

Pattern Processing using AI Practical File



COSCE60

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2019UCO1719
COE Section 3**

```
In [ ]: import json  
import requests
```

```
In [ ]: def chatbot():  
    print("Hi! I'm a weather prediction chatbot")  
    api_key = "f37d0c3cb6c045218e1152633232504"  
    while(1):  
        print("Which city would you like the weather forecast for? Type 'exit' to quit")  
        city = input().lower()  
        if(city=="exit"):  
            break  
        url = f"https://api.weatherapi.com/v1/forecast.json?key={api_key}&q={city}"  
        response = requests.get(url)  
        data = json.loads(response.text)  
        if len(data)>1:  
            temp = data["current"]["temp_c"]  
            description = data["current"]["condition"]["text"]  
            humidity = data["current"]["humidity"]  
            wind_speed = data["current"]["wind_kph"]  
            print(f"The weather in {city.title()} is {description}, with a temperature of {temp}°C, humidity of {humidity}%, and wind speed of {wind_speed} km/h.")  
            print()  
        else:  
            print("City not found. Please try again.")  
            print()  
    print("Thank you for using the chatbot.")
```

```
In [ ]: chatbot()
```

```
Hi! I'm a weather prediction chatbot  
Which city would you like the weather forecast for? Type 'exit' to quit  
The weather in New Delhi is Mist, with a temperature of 32.0°C , humidity of 26%, and wind speed of 9.0 km/h.  
  
Which city would you like the weather forecast for? Type 'exit' to quit  
The weather in Mumbai is Overcast, with a temperature of 31.0°C , humidity of 59%, and wind speed of 13.0 km/h.  
  
Which city would you like the weather forecast for? Type 'exit' to quit  
The weather in London is Partly cloudy, with a temperature of 5.0°C , humidity of 81%, and wind speed of 19.1 km/h.  
  
Which city would you like the weather forecast for? Type 'exit' to quit  
The weather in Dwarka is Sunny, with a temperature of 31.9°C , humidity of 59%, and wind speed of 16.9 km/h.  
  
Which city would you like the weather forecast for? Type 'exit' to quit  
City not found. Please try again.  
  
Which city would you like the weather forecast for? Type 'exit' to quit  
The weather in Mexico is Partly cloudy, with a temperature of 21.0°C , humidity of 23%, and wind speed of 13.0 km/h.  
  
Which city would you like the weather forecast for? Type 'exit' to quit  
Thank you for using the chatbot.
```

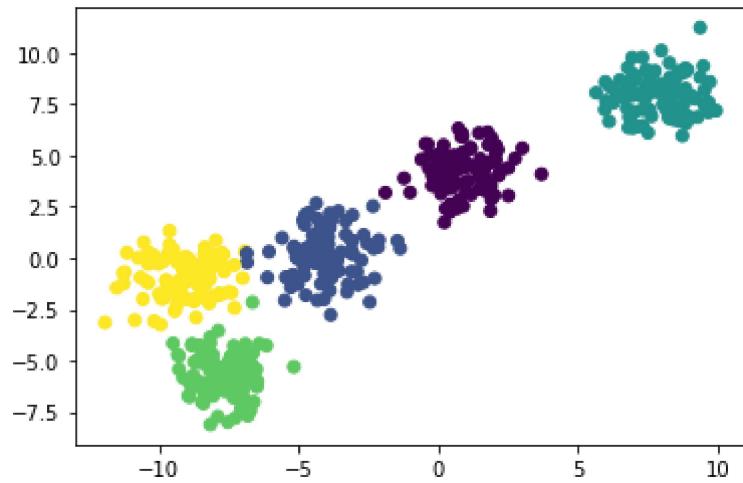
```
In [ ]:
```

KMeans

```
In [ ]: import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.datasets import make_blobs
```

```
In [ ]: X,Y = make_blobs(n_samples=500,n_features=2,centers=5,random_state=3)
```

```
In [ ]: plt.figure(0)
plt.scatter(X[:,0],X[:,1],c=Y)
plt.show()
```



```
In [ ]: k = 5
color = ["green", "red", "yellow", "blue", "orange"]

clusters = {}

for i in range(k):
    center = 10*(2*np.random.random((X.shape[1],))-1)
    points = []
    cluster = {
        "center":center,
        "points":points,
        "color":color[i]
    }

    clusters[i] = cluster
```

```
In [ ]: print(clusters)
```

```
{0: {'center': array([-0.53948567, -4.99002492]), 'points': [], 'color': 'green'}, 1: {'center': array([-4.0003705,  3.05827539]), 'points': [], 'color': 'red'}, 2: {'center': array([-4.4061116, -3.7088346]), 'points': [], 'color': 'yellow'}, 3: {'center': array([-8.86629643,  0.72809729]), 'points': [], 'color': 'blue'}, 4: {'center': array([-4.2499521,  7.7633045]), 'points': [], 'color': 'orange'}}
```

```
In [ ]: def distance(x1,x2):
    return np.sqrt(np.sum((x1-x2)**2))

def assignPointsToCluster(clusters):
    for i in range(X.shape[0]):
        clust_x = X[i]
```

```

dist = []
for kx in range(k):
    d = distance(clust_x,clusters[kx]['center'])
    dist.append(d)

idx = np.argmin(dist)
clusters[idx]['points'].append(clust_x)

def updateCluster(clusters):
    for kx in range(k):
        pts = np.array(clusters[kx]['points'])

        if(pts.shape[0]>0):
            new_centers = np.mean(pts, axis=0)
            clusters[kx]['center'] = new_centers
            clusters[kx]['points'] = []

def plotClusters(clusters):

    plt.figure()
    for kx in range(k):
        pts = np.array(clusters[kx]['points'])

        try:
            plt.scatter(pts[:,0],pts[:,1],color=clusters[kx]['color'])
        except:
            pass

        cent = clusters[kx]['center']
        plt.scatter(cent[0],cent[1],color='black',marker="*")

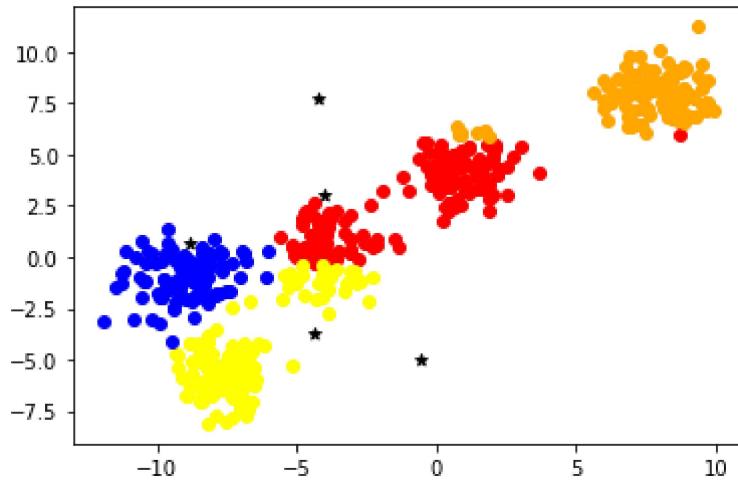
```

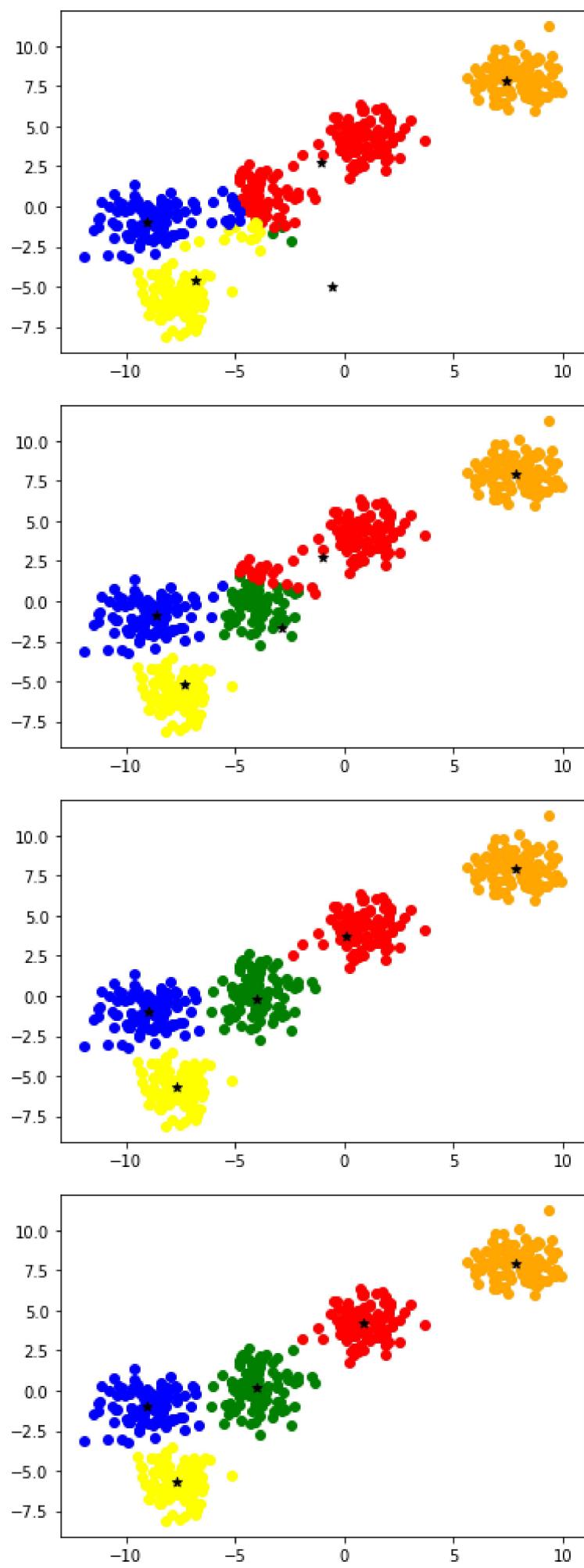
In []:

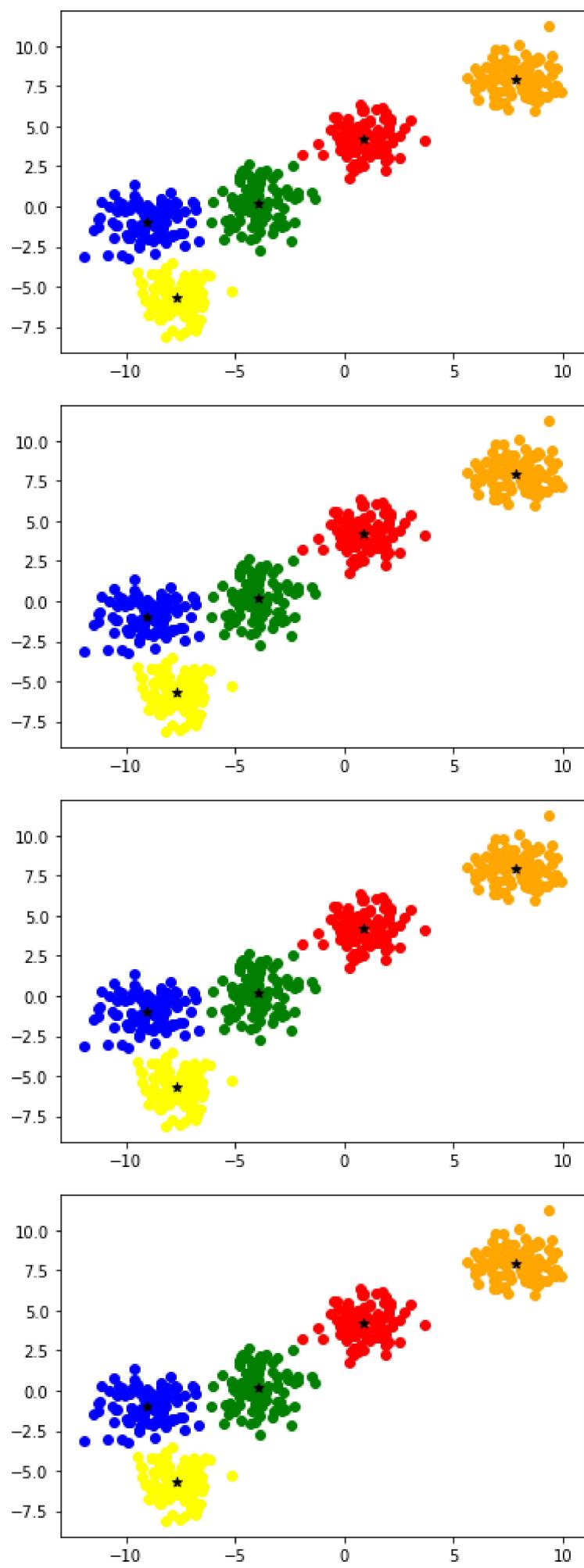
```

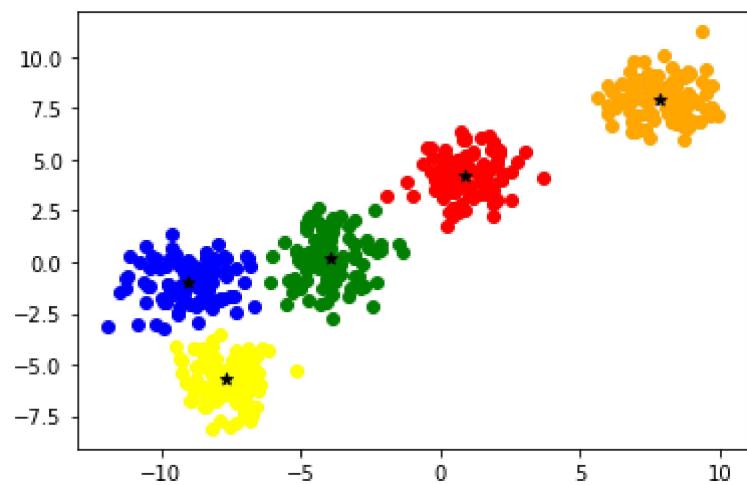
epoch = 10
for i in range(epoch):
    assignPointsToCluster(clusters)
    plotClusters(clusters)
    updateCluster(clusters)

```









In []:

Gaussian

```
In [ ]: import numpy as np  
import matplotlib.pyplot as plt
```

```
In [ ]: x_axis = np.arange(-100,100,0.1)  
print(x_axis)
```

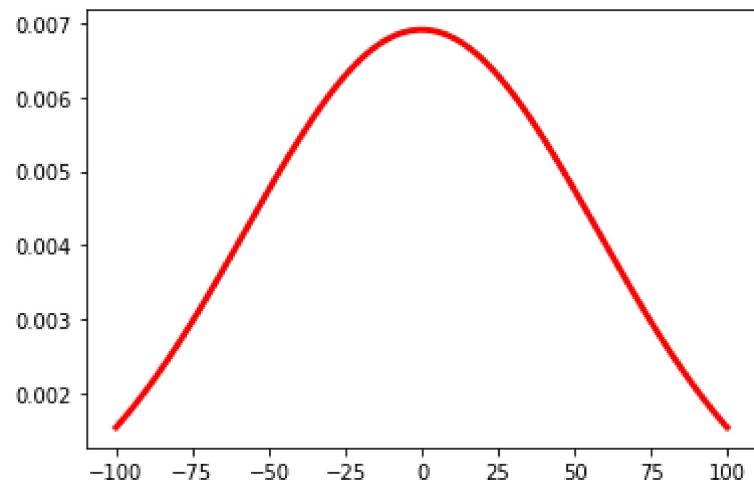
```
[ -100. -99.9 -99.8 ... 99.7 99.8 99.9]
```

```
In [ ]: mean = np.mean(x_axis)  
std = np.std(x_axis)  
print(mean,std)
```

```
-0.05000000000567525 57.73501970208048
```

```
In [ ]: y_axis = 1/(std * np.sqrt(2 * np.pi)) * np.exp( - (x_axis - mean)**2 / (2 * std**2)
```

```
In [ ]: plt.plot(x_axis,y_axis,linewidth=3, color='r')  
plt.show()
```



```
In [ ]:
```

Decision Tree

```
In [ ]: !pip install graphviz
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheel-s/public/simple/
Requirement already satisfied: graphviz in /usr/local/lib/python3.9/dist-packages (0.20.1)
```

```
In [ ]: import matplotlib.pyplot as plt
from sklearn import datasets
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.model_selection import train_test_split
from sklearn.tree import export_graphviz
import graphviz
from sklearn.tree import DecisionTreeClassifier
```

```
In [ ]: iris = datasets.load_iris()
```

```
In [ ]: X = iris.data
y = iris.target
```

```
In [ ]: X_train, X_test, y_train, y_test = train_test_split(X, y, random_state = 0, test_size=0.2)
```

```
In [ ]: tree = DecisionTreeClassifier(max_depth = 5)
tree.fit(X_train, y_train)
tree_predictions = tree.predict(X_test)
```

```
In [ ]: cm = confusion_matrix(y_test, tree_predictions)
print(cm)

[[11  0  0]
 [ 0 13  0]
 [ 0  0  6]]
```

```
In [ ]: score =accuracy_score(tree_predictions, y_test)
print(score)
```

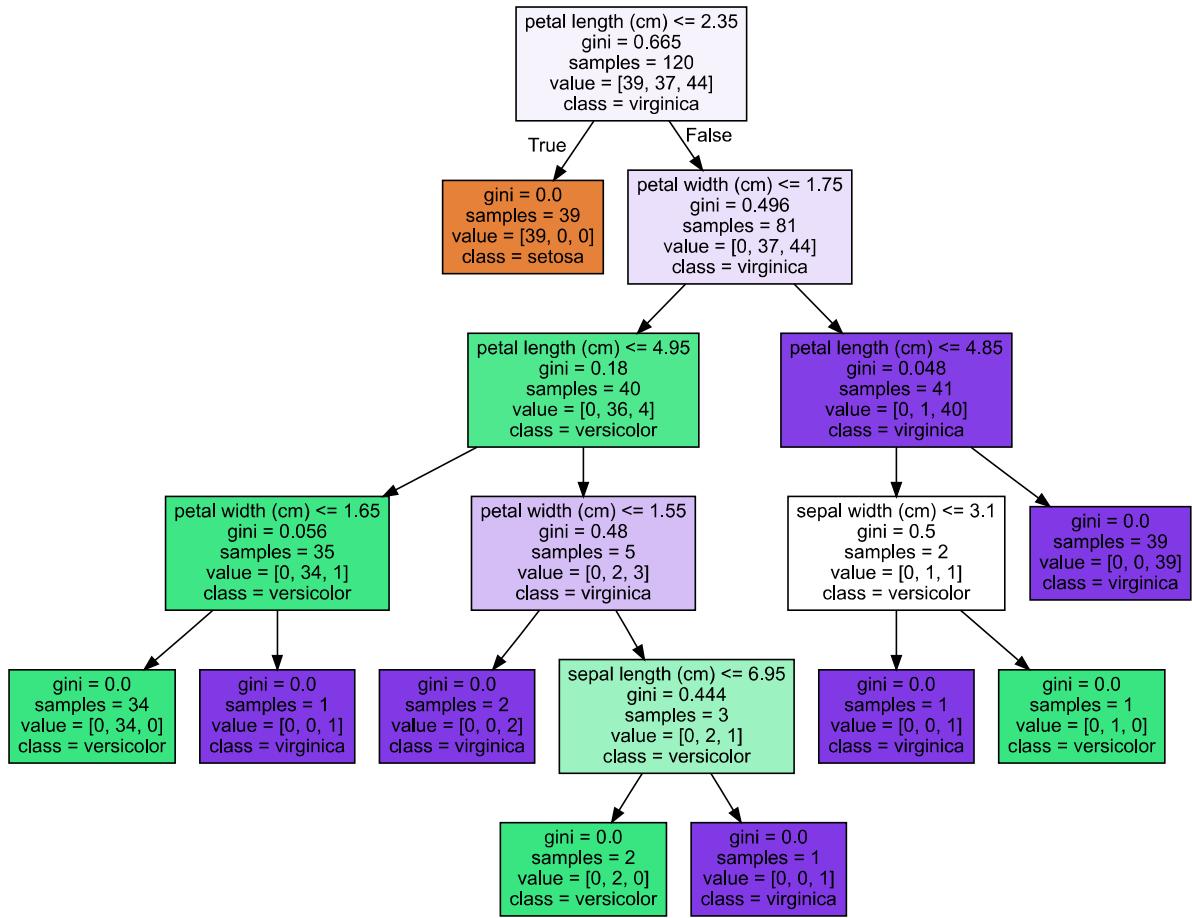
```
1.0
```

```
In [ ]: tree_formed = export_graphviz(tree, out_file = None, feature_names = iris.feature_names,
graph = graphviz.Source(tree_formed, format="png")
```

```
In [ ]: graph
```

Decision_Tree

Out[]:



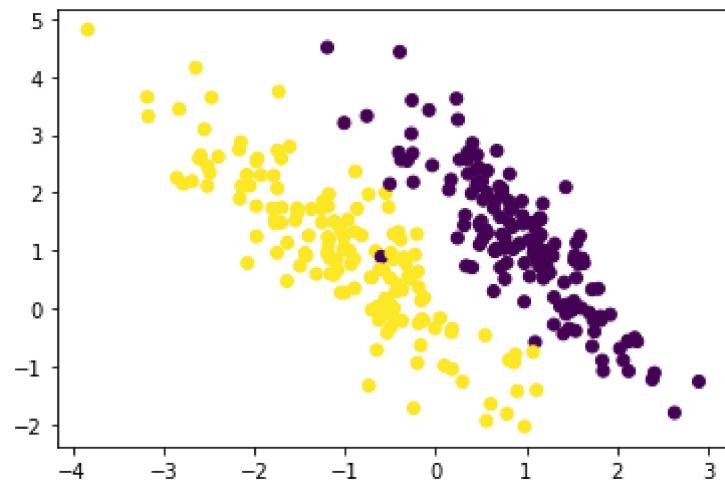
In []:

