K_MeansClustering

September 10, 2023

1 Problem Statement:

Lithionpower is the largest provider of electric vehicle batteries. It provides battery on a rental model to e-vehicle drivers. Drivers rent battery typically for a day and then replace it with a charged battery from the company. Lithionpower has a variable pricing model based on the driver's driving history. Battery life depends on factors like overspeeding, distance driven per day, and so on.

2 Objective:

Create a cluster model where drivers can be grouped together based on their driving data. Group the data points so that drivers will be incentivized based on the cluster.

3 Data Dictionary

For the sake of simplicity, you will take only two features such as mean distance driven per day and the mean percentage of time when a driver was more than 5 mph over the speed limit.

Here are what the data represent:

id: Unique ID of the driver mean_dist_day: Mean distance driven by driver per day mean_over_speed_perc: Mean percentage of time when a driver was more than 5 mph over the speed limit

[3]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

[6]:
```
vehicle = pd.read_csv("driver-data (1).csv")
vehicle.head()
```

[6]:

	id	mean_dist_day	mean_over_speed_perc
0	3423311935	71.24	28
1	3423313212	52.53	25
2	3423313724	64.54	27
3	3423311373	55.69	22
4	3423310999	54.58	25

[7]:
```
vehicle.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4000 entries, 0 to 3999
Data columns (total 3 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   id                    4000 non-null   int64
 1   mean_dist_day         4000 non-null   float64
 2   mean_over_speed_perc  4000 non-null   int64
dtypes: float64(1), int64(2)
memory usage: 93.9 KB
```

[8]:
```
vehicle.columns
```

[8]:
```
Index(['id', 'mean_dist_day', 'mean_over_speed_perc'], dtype='object')
```

4 Data Prearation

- Data Cleaning
- lets check the null values.

[9]:
```
vehicle.isnull().sum(axis=0)
```

[9]:
```
id                    0
mean_dist_day         0
mean_over_speed_perc  0
dtype: int64
```

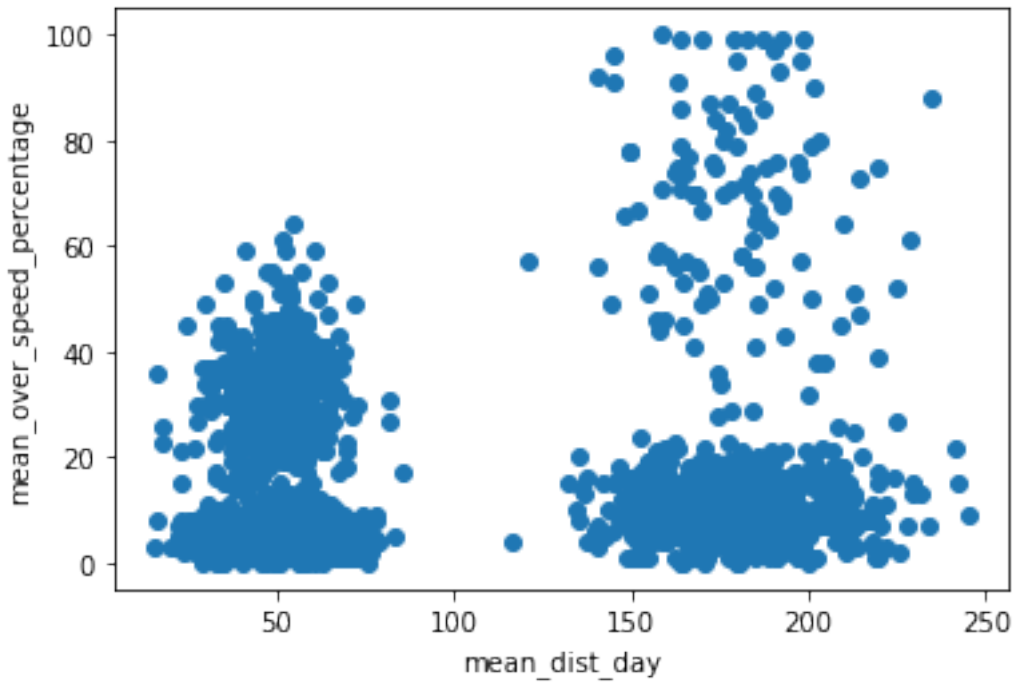
hence there are no null values, therefore we can proceed ahead

[10]:
```
# Lets check the data type
vehicle.dtypes
```

[10]:
```
id                      int64
mean_dist_day         float64
mean_over_speed_perc    int64
dtype: object
```

