lab11

April 29, 2024

Clustering

```
[ ]: import pandas as pd
```

```
[ ]: df = pd.read_csv('data.csv')
     df.head()
```

```
[ ]:    id      f_00      f_01      f_02      f_03      f_04      f_05      f_06  \
     0   0 -0.389420 -0.912791  0.648951  0.589045 -0.830817  0.733624  2.258560
     1   1 -0.689249 -0.453954  0.654175  0.995248 -1.653020  0.863810 -0.090651
     2   2  0.809079  0.324568 -1.170602 -0.624491  0.105448  0.783948  1.988301
     3   3 -0.500923  0.229049  0.264109  0.231520  0.415012 -1.221269  0.138850
     4   4 -0.671268 -1.039533 -0.270155 -1.830264 -0.290108 -1.852809  0.781898

        f_07  f_08  …      f_19      f_20      f_21      f_22      f_23  \
     0   2.0  13.0  … -0.478412 -0.757002 -0.763635 -1.090369  1.142641
     1   2.0   3.0  … -0.428791 -0.089908 -1.784204 -0.839474  0.459685
     2   5.0  11.0  … -0.413534 -1.602377  1.190984  3.267116 -0.088322
     3   6.0   2.0  …  0.619283  1.287801  0.532837  1.036631 -2.041828
     4   8.0   7.0  … -1.628830 -0.434948  0.322505  0.284326 -2.438365

            f_24      f_25      f_26      f_27      f_28
     0 -0.884274  1.137896  1.309073  1.463002  0.813527
     1  1.759412 -0.275422 -0.852168  0.562457 -2.680541
     2 -2.168635 -0.974989  1.335763 -1.110655 -3.630723
     3  1.440490 -1.900191 -0.630771 -0.050641  0.238333
     4  1.473930 -1.044684  1.602686 -0.405263 -1.987263

     [5 rows x 30 columns]
```

k-means clustering

```
[ ]: from numpy import unique
     from numpy import where
     from matplotlib import pyplot
     from sklearn.datasets import make_classification
     from sklearn.cluster import KMeans
```

```
# initialize the data set we'll work with
training_data, _ = make_classification(
    n_samples=1000,
    n_features=2,
    n_informative=2,
    n_redundant=0,
    n_clusters_per_class=1,
    random_state=4
)

# define the model
kmeans_model = KMeans(n_clusters=2)

# assign each data point to a cluster
kmeans_result = kmeans_model.fit_predict(training_data)

# get all of the unique clusters
kmeans_clusters = unique(kmeans_result)

# plot the DBSCAN clusters
for dbscan_cluster in kmeans_clusters:
    # get data points that fall in this cluster
    index = where(kmeans_result == kmeans_clusters)
    # make the plot
    pyplot.scatter(training_data[index, 0], training_data[index, 1])

# show the DBSCAN plot
pyplot.show()
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870:
FutureWarning: The default value of `n_init` will change from 10 to 'auto' in
1.4. Set the value of `n_init` explicitly to suppress the warning
  warnings.warn(
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-2-6fd27a077c32> in <cell line: 27>()
     27 for dbscan_cluster in kmeans_clusters:
     28     # get data points that fall in this cluster
---> 29     index = where(kmeans_result == kmeans_clusters)
     30     # make the plot
     31     pyplot.scatter(training_data[index, 0], training_data[index, 1])

ValueError: operands could not be broadcast together with shapes (1000,) (2,)
```

```
[ ]: df.dropna(inplace=True)
```

[ ]:

```
df.drop('id', axis=1, inplace=True)
```

[ ]:

```
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
scaled_df = scaler.fit_transform(df)

df_scaled = pd.DataFrame(scaled_df, columns=df.columns)

df_scaled.head()
```