SVM

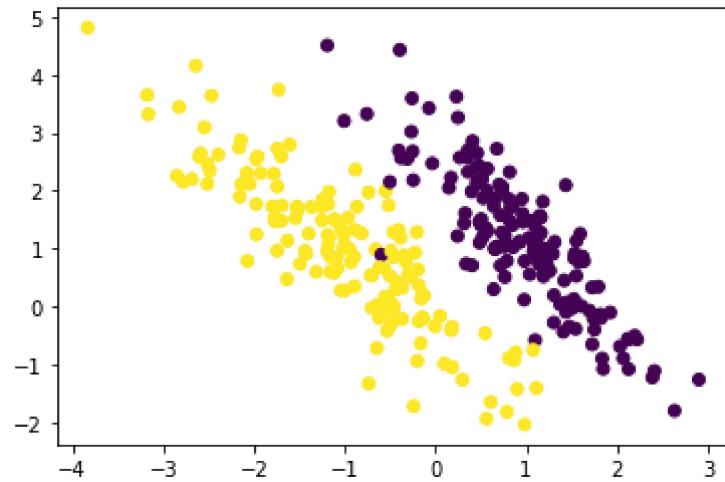
```
In [ ]: from sklearn.datasets import make_classification
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
import numpy as np
```

```
In [ ]: X,Y = make_classification(n_classes=2,n_samples=300,n_clusters_per_class=1,random_
```

```
In [ ]: plt.scatter(X[:,0],X[:,1],c=Y)
plt.show()
```



```
In [ ]: plt.scatter(X[:,0],X[:,1],c=Y)
plt.show()
```



```
In [ ]: from sklearn import svm
```

```
In [ ]: svc = svm.SVC(kernel='linear')
svc.fit(X,Y)
print(svc.score(X,Y))
```

```
0.9966666666666667
```

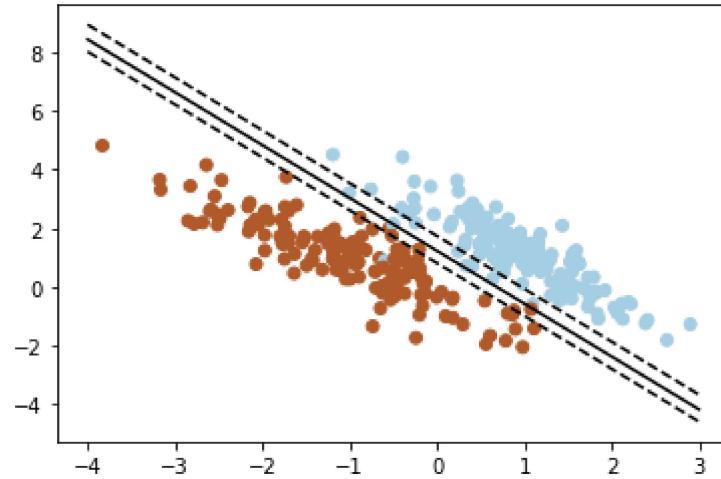
```
In [ ]: w = svc.coef_[0]
a = -w[0] / w[1]
xx = np.linspace(-4, 3)
yy = a * xx - (svc.intercept_[0]) / w[1]
```

```
# plot the parallels to the separating hyperplane that pass through the
# support vectors
b = svc.support_vectors_[0]
yy_down = a * xx + (b[1] - a * b[0])
b = svc.support_vectors_[-1]
yy_up = a * xx + (b[1] - a * b[0])

# plot the Line, the points, and the nearest vectors to the plane
plt.plot(xx, yy, 'k-')
plt.plot(xx, yy_down, 'k--')
plt.plot(xx, yy_up, 'k--')

plt.scatter(X[:, 0], X[:, 1], c=Y, cmap=plt.cm.Paired)

plt.show()
```



In []:

Maximum Likelihood Estimation

```
In [ ]: import numpy as np
import math
from scipy.optimize import minimize

In [ ]: mean = 10
std = 20

In [ ]: s = np.random.normal(mean, std, 3000)

In [ ]: def likelihood(mean, std, x):
    return (1 / math.sqrt(2 * math.pi * std**2)) * np.exp(-(x - mean)**2 / (2 * std**2))

def log_likelihood(mean, std, data):
    return sum(np.log(likelihood(mean, std, x)) for x in data)

In [ ]: neg_log_likelihood = lambda mean: -log_likelihood(mean, std, s)

In [ ]: result = minimize(neg_log_likelihood, x0=0.0)
mean_mle = result.x[0]
print(mean_mle)

9.437499921115245

In [ ]: print("Difference between original mean and new mean", mean-mean_mle)

Difference between original mean and new mean 0.5625000788847547

In [ ]:
```