5 Visualize the data points.

[14]:
```
plt.scatter(vehicle['mean_dist_day'],vehicle['mean_over_speed_perc'])
plt.xlabel("mean_dist_day")
plt.ylabel("mean_over_speed_percentage")
plt.show()
```



Interpretation: wecan see the scatterness in the data points hence required to create the cluster by using K_Means Clusterng Method

[16]:
```
from sklearn.cluster import KMeans
```

[17]:
```
km=KMeans(n_clusters=3) # we need to predifined the cluster before model␣
 ↪prediction
y_predict =km.fit_predict(vehicle[['mean_dist_day','mean_over_speed_perc']])
```

```
/usr/local/lib/python3.10/site-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(
```

[19]:
```
y_predict
```

[19]:
```
array([0, 0, 0, …, 1, 1, 1], dtype=int32)
```

[20]:
```
# lets check the uniqueness in the prediction
np.unique(y_predict)
```

[20]:
```
array([0, 1, 2], dtype=int32)
```

[28]:
```
# lets add predict cluster name in the column set in the dataset
vehicle['cluster']=y_predict
```

[29]:
```
vehicle.head()
```

[29]:

	id	mean_dist_day	mean_over_speed_perc	Cluster	cluster
0	3423311935	71.24	28	0	0
1	3423313212	52.53	25	0	0
2	3423313724	64.54	27	0	0
3	3423311373	55.69	22	0	0
4	3423310999	54.58	25	0	0

[30]:
```
vehicle.sample(5)
```

[30]:

	id	mean_dist_day	mean_over_speed_perc	Cluster	cluster
1214	3423313771	42.00	8	0	0
687	3423313369	53.75	8	0	0
2739	3423310579	65.60	6	0	0
136	3423311470	61.67	50	0	0
783	3423311656	42.75	4	0	0

6 Get the coordinates of cluster Centers

[31]:
```
km.cluster_centers_
```

[31]:
```
array([[ 50.04763438,   8.82875   ],
       [180.34311782,  10.52011494],
       [177.83509615,  70.28846154]])
```

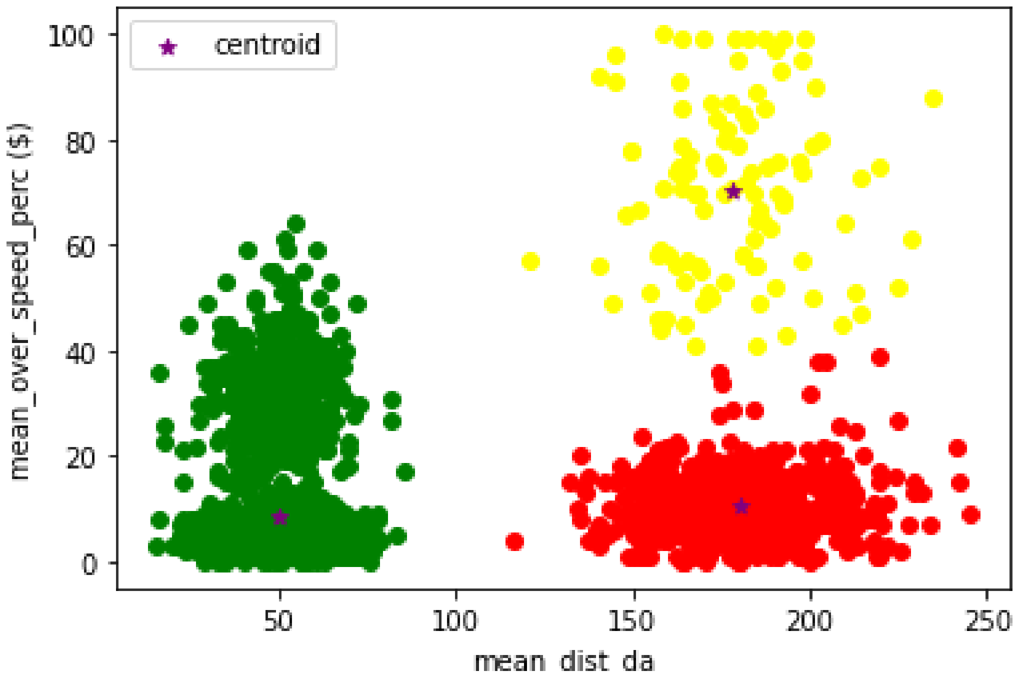
7 plot the clusters with their centroids