[ ]:

```
       f_00      f_01      f_02      f_03      f_04      f_05      f_06  \
0 -0.384097 -0.920202  0.646548  0.593885 -0.819312  0.733919  2.277303
1 -0.682934 -0.460889  0.651748  1.000337 -1.633111  0.863749 -0.085626
2  0.810436  0.318437 -1.164801 -0.620392  0.107384  0.784105  2.005465
3 -0.495232  0.222819  0.263441  0.236142  0.413784 -1.215624  0.145214
4 -0.665012 -1.047074 -0.268413 -1.826902 -0.284129 -1.845435  0.792017

       f_07      f_08      f_09  …      f_19      f_20      f_21      f_22  \
0 -0.963124  1.493302  0.982693  … -0.469244 -0.753174 -0.758777 -0.708501
1 -0.963124 -0.898965 -0.374797  … -0.420061 -0.085682 -1.774016 -0.539523
2 -0.150804  1.014849 -0.544484  … -0.404938 -1.599053  1.185633  2.226264
3  0.119969 -1.138192  0.813007  …  0.618763  1.292848  0.530923  0.724033
4  0.661515  0.057942 -0.544484  … -1.609509 -0.430927  0.321690  0.217356

       f_23      f_24      f_25      f_26      f_27      f_28
0  0.907756 -0.678755  0.760414  0.965619  1.048265  0.678770
1  0.451339  1.027074 -0.136340 -0.547354  0.360194 -1.591562
2  0.085107 -1.507484 -0.580217  0.984303 -0.918164 -2.208959
3 -1.220415  0.821291 -1.167259 -0.392366 -0.108250  0.305028
4 -1.485420  0.842868 -0.624438  1.171162 -0.379202 -1.141092

[5 rows x 29 columns]
```

[ ]:

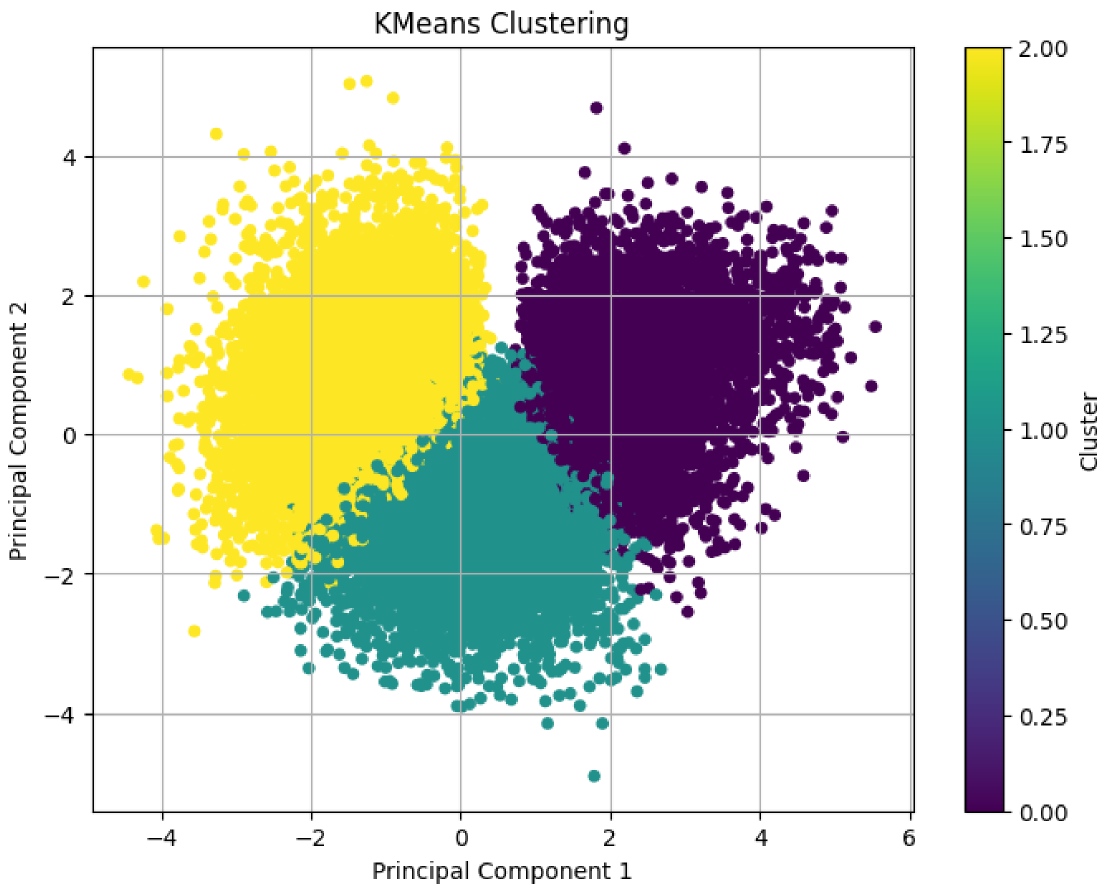
```
from sklearn.cluster import KMeans

# Initialize the KMeans model with the desired number of clusters
kmeans = KMeans(n_clusters=3)

kmeans_cluster = kmeans.fit_predict(df_scaled)

df_scaled['Cluster'] = kmeans_cluster

df_scaled.head()
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870:
FutureWarning: The default value of `n_init` will change from 10 to 'auto' in
```

```
1.4. Set the value of `n_init` explicitly to suppress the warning
  warnings.warn(
```

```
[ ]:        f_00      f_01      f_02      f_03      f_04      f_05      f_06  \
     0 -0.384097 -0.920202  0.646548  0.593885 -0.819312  0.733919  2.277303
     1 -0.682934 -0.460889  0.651748  1.000337 -1.633111  0.863749 -0.085626
     2  0.810436  0.318437 -1.164801 -0.620392  0.107384  0.784105  2.005465
     3 -0.495232  0.222819  0.263441  0.236142  0.413784 -1.215624  0.145214
     4 -0.665012 -1.047074 -0.268413 -1.826902 -0.284129 -1.845435  0.792017

            f_07      f_08      f_09  …      f_20      f_21      f_22      f_23  \
     0 -0.963124  1.493302  0.982693  … -0.753174 -0.758777 -0.708501  0.907756
     1 -0.963124 -0.898965 -0.374797  … -0.085682 -1.774016 -0.539523  0.451339
     2 -0.150804  1.014849 -0.544484  … -1.599053  1.185633  2.226264  0.085107
     3  0.119969 -1.138192  0.813007  …  1.292848  0.530923  0.724033 -1.220415
     4  0.661515  0.057942 -0.544484  … -0.430927  0.321690  0.217356 -1.485420

            f_24      f_25      f_26      f_27      f_28  Cluster
     0 -0.678755  0.760414  0.965619  1.048265  0.678770        1
     1  1.027074 -0.136340 -0.547354  0.360194 -1.591562        2
     2 -1.507484 -0.580217  0.984303 -0.918164 -2.208959        1
     3  0.821291 -1.167259 -0.392366 -0.108250  0.305028        0
     4  0.842868 -0.624438  1.171162 -0.379202 -1.141092        2

     [5 rows x 30 columns]
```

```
[ ]: import matplotlib.pyplot as plt
     from sklearn.decomposition import PCA

     # Reduce the dimensionality of the data using PCA
     pca = PCA(n_components=2)
     df_pca = pca.fit_transform(df_scaled)

     # Plot the clusters
     plt.figure(figsize=(8, 6))
     plt.scatter(df_pca[:, 0], df_pca[:, 1], c=kmeans_cluster, cmap='viridis', s=20)
     plt.title('KMeans Clustering')
     plt.xlabel('Principal Component 1')
     plt.ylabel('Principal Component 2')
     plt.colorbar(label='Cluster')
     plt.grid(True)
     plt.show()
```



DBSCAN Clustering

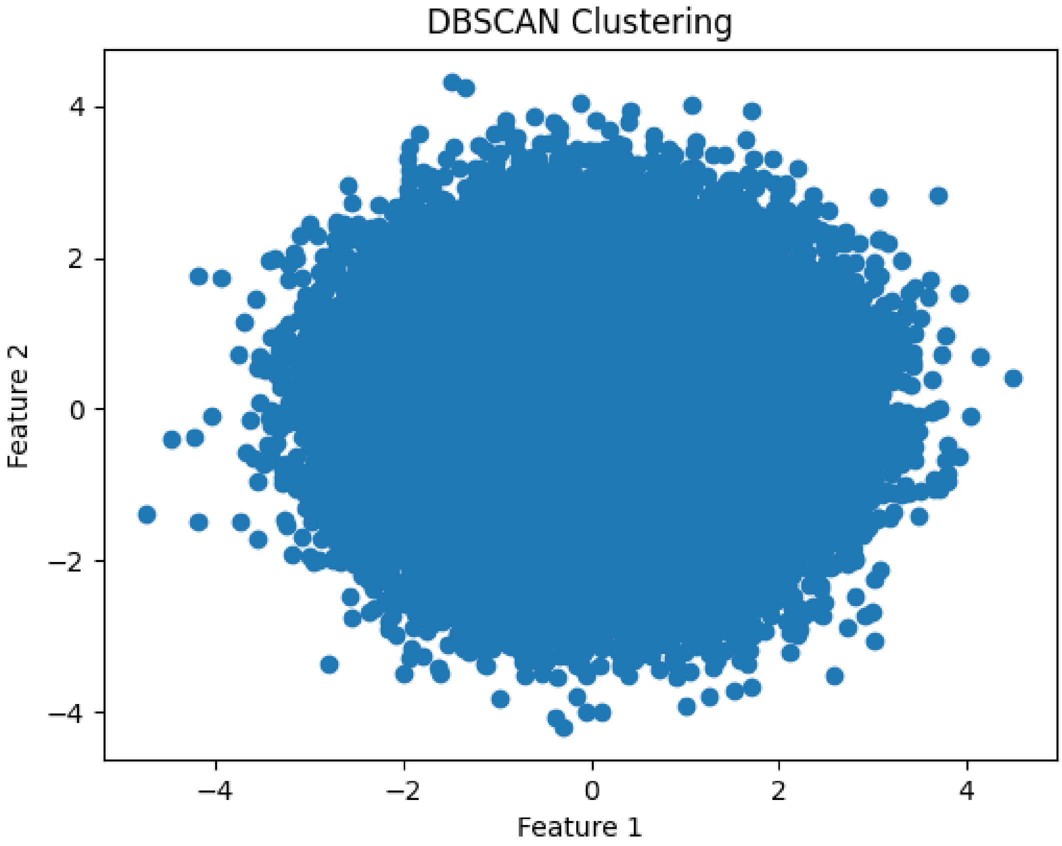
[ ]:

```python
from numpy import unique
from numpy import where
from matplotlib import pyplot
from sklearn.datasets import make_classification
from sklearn.cluster import DBSCAN

# initialize the data set we'll work with
training_data, _ = make_classification(
    n_samples=1000,
    n_features=2,
    n_informative=2,
    n_redundant=0,
    n_clusters_per_class=1,
    random_state=4
)

# define the model
```

```
dbscan_model = DBSCAN(eps=0.25, min_samples=9)

# train the model
dbscan_model.fit(training_data)

# assign each data point to a cluster
dbscan_result = dbscan_model.predict(training_data)

# get all of the unique clusters
dbscan_cluster = unique(dbscan_result)

# plot the DBSCAN clusters
for dbscan_cluster in dbscan_clusters:
    # get data points that fall in this cluster
    index = where(dbscan_result == dbscan_clusters)
    # make the plot
    pyplot.scatter(training_data[index, 0], training_data[index, 1])

# show the DBSCAN plot
pyplot.show()
```

[ ]:

```
import pandas as pd
import numpy as np
from sklearn.cluster import DBSCAN
from matplotlib import pyplot as plt

# Load the dataset
data = pd.read_csv('data.csv')

# Extract features
X = data.iloc[:, 1:].values  # Assuming the first column is 'id' and rest are␣
 ↪features

# Define the model
dbscan_model = DBSCAN(eps=0.25, min_samples=9)

# Train the model
dbscan_model.fit(X)

# Assign each data point to a cluster
dbscan_result = dbscan_model.labels_

# Get all of the unique clusters
dbscan_clusters = np.unique(dbscan_result)

# Plot the DBSCAN clusters
for cluster in dbscan_clusters:
    # Get data points that fall in this cluster
    index = np.where(dbscan_result == cluster)
    # Make the plot
    plt.scatter(X[index, 0], X[index, 1])

# Show the DBSCAN plot
plt.title('DBSCAN Clustering')
plt.xlabel('Feature 1')
plt.ylabel('Feature 2')
plt.show()
```

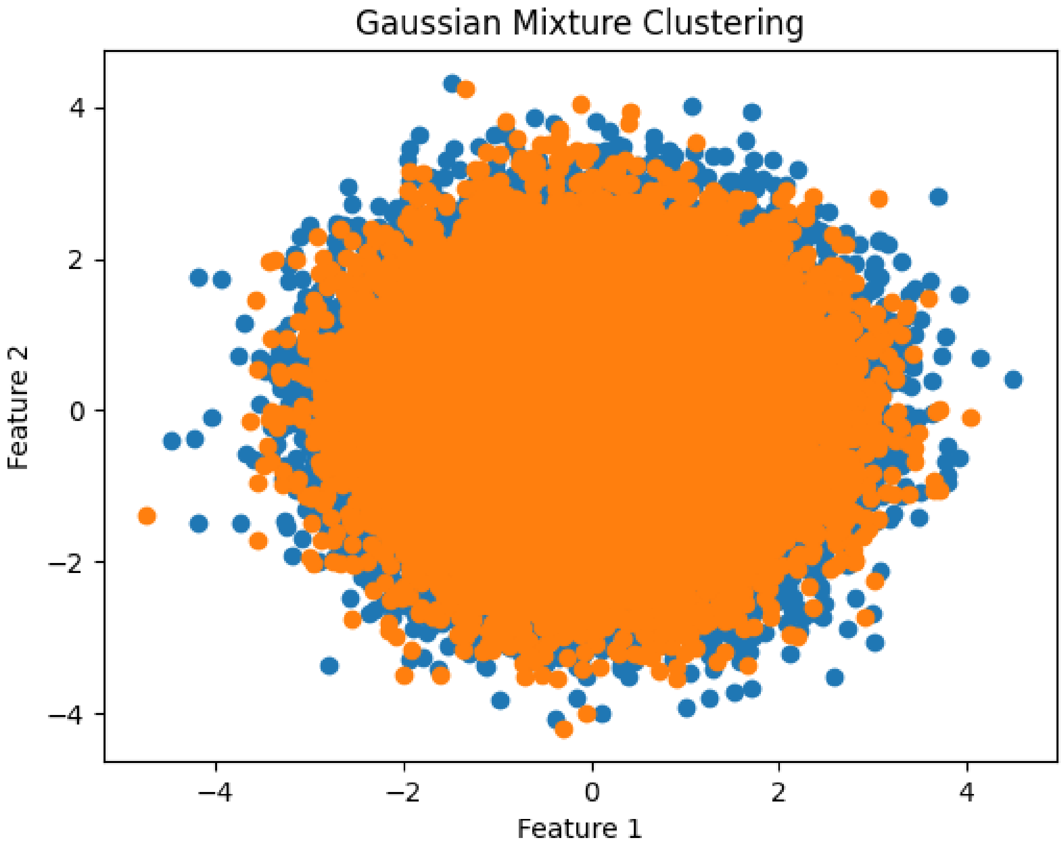


Gaussian Mixture Model algorithm

[ ]:

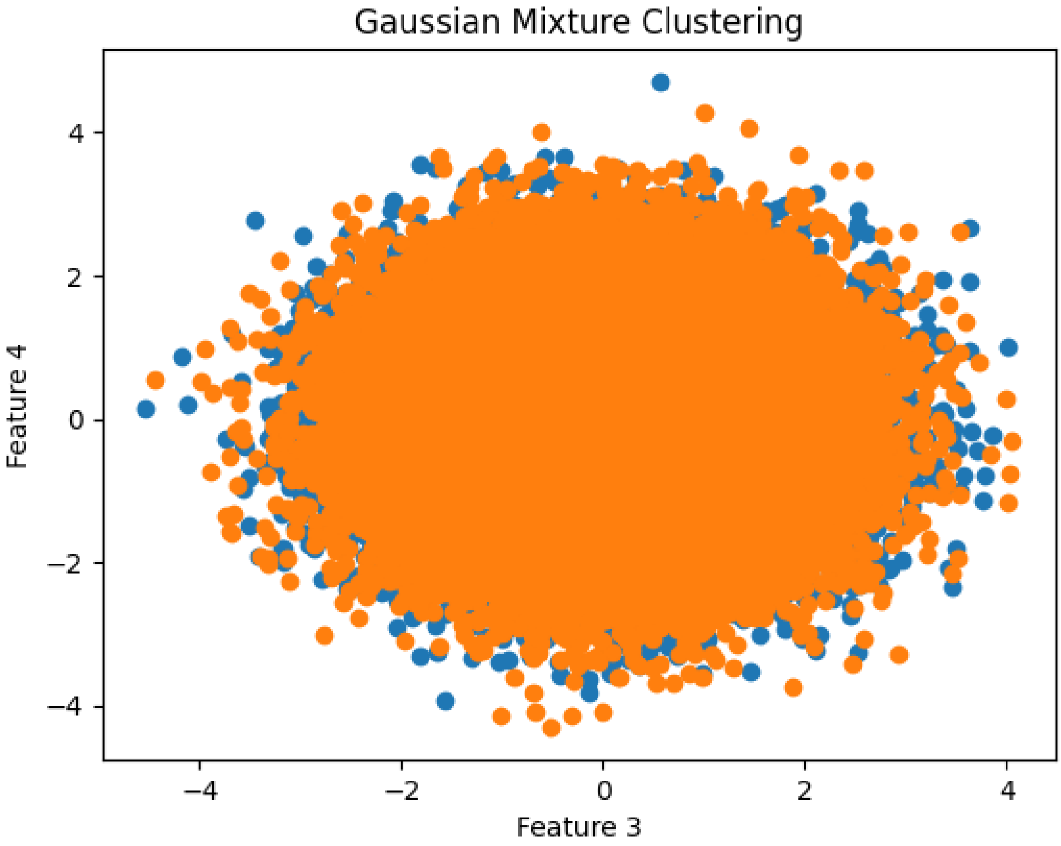
```
from sklearn.mixture import GaussianMixture

# Extract features
X = data.iloc[:, 1:].values  # Assuming the first column is 'id' and rest are␣
 ↪features

# Define the model
```

```python
gaussian_model = GaussianMixture(n_components=2)

# Train the model
gaussian_model.fit(X)

# Assign each data point to a cluster
gaussian_result = gaussian_model.predict(X)

# Get all of the unique clusters
gaussian_clusters = np.unique(gaussian_result)

# Plot the Gaussian Mixture clusters
for cluster in gaussian_clusters:
    # Get data points that fall in this cluster
    index = np.where(gaussian_result == cluster)
    # Make the plot
    plt.scatter(X[index, 0], X[index, 1])

# Show the Gaussian Mixture plot
plt.title('Gaussian Mixture Clustering')
plt.xlabel('Feature 1')
plt.ylabel('Feature 2')
plt.show()
```



[ ]:

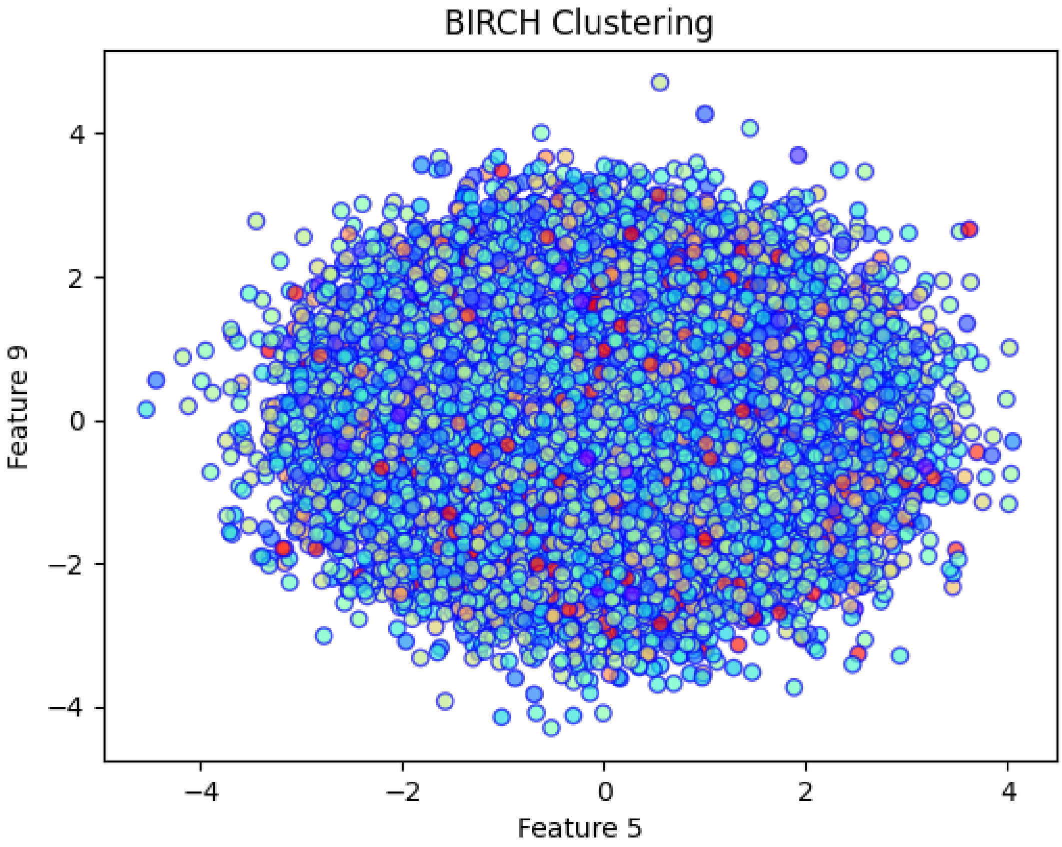
```
from sklearn.mixture import GaussianMixture

# Extract features
X = data.iloc[:, 5:10].values   # Assuming columns 3 and 4 are to be used for␣
 ↪clustering

# Define the model
gaussian_model = GaussianMixture(n_components=2)

# Train the model
gaussian_model.fit(X)

# Assign each data point to a cluster
gaussian_result = gaussian_model.predict(X)

# Get all of the unique clusters
gaussian_clusters = np.unique(gaussian_result)

# Plot the Gaussian Mixture clusters
for cluster in gaussian_clusters:
    # Get data points that fall in this cluster
    index = np.where(gaussian_result == cluster)
    # Make the plot
    plt.scatter(X[index, 0], X[index, 1])

# Show the Gaussian Mixture plot
plt.title('Gaussian Mixture Clustering')
plt.xlabel('Feature 3')
plt.ylabel('Feature 4')
plt.show()
```



BIRCH algorithm

[ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import Birch

# Load the dataset
data = pd.read_csv('data.csv')
```

```
# Extract features
X = data.iloc[:, 5:10].values  # Extracting columns 5 to 9 for clustering

# Creating the BIRCH clustering model
model = Birch(branching_factor=50, n_clusters=None, threshold=1.5)

# Fit the data (Training)
model.fit(X)

# Predict the same data
pred = model.predict(X)

# Creating a scatter plot
plt.scatter(X[:, 0], X[:, 1], c=pred, cmap='rainbow', alpha=0.7, edgecolors='b')
plt.title('BIRCH Clustering')
plt.xlabel('Feature 5')
plt.ylabel('Feature 9')
plt.show()
```


BIRCH Clustering
Feature 9
Feature 5