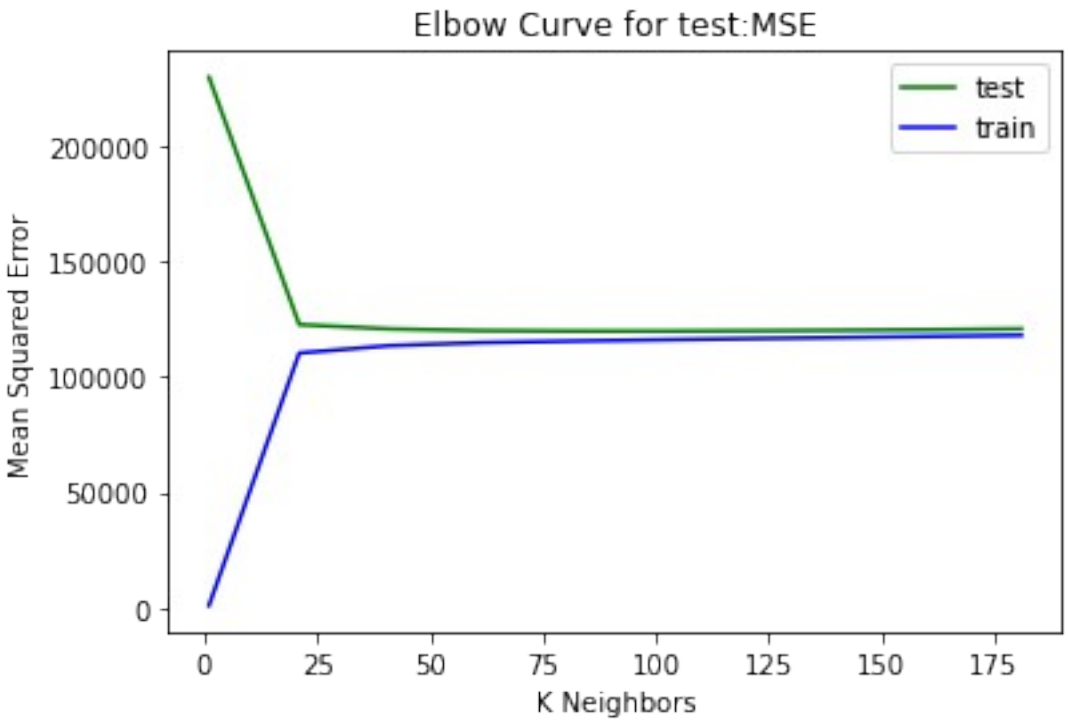
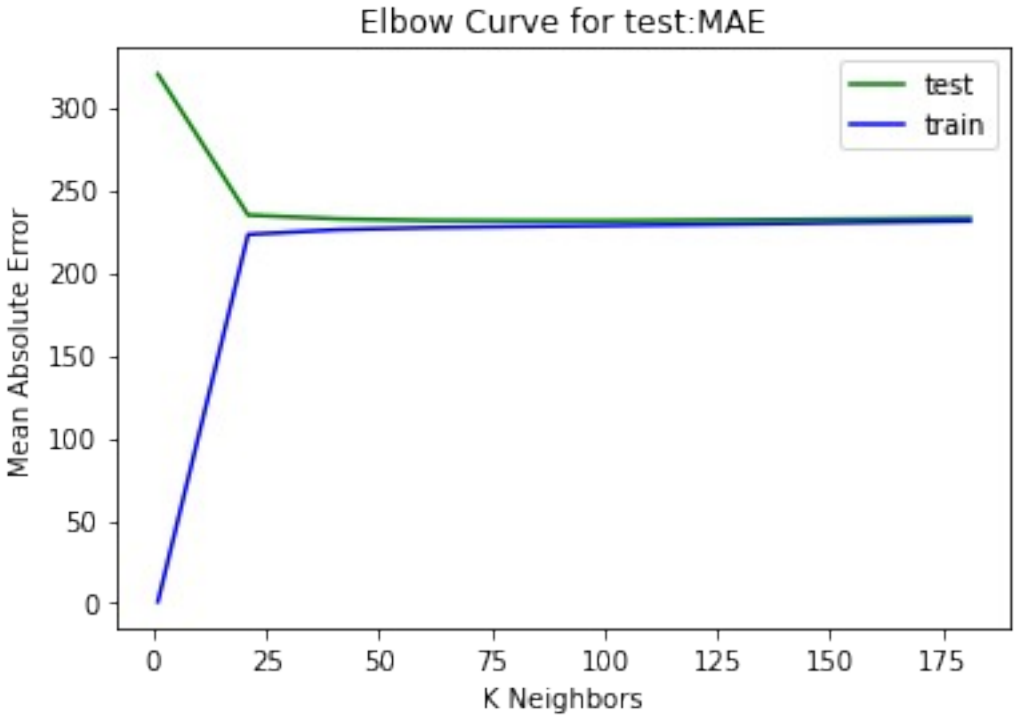
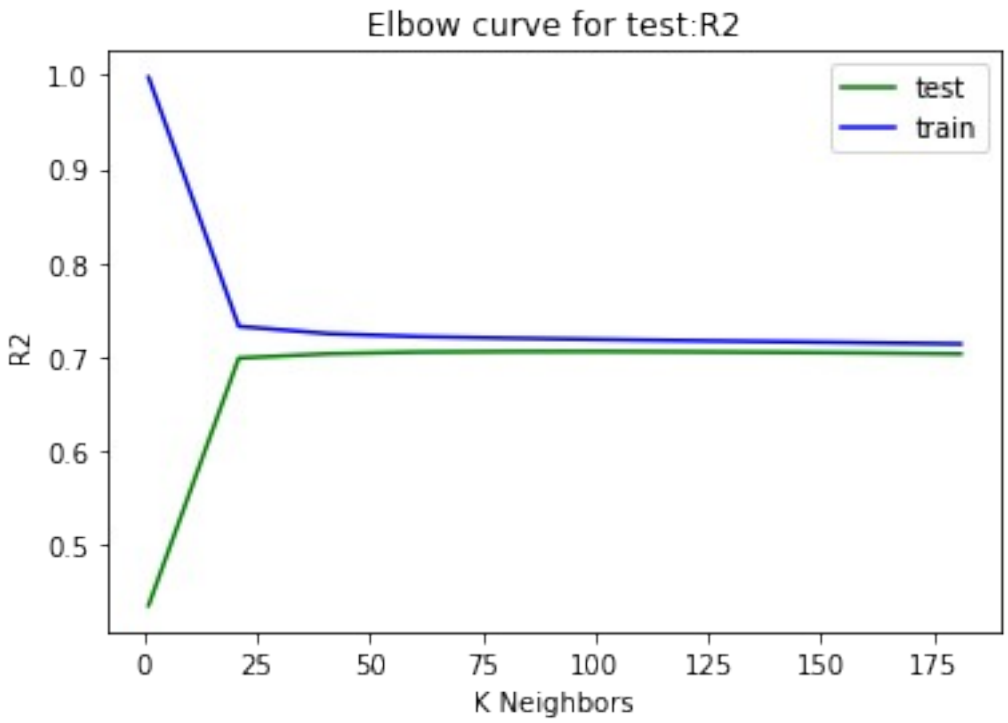
```
# K nearest neighbour
%matplotlib inline
import numpy as np
import pandas as pd
from datetime import timedelta
import datetime as dt
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
import warnings
warnings.filterwarnings('ignore')
from sklearn.neighbors import KNeighborsRegressor as KNN
from sklearn.metrics import mean_squared_error as mse
import geopy.distance
from sklearn.metrics import r2_score
from sklearn.metrics import mean_absolute_error as mae

df = pd.read_csv('nyc_taxi_trip_duration Dataset.csv')
df['pickup_datetime'] = pd.to_datetime(df.pickup_datetime)
df['dropoff_datetime'] = pd.to_datetime(df.dropoff_datetime)

# Converting yes/no flag to 1 and 0
df['store_and_fwd_flag'] = 1 * (df.store_and_fwd_flag.values == 'Y')

df['log_trip_duration'] = np.log(df['trip_duration'].values + 1)

df['day_of_week'] = df['pickup_datetime'].dt.weekday
df['hour_of_day'] = df['pickup_datetime'].dt.hour

#short_distance
from geopy.distance import geodesic,great_circle
list1=[]
for i in range(0,df.shape[0]):
    coords_1 = (df["pickup_latitude"][i],df["pickup_longitude"][i])
    coords_2 = (df['dropoff_latitude'][i],df["dropoff_longitude"][i])
    c=great_circle(coords_1,coords_2).km
    list1.append(c)
df["Short_distance"]=list1

#removing outliers
df=df[df["trip_duration"]<6000]
df = df.loc[(df.pickup_latitude > 40.6) & (df.pickup_latitude < 40.9)]
df = df.loc[(df.dropoff_latitude>40.6) & (df.dropoff_latitude < 40.9)]
df = df.loc[(df.dropoff_longitude > -74.05) & (df.dropoff_longitude <
-73.7)]
df = df.loc[(df.pickup_longitude > -74.05) & (df.pickup_longitude < -
73.7)]
df.drop(["id","pickup_datetime","dropoff_datetime","pickup_longitude",
"pickup_latitude","dropoff_longitude","dropoff_latitude","store_and_fw
d_flag"],axis=1,inplace=True)
```

```
#binning of target continous variable for stratified sampling
from matplotlib import *
bins=np.linspace(min(df["log_trip_duration"]),max(df["log_trip_duratio
n"]),201)  #for n equal bins we use n+1 dividers.therfore 4 dividers.
group_names=list(range(0,200))
df["log_binned"]=pd.cut(df["log_trip_duration"],bins,labels=group_name
s,include_lowest=True)   #new
column=cut(column,bins,labels,include_lowest)

#Stratify sample
df=df.groupby('log_binned', group_keys=False).apply(lambda x:
x.sample(frac=0.4,random_state=123))
#df=df.sample(n=85000,random_state=321)

#TRAIN and ERROR
x = df.drop(['trip_duration','log_trip_duration','log_binned'],
axis=1)
y = df['trip_duration']
train_x,test_x,train_y,test_y =
train_test_split(x,y,test_size=0.2,random_state=120)

def Elbow(K):
  #initiating empty list
    test_mse = []
    train_mse=[]
    test_r2 = []
    train_r2=[]
    test_mae = []
    train_mae=[]

  #training model for evey value of K
    for i in K:
        #Instance of KNN
        reg = KNN(n_neighbors = i)
        reg.fit(train_x, train_y)

        #Appending mse value to empty list claculated using the
predictions

        #test error mse and r2
        yhat_test = reg.predict(test_x)

        mse_test = mse(yhat_test,test_y)
        mae_test = mae(yhat_test,test_y)
        r2_test=r2_score(test_y,yhat_test)

        test_mse.append(mse_test)
        test_mae.append(mae_test)
        test_r2.append(r2_test)
```

```
        #train error mse and r2
        yhat_train = reg.predict(train_x)

        mse_train = mse(yhat_train,train_y)
        mae_train = mae(yhat_train,train_y)
        r2_train=r2_score(train_y,yhat_train)

        train_mse.append(mse_train)
        train_mae.append(mae_train)
        train_r2.append(r2_train)
    return test_mse,train_mse,test_r2,train_r2,test_mae,train_mae

k = range(1,200,20)
test_mse,train_mse,test_r2,train_r2,test_mae,train_mae = Elbow(k)

plt.plot(k, test_mse,color = 'green' , label = 'test')
plt.plot(k, train_mse,color = 'blue' , label = 'train')
plt.xlabel('K Neighbors')
plt.ylabel('Mean Squared Error')
plt.title('Elbow Curve for test:MSE')
#plt.ylim(0.4,1)
plt.legend()
plt.show()

plt.plot(k, test_mae,color = 'green' , label = 'test')
plt.plot(k, train_mae,color = 'blue' , label = 'train')
plt.xlabel('K Neighbors')
plt.ylabel('Mean Absolute Error')
plt.title('Elbow Curve for test:MAE')
#plt.ylim(0.4,1)
plt.legend()
plt.show()

plt.plot(k, test_r2,color = 'green' , label = 'test')
plt.plot(k, train_r2,color = 'blue' , label = 'train')
plt.xlabel('K Neighbors')
plt.ylabel('R2')
plt.title('Elbow curve for test:R2')
#plt.ylim(0.4,1)
plt.legend()
plt.show()

df_error=pd.DataFrame({"K":k,"test_mse":test_mse,"train_mse":train_mse
,"test_r2":test_r2,"train_r2":train_r2,"test_mae":test_mae,"train_mae"
:train_mae})
df_error.head(15)
```


Elbow Curve for test:MSE
test
train
Mean Squared Error
200000
150000
100000
50000
0
0
25
50
75
100
125
150
175
K Neighbors


Elbow Curve for test:MAE
test
train
Mean Absolute Error
300
250
200
150
100
50
0
0
25
50
75
100
125
150
175
K Neighbors



	K	test_mse	train_mse	test_r2	train_r2	test_mae
0	1	229435.664293	1074.564589	0.436016	0.997392	320.034672
1	21	122481.406331	110170.961424	0.698924	0.732608	234.741452
2	41	120610.551719	113387.175237	0.703523	0.724802	232.419020
3	61	119883.775721	114672.748872	0.705309	0.721682	231.520260
4	81	119682.027961	115345.345928	0.705805	0.720050	231.321775
5	101	119650.300166	115907.153211	0.705883	0.718686	231.309799
6	121	119808.619527	116419.065448	0.705494	0.717444	231.665941
7	141	120024.119113	116881.934231	0.704964	0.716320	232.059875
8	161	120274.965126	117375.003084	0.704348	0.715124	232.452016
9	181	120653.650399	117851.398054	0.703417	0.713967	232.995365

	train_mae
0	0.915835
1	223.026161
2	225.919071

```
3  227.140654
4  227.793810
5  228.359853
6  229.008817
7  229.663456
8  230.410618
9  231.117266
```