker='x',alpha=.5)
plt.scatter(X_dr[y==1,0],X_dr[y==0,1],label=iris.target_names[1],alpha=.5)
plt.scatter(X_dr[y==2,0],X_dr[y==0,1],label=iris.target_names[2],alpha=.5)

plt.legend()
plt.title('鸢尾花数据集的可视化')
```

```
Text(0.5, 1.0, '鸢尾花数据集的可视化')
```



```
# 查看降维后新特征向量上所携带信息的大小 -- 可解释性方差的大小
pca_model.explained_variance_
```

```
array([4.22824171, 0.24267075])
```

```
# 查看降维后新特征向量上所携带的信息量占原始信息量的百分比  -- 可解释方差贡献率
pca_model.explained_variance_ratio_
```

```
array([0.92461872, 0.05306648])
```

```
pca_model.explained_variance_ratio_.sum() # 降维后总信息量占原始信息的比例
```

```
0.9776852063187949
```

```

```