[33]:
```
# here we have n_cluster =3 therefore, we need to define three dataset 0,1,2
df1= vehicle[vehicle.cluster==0]
df2= vehicle[vehicle.cluster==1]
df3= vehicle[vehicle.cluster==2]

plt.scatter(df1['mean_dist_day'],df1['mean_over_speed_perc'],color='green')
plt.scatter(df2['mean_dist_day'],df2['mean_over_speed_perc'],color='red')
plt.scatter(df3['mean_dist_day'],df3['mean_over_speed_perc'],color='yellow')


plt.scatter(km.cluster_centers_[:,0],km.cluster_centers_[:
 ↪,1],color='purple',marker='*',label='centroid')
plt.xlabel('mean_dist_da')
plt.ylabel('mean_over_speed_perc ($)')
plt.legend()
```

[33]:
```
<matplotlib.legend.Legend at 0x7f6dc091a6e0>
```



[42]:
```python
# lets check our assumption of making cluster is correct using elbow method
sse=[]
k_rng=range(1,10)
for k in k_rng:
    km=KMeans(n_clusters=k)
    km.fit(vehicle[['mean_dist_day','mean_over_speed_perc']])
    sse.append(km.inertia_)
```

```
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```

```
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  warnings.warn(
```
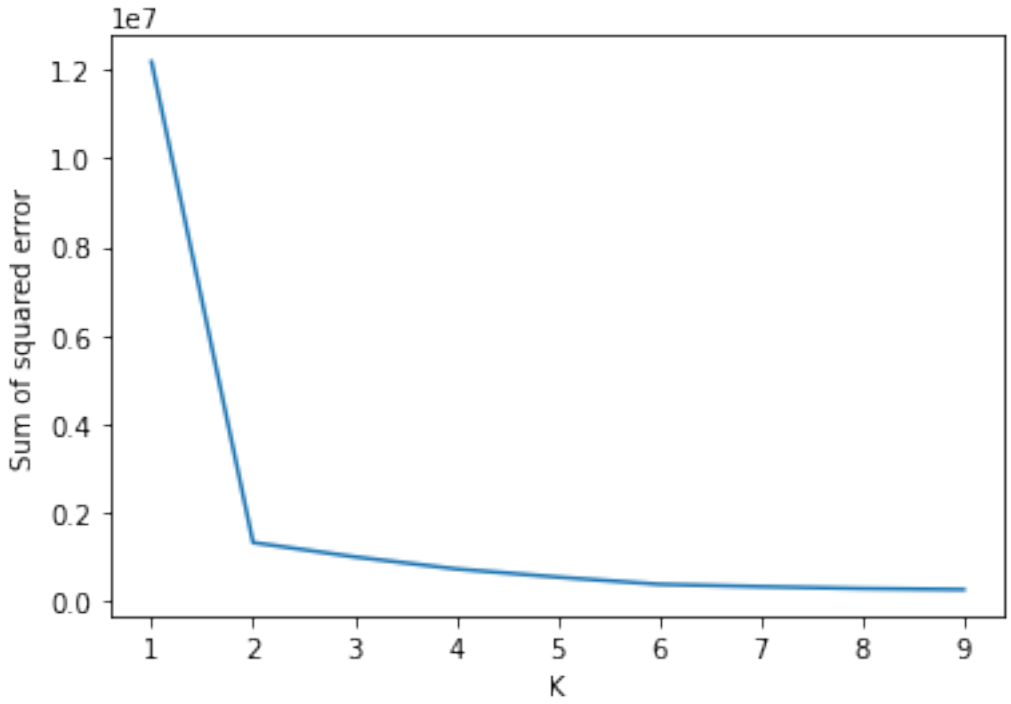

[43]:
```python
# lets check sse
sse
```

[43]:
```
[12184626.12962798,
 1316420.8509477177,
 992634.0606702471,
 719603.9690822503,
 534675.0545621562,
 372841.1452326999,
 319750.0505369911,
 276961.48247100855,
 252615.12344189786]
```

[44]:
```python
# lets plot the elbow
plt.xlabel('K')
plt.ylabel('Sum of squared error')
plt.plot(k_rng,sse)
```

[44]:
```
[<matplotlib.lines.Line2D at 0x7f6dc05e4580>]
```



Interpretation: we can see that 2 has the cluster range and our cluster n=3 which is approx correct and there will be no change of overfitting/underfitting of data points

[ ]: