```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

from sklearn.cluster import DBSCAN
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import normalize
from sklearn.decomposition import PCA
```

```
df = pd.read_csv('heart.csv')
df.head()
```

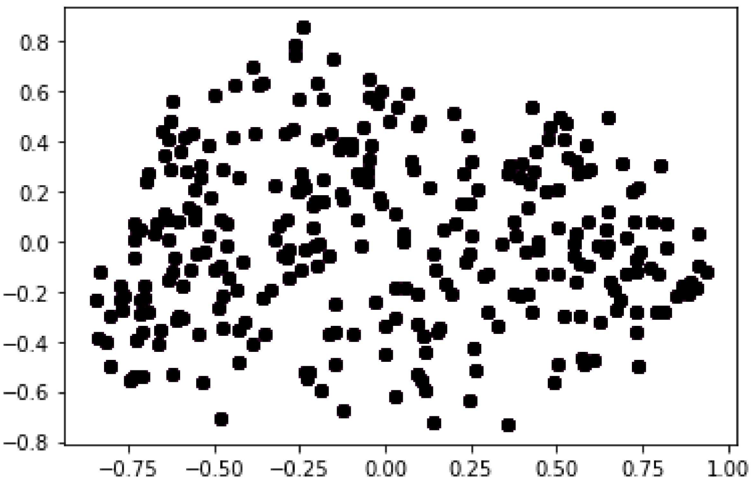
	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2

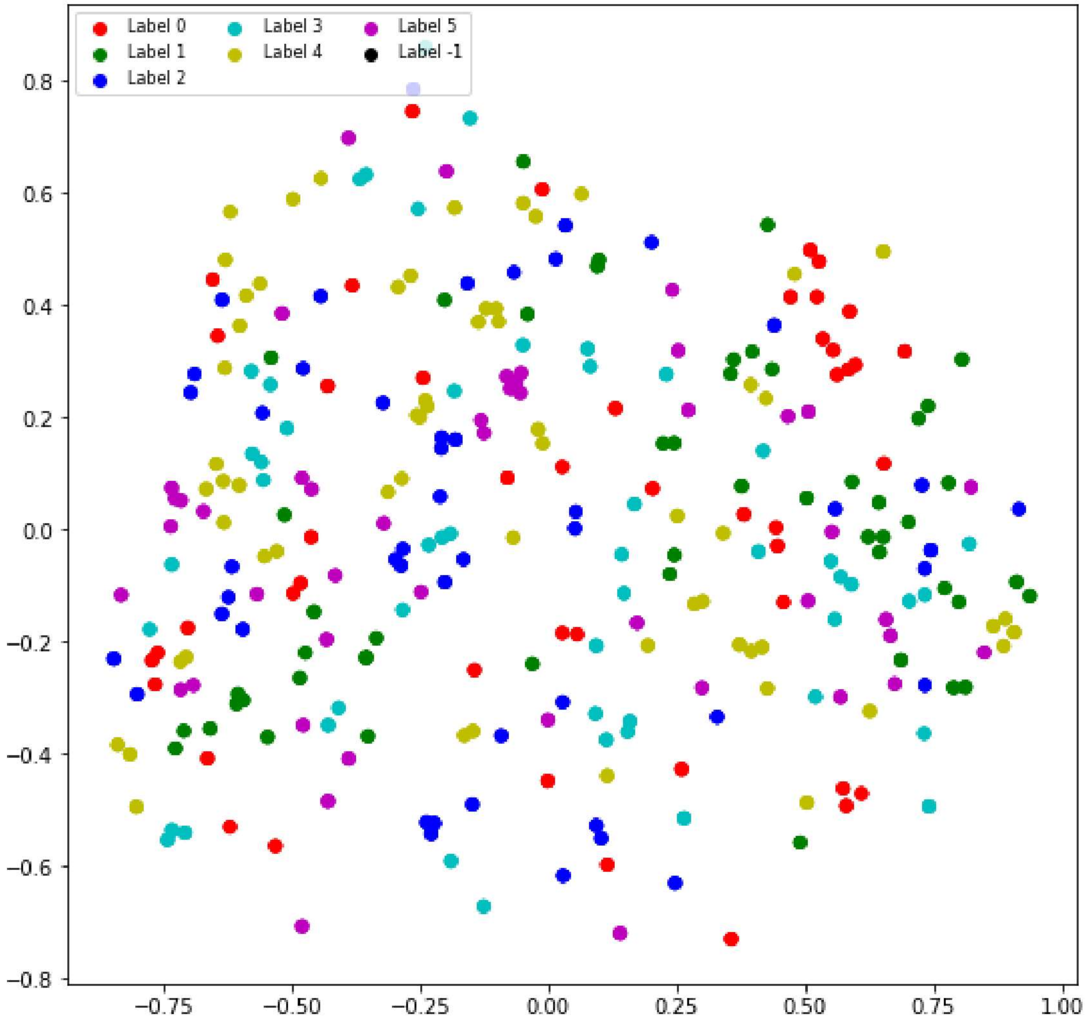
```
# Scaling the data to bring all the attributes to a comparable level
scaler = StandardScaler()
X_scaled = scaler.fit_transform(df)

# Normalizing the data so that
# the data approximately follows a Gaussian distribution
X_normalized = normalize(X_scaled)

# Converting the numpy array into a pandas DataFrame
X_normalized = pd.DataFrame(X_normalized)
```

```
pca = PCA(n_components = 2)
X_principal = pca.fit_transform(X_normalized)
X_principal = pd.DataFrame(X_principal)
X_principal.columns = ['P1', 'P2']
print(X_principal.head())
```

```
         P1        P2
0  0.114888 -0.598700
1  0.622429 -0.015325
2  0.732635 -0.072144
3  0.091776 -0.328850
4  0.479597  0.456162
```

```
# Numpy array of all the cluster labels assigned to each data point
db_default = DBSCAN(eps = 0.0375, min_samples = 3).fit(X_principal)
labels = db_default.labels_


# Tuning parameters of the model
db = DBSCAN(eps = 0.0375, min_samples = 50).fit(X_principal)
labels1 = db.labels_


colours1 = {}
colours1[0] = 'r'
colours1[1] = 'g'
colours1[2] = 'b'
colours1[3] = 'c'
colours1[4] = 'y'
colours1[5] = 'm'
colours1[-1] = 'k'

cvec = [colours1[label%6] for label in labels]
colors = ['r', 'g', 'b', 'c', 'y', 'm', 'k' ]

r = plt.scatter(
        X_principal['P1'], X_principal['P2'], marker ='o', color = colors[0])
g = plt.scatter(
        X_principal['P1'], X_principal['P2'], marker ='o', color = colors[1])
b = plt.scatter(
        X_principal['P1'], X_principal['P2'], marker ='o', color = colors[2])
c = plt.scatter(
        X_principal['P1'], X_principal['P2'], marker ='o', color = colors[3])
y = plt.scatter(
        X_principal['P1'], X_principal['P2'], marker ='o', color = colors[4])
m = plt.scatter(
        X_principal['P1'], X_principal['P2'], marker ='o', color = colors[5])
k = plt.scatter(
        X_principal['P1'], X_principal['P2'], marker ='o', color = colors[6])

plt.figure(figsize =(9, 9))
plt.scatter(X_principal['P1'], X_principal['P2'], c = cvec)
plt.legend((r, g, b, c, y, m, k),
           ('Label 0', 'Label 1', 'Label 2', 'Label 3','Label 4','Label 5', 'Label -1'),
           scatterpoints = 1,
           loc ='upper left',
           ncol = 3,
           fontsize = 8)
plt.show()
```


0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.8
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75
1.00


● Label 0
● Label 1
● Label 2
● Label 3
● Label 4
● Label 5
● Label -1
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.8
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75
1.00