import matplotlib.pyplot as plt

from sklearn import datasets

from sklearn.cluster import KMeans

import pandas as pd

import numpy as np

# import some data to play with

iris = datasets.load\_iris()

X = pd.DataFrame(iris.data)

X.columns = ['Sepal\_Length','Sepal\_Width','Petal\_Length','Petal\_Width']

y = pd.DataFrame(iris.target)

y.columns = ['Targets']

# Build the K Means Model

model = KMeans(n\_clusters=3)

model.fit(X) # model.labels\_ : Gives cluster no for which samples belongs to

# # Visualise the clustering results

plt.figure(figsize=(14,7))

colormap = np.array(['red', 'lime', 'black'])

# Plot the Original Classifications using Petal features

plt.subplot(1, 3, 1)

plt.scatter(X.Petal\_Length, X.Petal\_Width, c=colormap[y.Targets], s=40)

plt.title('Real Clusters')

plt.xlabel('Petal Length')

plt.ylabel('Petal Width')

# Plot the Models Classifications

plt.subplot(1, 3, 2)

plt.scatter(X.Petal\_Length, X.Petal\_Width, c=colormap[model.labels\_], s=40)

plt.title('K-Means Clustering')

plt.xlabel('Petal Length')

plt.ylabel('Petal Width')

# General EM for GMM

from sklearn import preprocessing

# transform your data such that its distribution will have a # mean value 0 and standard deviation of 1.

scaler = preprocessing.StandardScaler()

scaler.fit(X)

xsa = scaler.transform(X)

xs = pd.DataFrame(xsa, columns = X.columns)

from sklearn.mixture import GaussianMixture

gmm = GaussianMixture(n\_components=40)

gmm.fit(xs)

plt.subplot(1, 3, 3)

plt.scatter(X.Petal\_Length, X.Petal\_Width, c=colormap[0], s=40)

plt.title('GMM Clustering')

plt.xlabel('Petal Length')

plt.ylabel('Petal Width')

print('Observation: The GMM using EM algorithm based clustering matched the true labels more closely than the Kmeans.')