In []: `!pip install clustimage`

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheel-s/public/simple/
Collecting clustimage
  Downloading clustimage-1.5.14-py3-none-any.whl (37 kB)
Collecting umap-learn
  Downloading umap-learn-0.5.3.tar.gz (88 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 88.2/88.2 kB 5.5 MB/s eta 0:00:00
    Preparing metadata (setup.py) ... done
Collecting ismember
  Downloading ismember-1.0.2-py3-none-any.whl (7.5 kB)
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.9/dist-packages (from clustimage) (1.2.2)
Collecting distfit
  Downloading distfit-1.6.10-py3-none-any.whl (40 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 40.4/40.4 kB 4.5 MB/s eta 0:00:00
Requirement already satisfied: scipy in /usr/local/lib/python3.9/dist-packages (from clustimage) (1.10.1)
Requirement already satisfied: requests in /usr/local/lib/python3.9/dist-packages (from clustimage) (2.27.1)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.9/dist-packages (from clustimage) (3.7.1)
Collecting colourmap
  Downloading colourmap-1.1.11-py3-none-any.whl (8.1 kB)
Requirement already satisfied: pandas in /usr/local/lib/python3.9/dist-packages (from clustimage) (1.5.3)
Requirement already satisfied: scikit-image in /usr/local/lib/python3.9/dist-packages (from clustimage) (0.19.3)
Collecting scatterd>=1.1.2
  Downloading scatterd-1.3.1-py3-none-any.whl (11 kB)
Requirement already satisfied: tqdm in /usr/local/lib/python3.9/dist-packages (from clustimage) (4.65.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.9/dist-packages (from clustimage) (1.22.4)
Requirement already satisfied: opencv-python in /usr/local/lib/python3.9/dist-packages (from clustimage) (4.7.0.72)
Collecting clusteval>=2.1.5
  Downloading clusteval-2.2.1-py3-none-any.whl (42 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 42.4/42.4 kB 5.1 MB/s eta 0:00:00
Collecting pypickle
  Downloading pypickle-1.1.0-py3-none-any.whl (5.1 kB)
Collecting pca
  Downloading pca-2.0.0-py3-none-any.whl (33 kB)
Collecting imagehash
  Downloading ImageHash-4.3.1-py2.py3-none-any.whl (296 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━ 296.5/296.5 kB 19.5 MB/s eta 0:00:00
Requirement already satisfied: seaborn in /usr/local/lib/python3.9/dist-packages (from clusteval>=2.1.5->clustimage) (0.12.2)
Requirement already satisfied: statsmodels in /usr/local/lib/python3.9/dist-packages (from distfit->clustimage) (0.13.5)
Requirement already satisfied: packaging in /usr/local/lib/python3.9/dist-packages (from distfit->clustimage) (23.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (4.39.3)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (0.11.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (1.4.4)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (1.0.7)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (2.8.2)
Requirement already satisfied: importlib-resources>=3.2.0 in /usr/local/lib/python
```

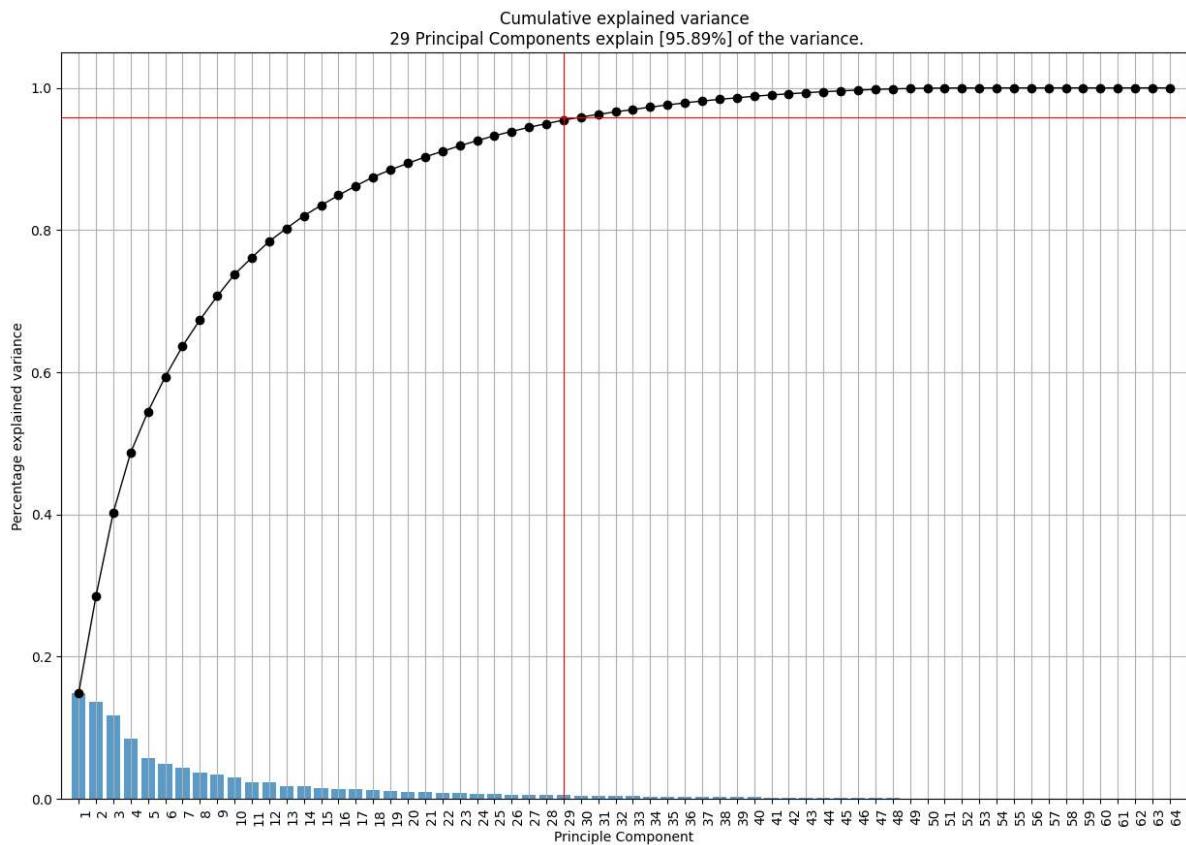
```

