Experiment-5

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TE Comps
Batch - C

Aim:
To train and test machine learning models using K-Means Clustering Algorithm.

Theory:

- K-Means Clustering is an unsupervised learning algorithm used in machine learning and data science to handle clustering problems. It divides the unlabelled data into many clusters. K specifies the number of predetermined clusters that must be produced during the procedure; for example, if K=2, two clusters will be created, and if K=3, three clusters will be created, and so on.
- How does the K-Means algorithm work?
    - The working of the K-Means algorithm is explained in the below steps:
      Step-1: Select the number K to decide the number of clusters.
      Step-2: Select random K points or centroids. (It can be different from the input dataset).
      Step-3: Assign each data point to their closest centroid, which will form the predefined K clusters.
      Step-4: Calculate the variance and place a new centroid of each cluster.
      Step-5: Repeat the third steps, which means assign each datapoint to the new closest centroid of each cluster.
      Step-6: If any reassignment occurs, then go to step-4 else go to FINISH.
      Step-7: The model is ready.

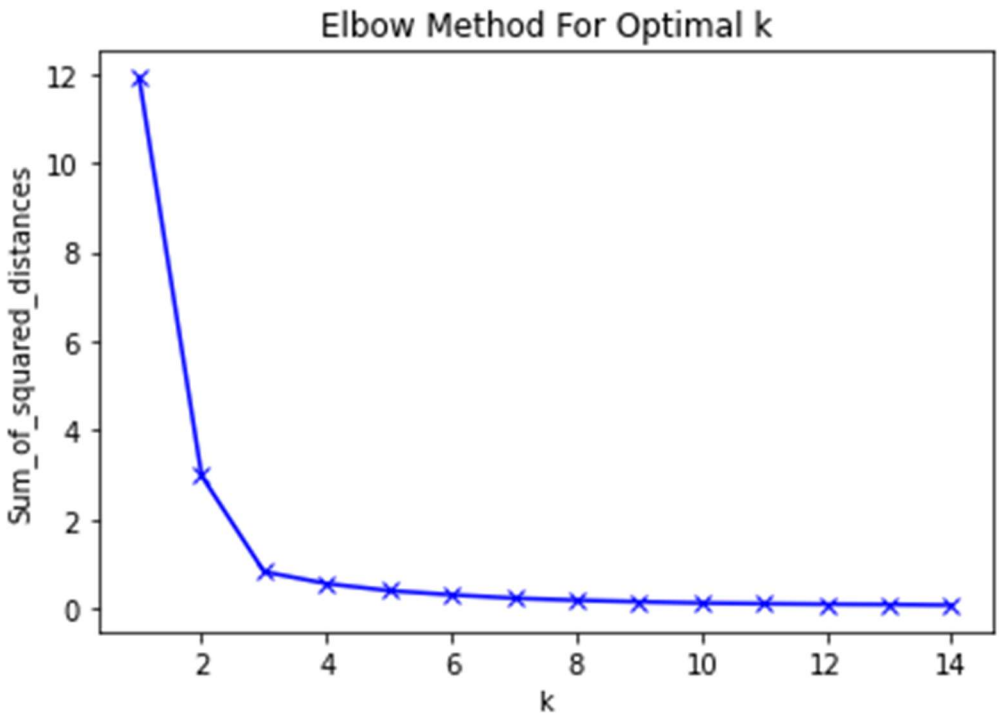
Code:

