Code and output screenshots from python notebook

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# implementation of basic K-means clustering algorithm using Python in jupyter notebook
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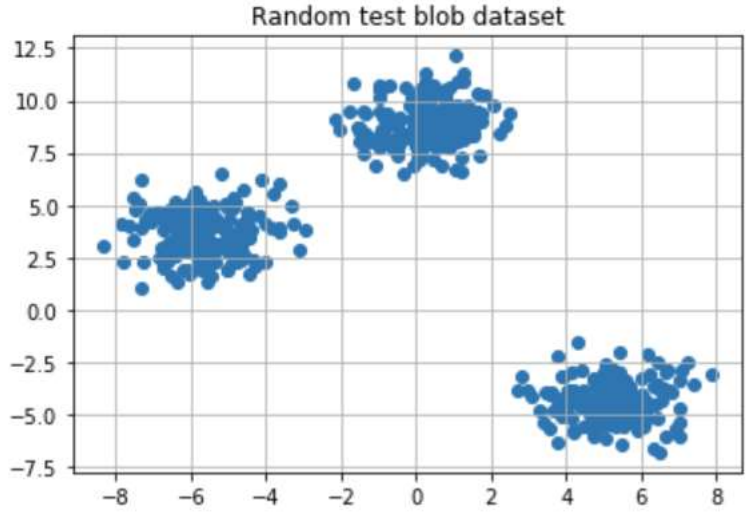
# Subject/Class: CMPS 451 Artificial Intelligence

#Step 1:- Import the required libraries
#Numpy for statistical computations
#Matplotlib to plot the graph
#make_blobs from sklearn.datasets
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import make_blobs
#Step 2:- Create the custom test dataset with make_blobs and plot it
X,y = make_blobs(n_samples = 550,n_features = 2,centers = 3,random_state = 23)

fig = plt.figure(0)
plt.grid(True)
plt.scatter(X[:,0],X[:,1])
plt.title("Random test blob dataset")
plt.show()

#output of above code
```

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#Step 3: Initialize the random centroids
#initializes 3 clusters for K-means
#sets a random seed
#generates random cluster centers within a specified range
#creates an empty list of points for each cluster.
k = 3
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clusters = {}
np.random.seed(23)

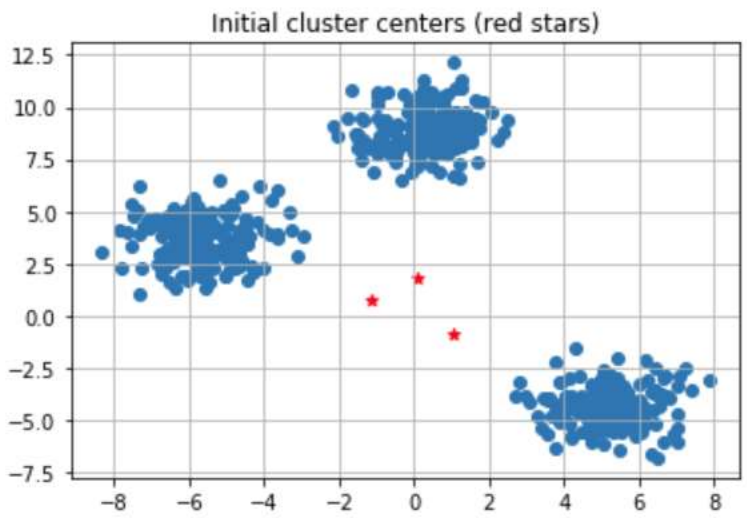
for idx in range(k):
   center = 2*(2*np.random.random((X.shape[1],))-1)
   points = []
   cluster = {
      'center' : center,
      'points' : []
   }

   clusters[idx] = cluster

clusters

# output of above code
{0: {'center': array([0.06919154, 1.78785042]), 'points': []},
 1: {'center': array([ 1.06183904, -0.87041662]), 'points': []},
 2: {'center': array([-1.11581855,  0.74488834]), 'points': []}}

#Step 4: Plot the random initialize center with data points
plt.scatter(X[:,0],X[:,1])
plt.grid(True)
for i in clusters:
   center = clusters[i]['center']
   plt.scatter(center[0],center[1],marker = '*',c = 'red')
plt.title("Initial cluster centers (red stars)")
plt.show()
#output of above code
```

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#Step 5: Define Euclidean distance
def distance(p1,p2):
   return np.sqrt(np.sum((p1-p2)**2))

#Step 6: the function to Assign and Update the cluster center
#This step assigns data points to the nearest cluster center,
# and the M-step updates cluster centers based on the mean of assigned points in K-means clustering.

def assign_clusters(X, clusters):
   for idx in range(X.shape[0]):
      dist = []

      curr_x = X[idx]

      for i in range(k):
         dis = distance(curr_x,clusters[i]['center'])
         dist.append(dis)
      curr_cluster = np.argmin(dist)
      clusters[curr_cluster]['points'].append(curr_x)
   return clusters

def update_clusters(X, clusters):
   for i in range(k):
      points = np.array(clusters[i]['points'])
      if points.shape[0] > 0:
         new_center = points.mean(axis =0)
         clusters[i]['center'] = new_center
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        clusters[i]['points'] = []
    return clusters

#Step 7: the function to Predict the cluster for the datapoints
def pred_cluster(X, clusters):
    pred = []
    for i in range(X.shape[0]):
        dist = []
        for j in range(k):
            dist.append(distance(X[i],clusters[j]['center']))
        pred.append(np.argmin(dist))
    return pred


#Step 8: Assign, Update, and predict the cluster center
clusters = assign_clusters(X,clusters)
clusters = update_clusters(X,clusters)
pred = pred_cluster(X,clusters)

#Step 9: Plot the data points with their predicted cluster center
plt.scatter(X[:,0],X[:,1],c = pred)
for i in clusters:
    center = clusters[i]['center']
    plt.scatter(center[0],center[1],marker = '^',c = 'red')
plt.title("Red markers represent the updated cluster centers")
plt.show()

#output of above code
```