PCA - Principal Component Analysis

In [2]:
```
from sklearn.decomposition import PCA
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.datasets import load_iris
```

In [3]:
```
iris=load_iris()
iris
```

Out[3]:
```
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```

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[5.6, 2.8, 4.9, 2. ],
```

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        2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2]),
 'frame': None,
 'target_names': array(['setosa', 'versicolor', 'virginica'], dtype='<U10'),
 'DESCR': '.. _iris_dataset:\n\nIris plants dataset\n--------------------\n\n**Data Set Characteristics:**\n\n:Number of Inst
ances: 150 (50 in each of three classes)\n:Number of Attributes: 4 numeric, predictive attributes and the class\n:Attribute I
nformation:\n    - sepal length in cm\n    - sepal width in cm\n    - petal length in cm\n    - petal width in cm\n    - clas
s:\n            - Iris-Setosa\n            - Iris-Versicolour\n            - Iris-Virginica\n\n:Summary Statistics:\n\n======
```

```
======== ==== ==== ======= ===== ====================\n                Min  Max   Mean    SD   Class Correlation\n==========
=== ==== ==== ======= ===== ====================\nsepal length:   4.3  7.9   5.84   0.83    0.7826\nsepal width:    2.0  4.4
3.05   0.43   -0.4194\npetal length:   1.0  6.9   3.76   1.76    0.9490  (high!)\npetal width:    0.1  2.5   1.20   0.76
0.9565  (high!)\n============== ==== ==== ======= ===== ====================\n\n:Missing Attribute Values: None\n:Class Distr
ibution: 33.3% for each of 3 classes.\n:Creator: R.A. Fisher\n:Donor: Michael Marshall (MARSHALL%PLU@io.arc.nasa.gov)\n:Date:
July, 1988\n\nThe famous Iris database, first used by Sir R.A. Fisher. The dataset is taken\nfrom Fisher\'s paper. Note that
it\'s the same as in R, but not as in the UCI\nMachine Learning Repository, which has two wrong data points.\n\nThis is perha
ps the best known database to be found in the\npattern recognition literature.  Fisher\'s paper is a classic in the field and
\nis referenced frequently to this day.  (See Duda & Hart, for example.)  The\ndata set contains 3 classes of 50 instances ea
ch, where each class refers to a\ntype of iris plant.  One class is linearly separable from the other 2; the\nlatter are NOT
linearly separable from each other.\n\n|details-start|\n**References**\n|details-split|\n\n- Fisher, R.A. "The use of multipl
e measurements in taxonomic problems"\n  Annual Eugenics, 7, Part II, 179-188 (1936); also in "Contributions to\n  Mathematic
al Statistics" (John Wiley, NY, 1950).\n- Duda, R.O., & Hart, P.E. (1973) Pattern Classification and Scene Analysis.\n  (Q32
7.D83) John Wiley & Sons.  ISBN 0-471-22361-1.  See page 218.\n- Dasarathy, B.V. (1980) "Nosing Around the Neighborhood: A Ne
w System\n  Structure and Classification Rule for Recognition in Partially Exposed\n  Environments".  IEEE Transactions on Pa
ttern Analysis and Machine\n  Intelligence, Vol. PAMI-2, No. 1, 67-71.\n- Gates, G.W. (1972) "The Reduced Nearest Neighbor Ru
le".  IEEE Transactions\n  on Information Theory, May 1972, 431-433.\n- See also: 1988 MLC Proceedings, 54-64.  Cheeseman et
al"s AUTOCLASS II\n  conceptual clustering system finds 3 classes in the data.\n- Many, many more ...\n\n|details-end|\n',
 'feature_names': ['sepal length (cm)',
  'sepal width (cm)',
  'petal length (cm)',
  'petal width (cm)'],
 'filename': 'iris.csv',
 'data_module': 'sklearn.datasets.data'}
```

In [4]:
```
x=iris.data
x
```

Out[4]:
```
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       [5.9, 3. , 5.1, 1.8]])
```

In [5]:
```
y=iris.target
y
```

Out[5]:
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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```

In [6]:
```
pca=PCA(n_components=2)
pca
```

Out[6]:
```
PCA(n_components=2)
```

In [7]:
```
x_pca=pca.fit_transform(x)
x_pca
```

Out[7]:
```
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],
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       [-2.54370523,  0.43299606],
       [-3.21593942,  0.13346807],
       [-2.30273318,  0.09870885],
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```
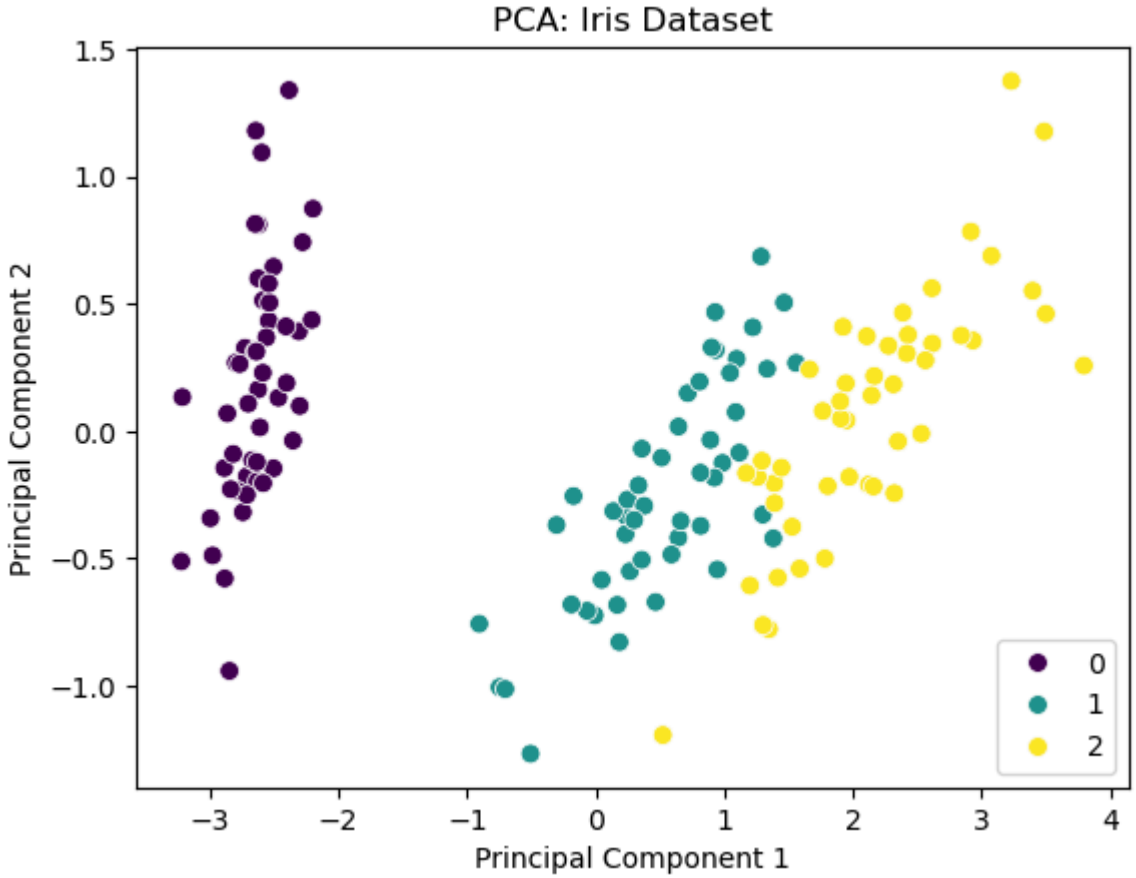

In [8]:

```
sns.scatterplot(x=x_pca[:,0],y=x_pca[:,1],hue=y,palette='viridis',s=50)
plt.title('PCA: Iris Dataset')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.legend()
plt.show()
```


PCA: Iris Dataset
Principal Component 2
Principal Component 1
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1.0
0.5
0.0
−0.5
−1.0
−3
−2
−1
0
1
2
3
4
0
1
2