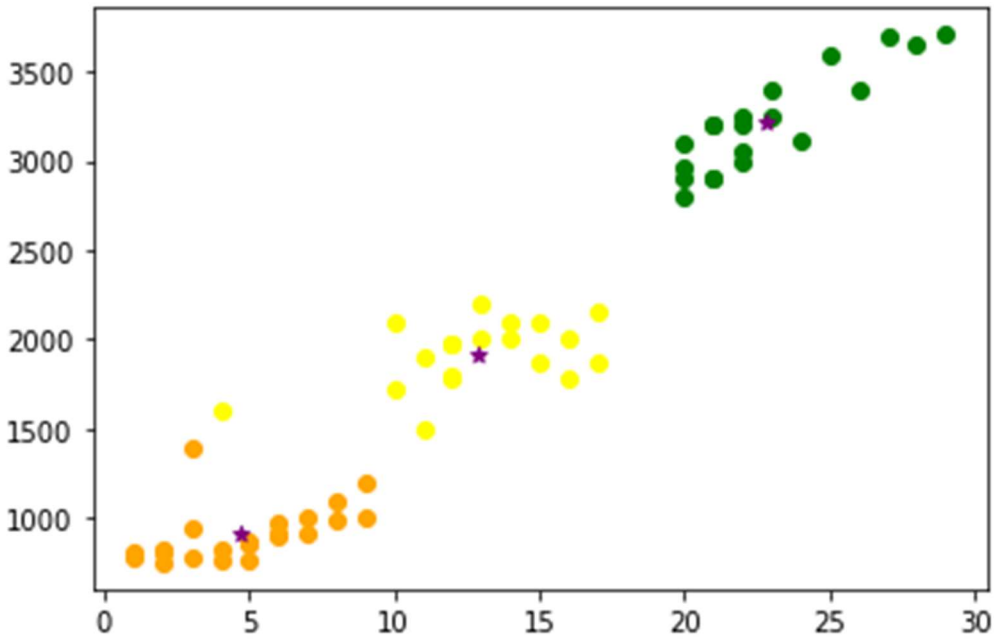
```
#Importing libraries
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
from sklearn.cluster import KMeans

#Loading dataset
import pandas as pd
data=pd.read_csv('EmployeeSalary.csv')
data
data.plot(kind='scatter', x='WorkingYears',y='Salary')
plt.show()
#Drop ID column, we don't use this column
df=data.drop(['ID'], axis=1)
#Scaling the dataset
mms=MinMaxScaler()
mms.fit(df)
data_transformed=mms.transform(df)
#Convert to Dataframe
data_transformed=pd.DataFrame(data_transformed, columns=['WorkingYears','Salary'])
```

```
data_transformed
#Replotting dataset after scalling
data_transformed.plot(kind='scatter', x='WorkingYears',y='Salary')
plt.show()
#Elbow method to minimize WSS (Within-cluster Sum of Square)
Sum_of_squared_distances = []
K = range(1,15)
for k in K:
    km = KMeans(n_clusters=k)
    km = km.fit(data_transformed)
    Sum_of_squared_distances.append(km.inertia_)
#Plotting the Elbow Curve
plt.plot(K, Sum_of_squared_distances, 'bx-')
plt.xlabel('k')
plt.ylabel('Sum_of_squared_distances')
plt.title('Elbow Method For Optimal k')
plt.show()
#Using K-Mean with k=3 to cluster for the dataset
data=pd.read_csv('EmployeeSalary.csv')
df=data.drop(['ID'], axis=1)
#Clustering the dataset with k=3
km3 = KMeans(n_clusters=3)
km3 = km3.fit(df)
labels=km3.labels_
labels=pd.DataFrame(labels, columns=['cluster'])
df_clustered=pd.concat([df,labels], axis=1)
#how many observations are in each cluster
print(km3.labels_)
result=km3.labels_
result=pd.DataFrame(result, columns=['cluster'])
result.groupby('cluster').size()
#The centroid of cluster
centroids = km3.cluster_centers_
centroids=pd.DataFrame(centroids, columns=['Centroid_Year', 'Centroid_Salary'])
centroids
#Predict clusters for 3 employees with WorkingYears and Salary as below
clu_pred=km3.predict([[18,3700],[4,900],[10,1700]])
df1 = df_clustered[df_clustered.cluster==0]
df2 = df_clustered[df_clustered.cluster==1]
df3 = df_clustered[df_clustered.cluster==2]
plt.scatter(df1.WorkingYears,df1['Salary'],color='green')
plt.scatter(df2.WorkingYears,df2['Salary'],color='orange')
plt.scatter(df3.WorkingYears,df3['Salary'],color='yellow')
plt.scatter(centroids.Centroid_Year,centroids.Centroid_Salary,color='purple',marker
='*',label='centroid')
```

Output:


Elbow Method For Optimal k
Sum_of_squared_distances
k
0
2
4
6
8
10
12
14


1000
1500
2000
2500
3000
3500
0
5
10
15
20
25
30

Conclusion:

- I acquired the basics of the K-Means method from the above experiment. It's a centroid-based approach, which means that each cluster has its own centroid.
- The main goal of this technique is to reduce the sum of distances between data points and the clusters that they belong to.
- It uses an iterative procedure to find the best value for K centre points or centroids, and then allocates each data point to the closest k-centre. A cluster is formed by data points that are close to a specific K-center.
- The algorithm takes an unlabeled dataset as input, separates it into k-number of clusters, and continues the procedure until no better clusters are found. In this algorithm, the value of k should be predetermined.
- The algorithm's accuracy varies depending on the number of clusters picked.