3.9/dist-packages (from matplotlib->clustimage) (5.12.0)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (8.4.0)
Requirement already satisfied: PyWavelets in /usr/local/lib/python3.9/dist-packages (from imagehash->clustimage) (1.4.1)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.9/dist-packages (from pandas->clustimage) (2022.7.1)
Collecting adjusttext
    Downloading adjustText-0.8-py3-none-any.whl (9.1 kB)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.9/dist-packages (from requests->clustimage) (3.4)
Requirement already satisfied: charset-normalizer~=2.0.0 in /usr/local/lib/python3.9/dist-packages (from requests->clustimage) (2.0.12)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /usr/local/lib/python3.9/dist-packages (from requests->clustimage) (1.26.15)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.9/dist-packages (from requests->clustimage) (2022.12.7)
Requirement already satisfied: tifffile>=2019.7.26 in /usr/local/lib/python3.9/dist-packages (from scikit-image->clustimage) (2023.4.12)
Requirement already satisfied: networkx>=2.2 in /usr/local/lib/python3.9/dist-packages (from scikit-image->clustimage) (3.1)
Requirement already satisfied: imageio>=2.4.1 in /usr/local/lib/python3.9/dist-packages (from scikit-image->clustimage) (2.25.1)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.9/dist-packages (from scikit-learn->clustimage) (3.1.0)
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.9/dist-packages (from scikit-learn->clustimage) (1.2.0)
Requirement already satisfied: numba>=0.49 in /usr/local/lib/python3.9/dist-packages (from umap-learn->clustimage) (0.56.4)
Collecting pynndescent>=0.5
    Downloading pynndescent-0.5.10.tar.gz (1.1 MB)
    1.1/1.1 MB 58.8 MB/s eta 0:00:00
        Preparing metadata (setup.py) ... done
Requirement already satisfied: zipp>=3.1.0 in /usr/local/lib/python3.9/dist-packages (from importlib-resources>=3.2.0->matplotlib->clustimage) (3.15.0)
Requirement already satisfied: setuptools in /usr/local/lib/python3.9/dist-packages (from numba>=0.49->umap-learn->clustimage) (67.7.2)
Requirement already satisfied: llvmlite<0.40,>=0.39.0dev0 in /usr/local/lib/python3.9/dist-packages (from numba>=0.49->umap-learn->clustimage) (0.39.1)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.9/dist-packages (from python-dateutil>=2.7->matplotlib->clustimage) (1.16.0)
Requirement already satisfied: patsy>=0.5.2 in /usr/local/lib/python3.9/dist-packages (from statsmodels->distfit->clustimage) (0.5.3)
Building wheels for collected packages: umap-learn, pynndescent
    Building wheel for umap-learn (setup.py) ... done
    Created wheel for umap-learn: filename=umap_learn-0.5.3-py3-none-any.whl size=82830 sha256=5c919961619a93edfe54efcabae8f8cfbf09950e7b2ccc26910dc14d3ec7d
    Stored in directory: /root/.cache/pip/wheels/f4/3e/1c/596d0a463d17475af648688443fa4846fef624d1390339e7e9
    Building wheel for pynndescent (setup.py) ... done
    Created wheel for pynndescent: filename=pynndescent-0.5.10-py3-none-any.whl size=55640 sha256=2a6a18f166507b15967fde52077b543def3ebc95de75df954a6301643103b385
    Stored in directory: /root/.cache/pip/wheels/12/f9/4d/ec5ad1c823c710fcc4473669fdcffc8891f4bc398c841af22e
Successfully built umap-learn pynndescent
Installing collected packages: pickle, ismember, imagehash, pynndescent, colourmap, adjusttext, umap-learn, scatterd, distfit, pca, clusteval, clustimage
Successfully installed adjusttext-0.8 clusteval-2.2.1 clustimage-1.5.14 colourmap-1.1.11 distfit-1.6.10 imagehash-4.3.1 ismember-1.0.2 pca-2.0.0 pynndescent-0.5.10 pickle-1.1.0 scatterd-1.3.1 umap-learn-0.5.3

```

In []: `from clustimage import Clustimage`

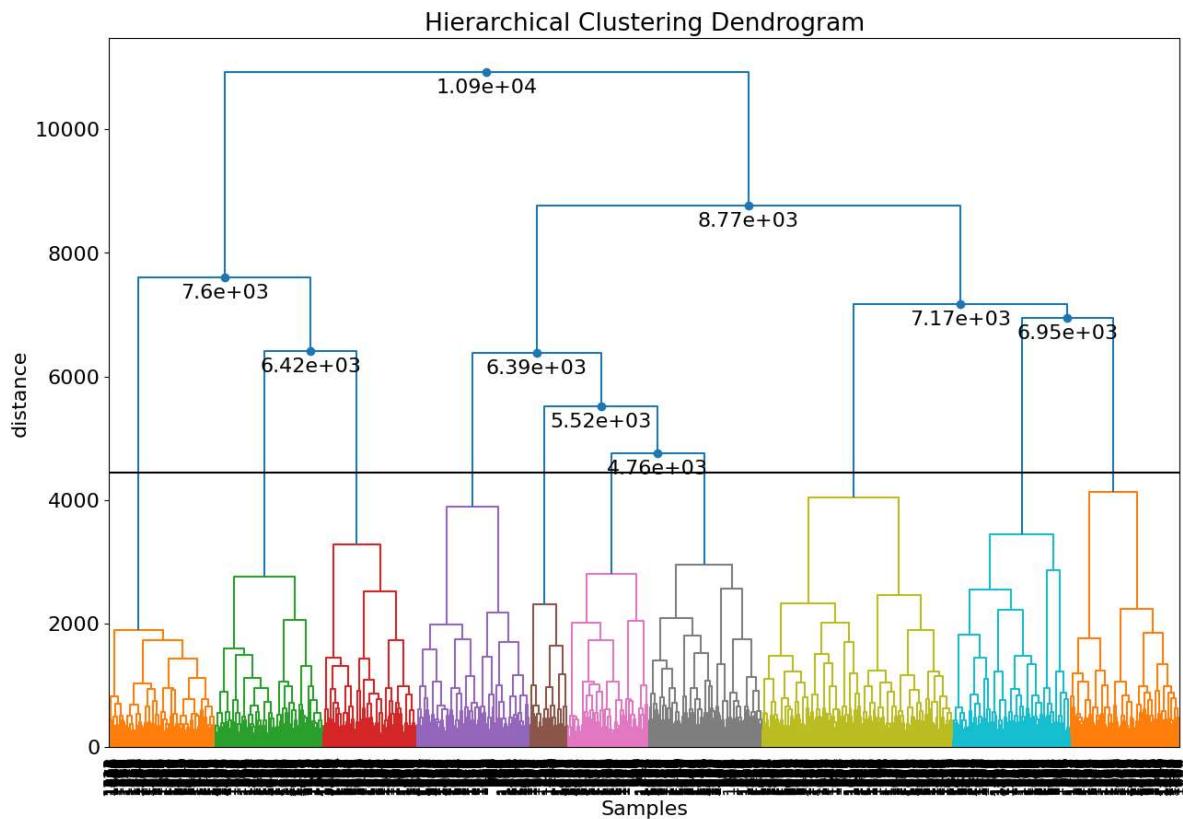
In []: `model.pca.plot()`



Out[]: (`<Figure size 1500x1000 with 1 Axes>`,
`<Axes: title={'center': 'Cumulative explained variance\n 29 Principal Components explain [95.89%] of the variance.'}, xlabel='Principle Component', ylabel='Percent age explained variance'>`)
`<Figure size 640x480 with 0 Axes>`

In []: `cl.dendrogram()`

[clusteval] >Plotting the dendrogram with optimized settings: metric=euclidean, linkage=ward, max_d=4445.983. Be patient now..
[clusteval] >Compute cluster labels.

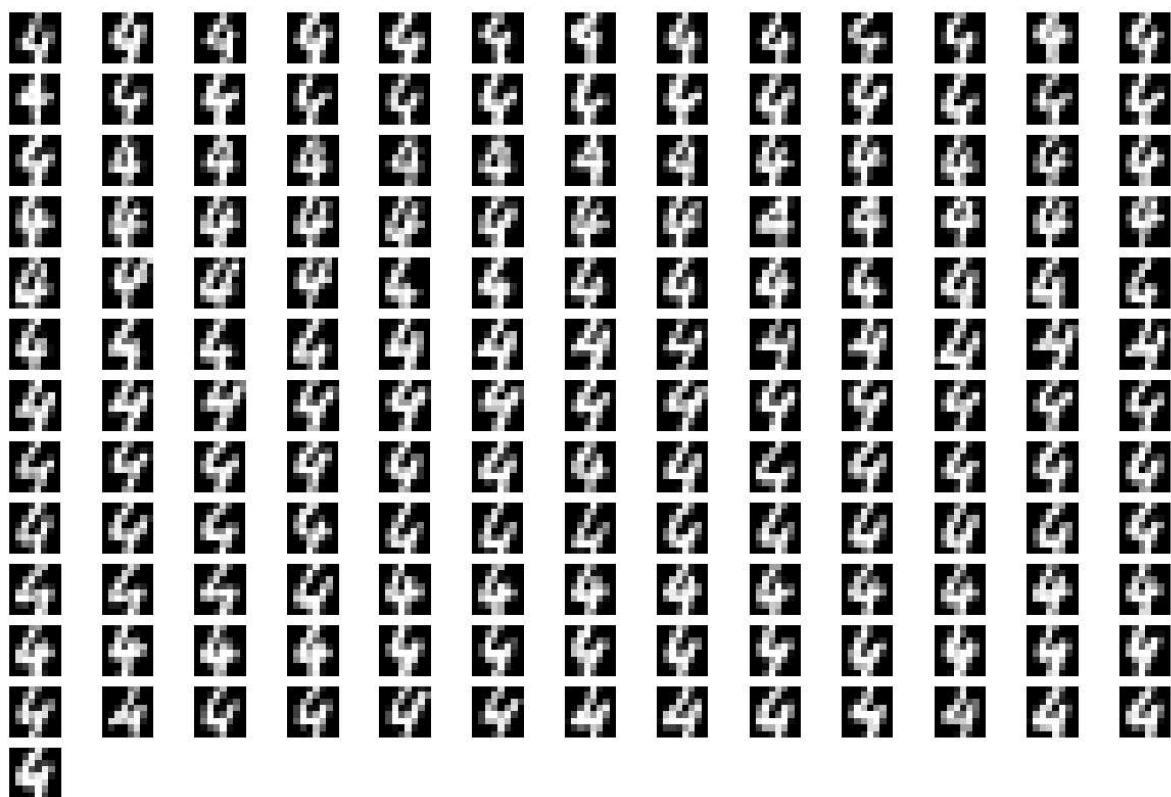


```
In [ ]: cl.plot(cmap='binary', labels=[1,2])
```

Images in cluster 1



Images in cluster 2



In []:

Agglomerative

```
In [ ]: !pip install clustimage
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheel-s/public/simple/
Collecting clustimage
  Downloading clustimage-1.5.14-py3-none-any.whl (37 kB)
Collecting imagehash
  Downloading ImageHash-4.3.1-py2.py3-none-any.whl (296 kB)
                                                 296.5/296.5 kB 11.7 MB/s eta 0:00:00
Collecting scatterd>=1.1.2
  Downloading scatterd-1.3.1-py3-none-any.whl (11 kB)
Requirement already satisfied: scikit-image in /usr/local/lib/python3.9/dist-packages (from clustimage) (0.19.3)
Collecting colourmap
  Downloading colourmap-1.1.11-py3-none-any.whl (8.1 kB)
Collecting distfit
  Downloading distfit-1.6.10-py3-none-any.whl (40 kB)
                                                 40.4/40.4 kB 1.8 MB/s eta 0:00:00
Requirement already satisfied: matplotlib in /usr/local/lib/python3.9/dist-packages (from clustimage) (3.7.1)
Collecting clusteval>=2.1.5
  Downloading clusteval-2.2.1-py3-none-any.whl (42 kB)
                                                 42.4/42.4 kB 2.0 MB/s eta 0:00:00
Requirement already satisfied: opencv-python in /usr/local/lib/python3.9/dist-packages (from clustimage) (4.7.0.72)
Requirement already satisfied: pandas in /usr/local/lib/python3.9/dist-packages (from clustimage) (1.5.3)
Collecting umap-learn
  Downloading umap-learn-0.5.3.tar.gz (88 kB)
                                                 88.2/88.2 kB 4.8 MB/s eta 0:00:00
Preparing metadata (setup.py) ... done
Collecting pca
  Downloading pca-2.0.0-py3-none-any.whl (33 kB)
Requirement already satisfied: requests in /usr/local/lib/python3.9/dist-packages (from clustimage) (2.27.1)
Requirement already satisfied: scipy in /usr/local/lib/python3.9/dist-packages (from clustimage) (1.10.1)
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.9/dist-packages (from clustimage) (1.2.2)
Collecting pypickle
  Downloading pypickle-1.1.0-py3-none-any.whl (5.1 kB)
Requirement already satisfied: tqdm in /usr/local/lib/python3.9/dist-packages (from clustimage) (4.65.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.9/dist-packages (from clustimage) (1.22.4)
Collecting ismember
  Downloading ismember-1.0.2-py3-none-any.whl (7.5 kB)
Requirement already satisfied: seaborn in /usr/local/lib/python3.9/dist-packages (from clusteval>=2.1.5->clustimage) (0.12.2)
Requirement already satisfied: packaging in /usr/local/lib/python3.9/dist-packages (from distfit->clustimage) (23.1)
Requirement already satisfied: statsmodels in /usr/local/lib/python3.9/dist-packages (from distfit->clustimage) (0.13.5)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (2.8.2)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (4.39.3)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (1.4.4)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (3.0.9)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (1.0.7)
Requirement already satisfied: importlib-resources>=3.2.0 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (5.12.0)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.9/dist-packages
```

```

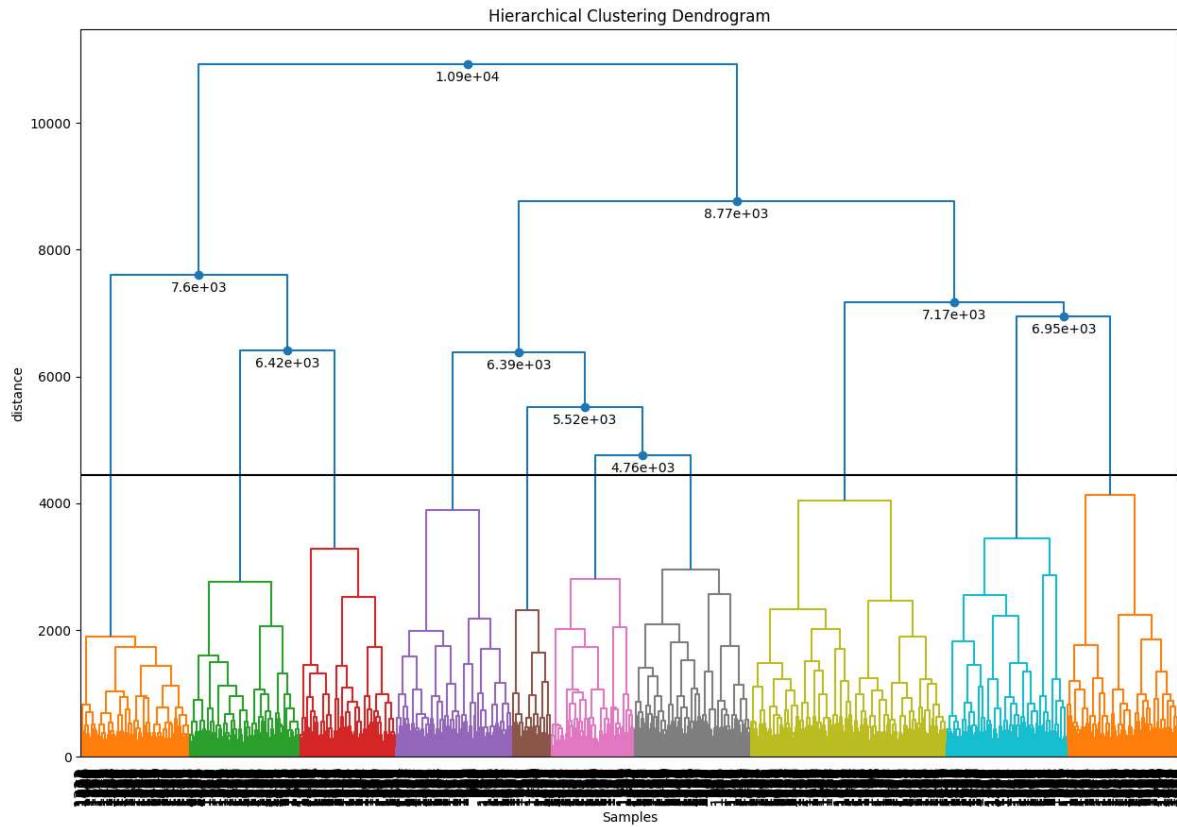
ages (from matplotlib->clustimage) (8.4.0)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.9/dist-packages (from matplotlib->clustimage) (0.11.0)
Requirement already satisfied: PyWavelets in /usr/local/lib/python3.9/dist-packages (from imagehash->clustimage) (1.4.1)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.9/dist-packages (from pandas->clustimage) (2022.7.1)
Collecting adjusttext
    Downloading adjustText-0.8-py3-none-any.whl (9.1 kB)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /usr/local/lib/python3.9/dist-packages (from requests->clustimage) (1.26.15)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.9/dist-packages (from requests->clustimage) (2022.12.7)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.9/dist-packages (from requests->clustimage) (3.4)
Requirement already satisfied: charset-normalizer~=2.0.0 in /usr/local/lib/python3.9/dist-packages (from requests->clustimage) (2.0.12)
Requirement already satisfied: tifffile>=2019.7.26 in /usr/local/lib/python3.9/dist-packages (from scikit-image->clustimage) (2023.4.12)
Requirement already satisfied: networkx>=2.2 in /usr/local/lib/python3.9/dist-packages (from scikit-image->clustimage) (3.1)
Requirement already satisfied: imageio>=2.4.1 in /usr/local/lib/python3.9/dist-packages (from scikit-image->clustimage) (2.25.1)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.9/dist-packages (from scikit-learn->clustimage) (3.1.0)
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.9/dist-packages (from scikit-learn->clustimage) (1.2.0)
Requirement already satisfied: numba>=0.49 in /usr/local/lib/python3.9/dist-packages (from umap-learn->clustimage) (0.56.4)
Collecting pynndescent>=0.5
    Downloading pynndescent-0.5.10.tar.gz (1.1 MB)
    1.1/1.1 MB 19.3 MB/s eta 0:00:00
        Preparing metadata (setup.py) ... done
Requirement already satisfied: zipp>=3.1.0 in /usr/local/lib/python3.9/dist-packages (from importlib-resources>=3.2.0->matplotlib->clustimage) (3.15.0)
Requirement already satisfied: llvmlite<0.40,>=0.39.0dev0 in /usr/local/lib/python3.9/dist-packages (from numba>=0.49->umap-learn->clustimage) (0.39.1)
Requirement already satisfied: setuptools in /usr/local/lib/python3.9/dist-packages (from numba>=0.49->umap-learn->clustimage) (67.7.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.9/dist-packages (from python-dateutil>=2.7->matplotlib->clustimage) (1.16.0)
Requirement already satisfied: patsy>=0.5.2 in /usr/local/lib/python3.9/dist-packages (from statsmodels->distfit->clustimage) (0.5.3)
Building wheels for collected packages: umap-learn, pynndescent
    Building wheel for umap-learn (setup.py) ... done
    Created wheel for umap-learn: filename=umap_learn-0.5.3-py3-none-any.whl size=82830 sha256=46be706963b9f9b616f2805c71a49430b187e4fd379ad0966d0c2db027eebf3
    Stored in directory: /root/.cache/pip/wheels/f4/3e/1c/596d0a463d17475af648688443fa4846fef624d1390339e7e9
    Building wheel for pynndescent (setup.py) ... done
    Created wheel for pynndescent: filename=pynndescent-0.5.10-py3-none-any.whl size=55640 sha256=ed369fc1db9e85bfa6837b23eccb77ad6f11974a104cb92539202bdd17d29940
    Stored in directory: /root/.cache/pip/wheels/12/f9/4d/ec5ad1c823c710fcc4473669fdcffc8891f4bc398c841af22e
Successfully built umap-learn pynndescent
Installing collected packages: pypickle, ismember, imagehash, pynndescent, colourmap, adjusttext, umap-learn, scatterd, distfit, pca, clusteval, clustimage
Successfully installed adjusttext-0.8 clusteval-2.2.1 clustimage-1.5.14 colourmap-1.1.11 distfit-1.6.10 imagehash-4.3.1 ismember-1.0.2 pca-2.0.0 pynndescent-0.5.10 pypickle-1.1.0 scatterd-1.3.1 umap-learn-0.5.3

```

In []: `from clustimage import Clustimage`

In []: `model.dendrogram()`

```
[clustimage] >INFO> Retrieving input data set.
[clustimage] >INFO> Plotting the dendrogram with optimized settings: metric=euclidean, linkage=ward, max_d=4445.940. Be patient now..
[clustimage] >INFO> Compute cluster labels.
```

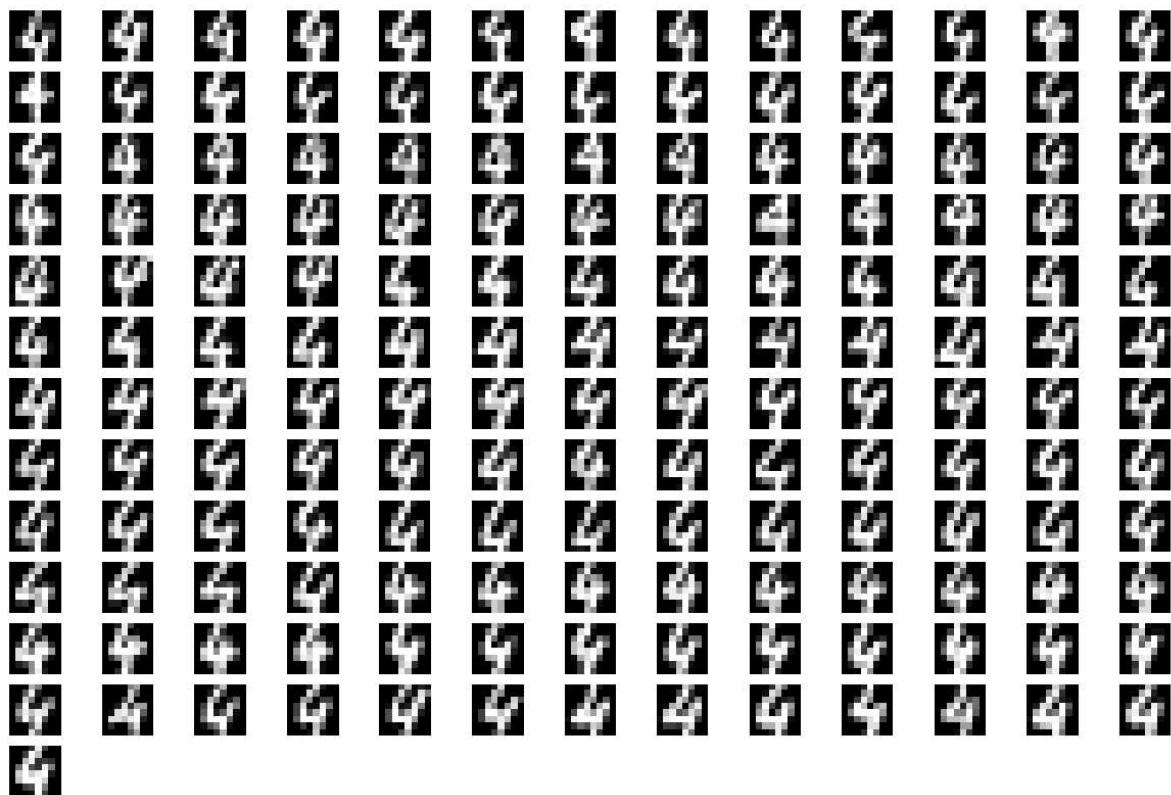


In []: `model.plot(cmap='binary', labels=[1,2])`

Images in cluster 1



Images in cluster 2



In []: