#Predict the price of the Uber ride from a given pickup point to the agreed drop-off location. Perform following tasks:

1. Pre-process the dataset.
2. Identify outliers.
3. Check the correlation.
4. Implement linear regression and random forest regression models.
5. Evaluate the models and compare their respective scores like R2, RMSE, etc. Dataset link: https://www.kaggle.com/datasets/yasserh/uber-fares-dataset

```
1 #Importing the required libraries
2 import pandas as pd
3 import numpy as np
4 import seaborn as sns
5 import matplotlib.pyplot as plt
```

```
1 #importing the dataset
2 df  = pd.read_csv("uber.csv")
```

1. Pre-process the dataset.

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	Unnamed: 0	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_long
0	24238194	2015-05-07 19:52:06.0000003	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.9
1	27835199	2009-07-17 20:04:56.0000002	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.9
2	44984355	2009-08-24 21:45:00.00000061	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.9
3	25894730	2009-06-26 08:22:21.0000001	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.9
4	17610152	2014-08-28 17:47:00.000000188	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.9

```
1 df.info() #To get the required information of the dataset
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 35725 entries, 0 to 35724
Data columns (total 9 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Unnamed: 0         35725 non-null  int64
 1   key                35725 non-null  object
```

```
 2   fare_amount        35725 non-null  float64
 3   pickup_datetime    35725 non-null  object
 4   pickup_longitude   35724 non-null  float64
 5   pickup_latitude    35724 non-null  float64
 6   dropoff_longitude  35724 non-null  float64
 7   dropoff_latitude   35724 non-null  float64
 8   passenger_count    35724 non-null  float64
dtypes: float64(6), int64(1), object(2)
memory usage: 2.5+ MB
```

```
1 df.columns #TO get number of columns in the dataset
```

```
Index(['Unnamed: 0', 'key', 'fare_amount', 'pickup_datetime',
       'pickup_longitude', 'pickup_latitude', 'dropoff_longitude',
       'dropoff_latitude', 'passenger_count'],
      dtype='object')
```

```
1 df = df.drop(['Unnamed: 0', 'key'], axis= 1) #To drop unnamed column as it isn't required
```

```
1 df.head()
```

	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	pass
0	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	40.723217	
1	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	40.750325	
		2009-08-24	-74.005043	40.740770	-73.962565	40.772647	

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```
1 df.shape #To get the total (Rows,Columns)
```

```
(35725, 7)
```

```
1 df.dtypes #To get the type of each column
```

```
fare_amount          float64
pickup_datetime       object
pickup_longitude     float64
pickup_latitude      float64
dropoff_longitude    float64
dropoff_latitude     float64
passenger_count      float64
dtype: object
```

```
1 df.info()
2
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 35725 entries, 0 to 35724
Data columns (total 7 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   fare_amount        35725 non-null  float64
 1   pickup_datetime    35725 non-null  object
 2   pickup_longitude   35724 non-null  float64
```

```
 3   pickup_latitude    35724 non-null  float64
 4   dropoff_longitude  35724 non-null  float64
 5   dropoff_latitude   35724 non-null  float64
 6   passenger_count    35724 non-null  float64
dtypes: float64(6), object(1)
memory usage: 1.9+ MB
```

```
1 df.describe() #To get statistics of each columns
```

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
count	35725.000000	35724.000000	35724.000000	35724.000000	35724.000000	35724.000000
mean	11.394681	-72.561212	39.942645	-72.572503	39.943957	1.677024
std	10.085005	10.911110	6.047059	10.852786	6.043435	1.294493
min	0.000000	-748.016667	-74.015515	-737.916665	-74.008745	0.000000
25%	6.000000	-73.992033	40.734753	-73.991475	40.733846	1.000000
50%	8.500000	-73.981821	40.752563	-73.980170	40.752855	1.000000
75%	12.900000	-73.967196	40.767152	-73.963545	40.768076	2.000000
max	350.000000	40.774042	45.031653	40.828377	45.031598	6.000000

Filling Missing values

```
1 df.isnull().sum()
```

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```
pickup_datetime      0
pickup_longitude     1
pickup_latitude      1
dropoff_longitude    1
dropoff_latitude     1
passenger_count      1
dtype: int64
```

```
1 # passengger_count has null value so replace it with mean or median value
2 df['passenger_count'].fillna(value=df['passenger_count'].mean(),inplace = True)
3 df['pickup_longitude'].fillna(value=df['pickup_longitude'].mean(),inplace = True)
4 df['pickup_latitude'].fillna(value=df['pickup_latitude'].mean(),inplace = True)
5 df['dropoff_longitude'].fillna(value=df['dropoff_longitude'].mean(),inplace = True)
6 df['dropoff_latitude'].fillna(value=df['dropoff_latitude'].mean(),inplace = True)
7
8
9
```

```
1 df.isnull().sum()
```

```
fare_amount          0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     0
passenger_count      0
dtype: int64
```

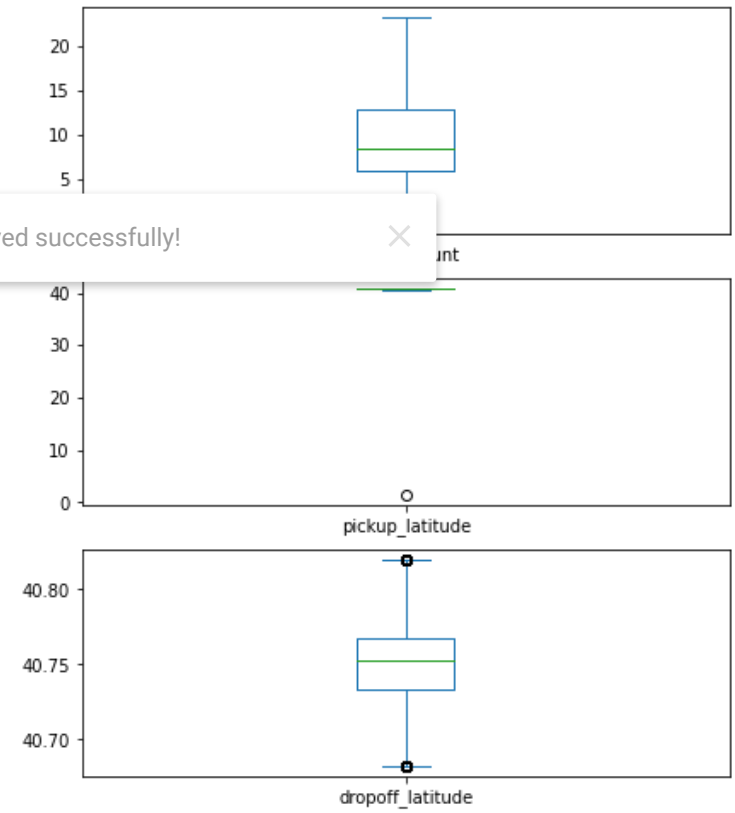
```
1 df.dtypes
```

```
fare_amount          float64
pickup_longitude     float64
pickup_latitude      float64
dropoff_longitude    float64
dropoff_latitude     float64
passenger_count      float64
dtype: object
```

Checking outliers and filling them

```
1 df.plot(kind = "box",subplots = True,layout = (7,2),figsize=(15,20)) #Boxplot to check the outliers
```

```
fare_amount            AxesSubplot(0.125,0.787927;0.352273x0.0920732)
pickup_longitude     AxesSubplot(0.547727,0.787927;0.352273x0.0920732)
pickup_latitude        AxesSubplot(0.125,0.677439;0.352273x0.0920732)
dropoff_longitude    AxesSubplot(0.547727,0.677439;0.352273x0.0920732)
dropoff_latitude       AxesSubplot(0.125,0.566951;0.352273x0.0920732)
passenger_count      AxesSubplot(0.547727,0.566951;0.352273x0.0920732)
dtype: object
```



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```
1 #Using the InterQuartile Range to fill the values
2 def remove_outlier(df1 , col):
3     Q1 = df1[col].quantile(0.25)
4     Q3 = df1[col].quantile(0.75)
5     IQR = Q3 - Q1
6     lower_whisker = Q1-1.5*IQR
7     upper_whisker = Q3+1.5*IQR
8     df[col] = np.clip(df1[col] , lower_whisker , upper_whisker)
```

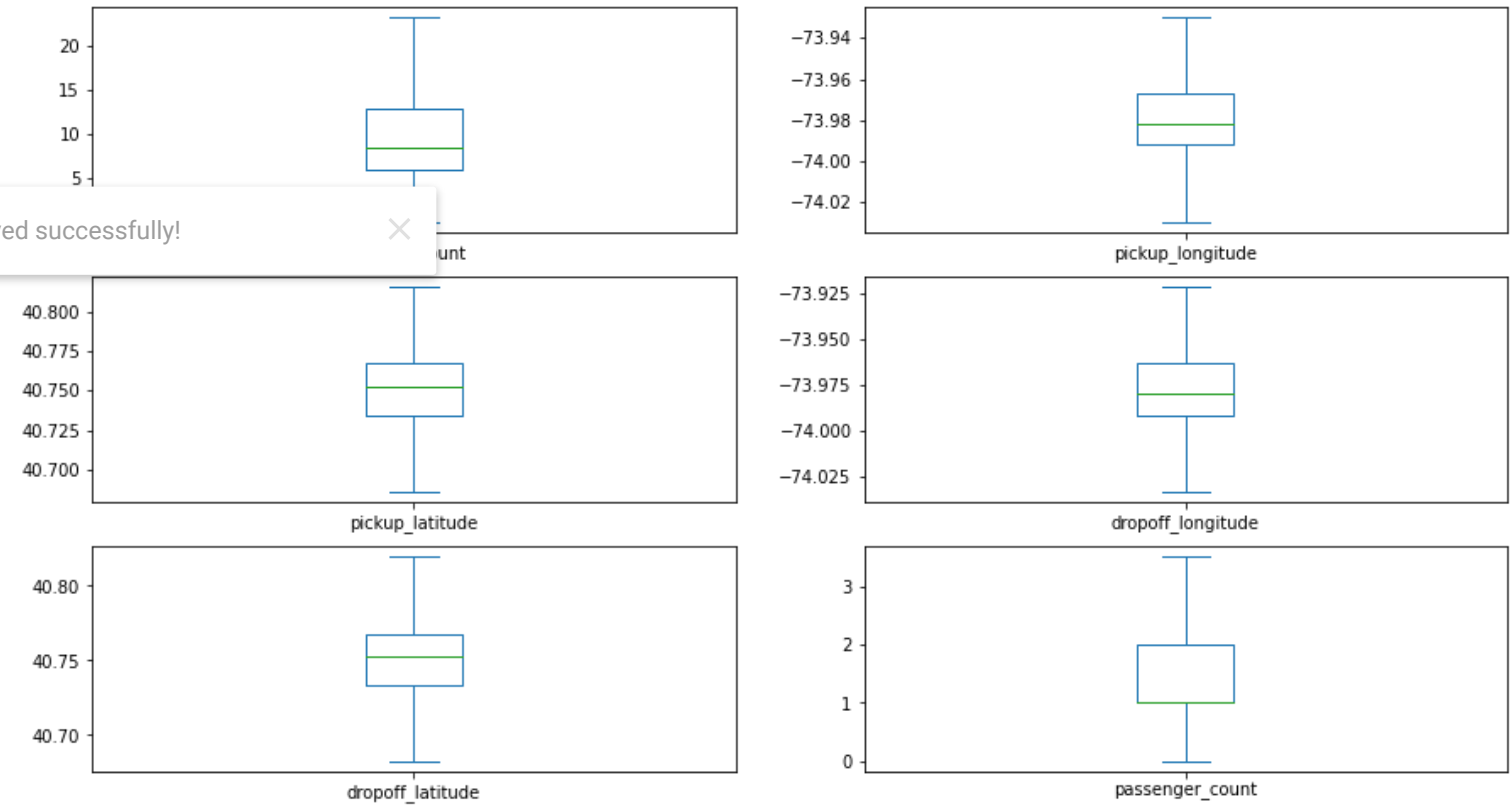
```
    return df1

def treat_outliers_all(df1 , col_list):
    for c in col_list:
        df1 = remove_outlier(df , c)
    return df1
```

```
df = treat_outliers_all(df , df.iloc[: , 0::])
```

```
df.plot(kind = "box",subplots = True,layout = (7,2),figsize=(15,20)) #Boxplot shows that dataset is free from ou
```

```
fare_amount            AxesSubplot(0.125,0.787927;0.352273x0.0920732)
pickup_longitude     AxesSubplot(0.547727,0.787927;0.352273x0.0920732)
pickup_latitude        AxesSubplot(0.125,0.677439;0.352273x0.0920732)
dropoff_longitude    AxesSubplot(0.547727,0.677439;0.352273x0.0920732)
dropoff_latitude       AxesSubplot(0.125,0.566951;0.352273x0.0920732)
passenger_count      AxesSubplot(0.547727,0.566951;0.352273x0.0920732)
dtype: object
```



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```
df.head()
```

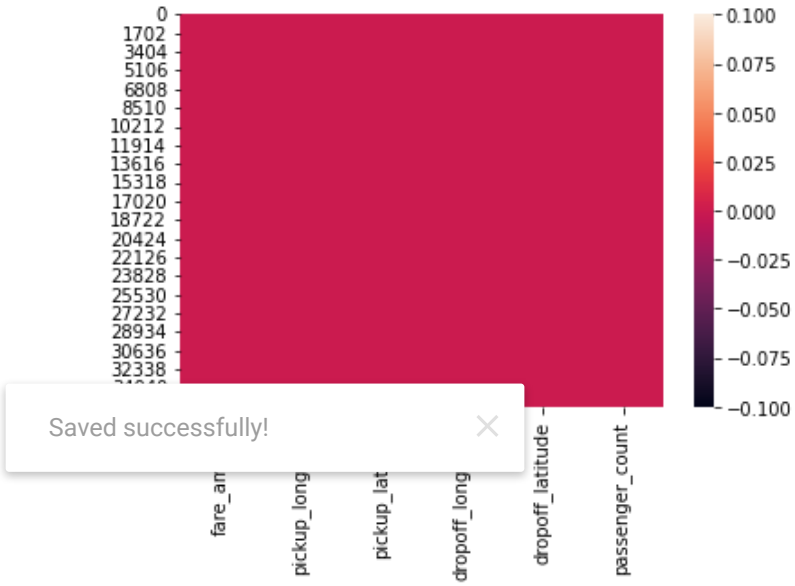
	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1.0
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1.0

```
1 df.isnull().sum()
```

```
fare_amount          0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     0
passenger_count      0
dtype: int64
```

```
1 sns.heatmap(df.isnull()) #Free for null values
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f67a5f81e90>
```



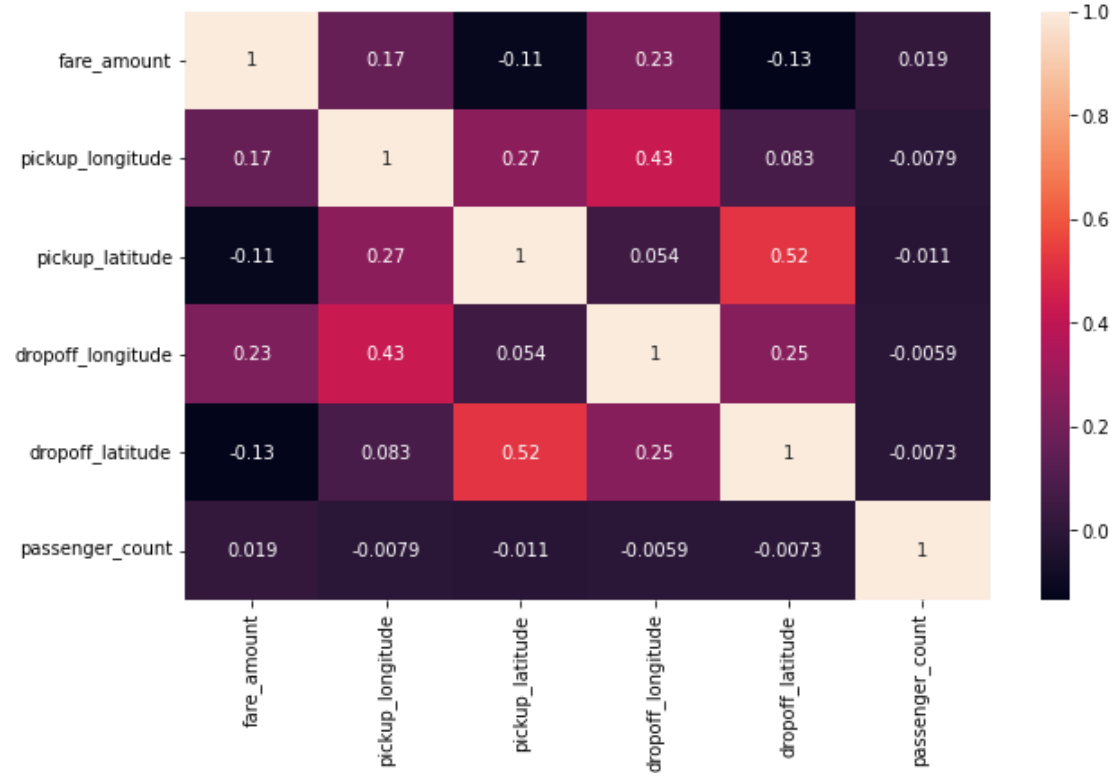

```
1 corr = df.corr() #Function to find the correlation
```

```
1 corr
```

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passen
fare_amount	1.000000	0.167049	-0.114343	0.228189	-0.133700	
pickup_longitude	0.167049	1.000000	0.268243	0.428222	0.083235	
pickup_latitude	-0.114343	0.268243	1.000000	0.053571	0.520707	
dropoff_longitude	0.228189	0.428222	0.053571	1.000000	0.249985	
dropoff_latitude	-0.133700	0.083235	0.520707	0.249985	1.000000	
passenger_count	0.018673	-0.007946	-0.011390	-0.005916	-0.007331	

```
1 fig,axis = plt.subplots(figsize = (10,6))
2 sns.heatmap(df.corr(),annot = True) #Correlation Heatmap (Light values means highly correlated)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f67a5ec4a50>
```



Dividing the dataset into feature and target values

```
1 df.isnull().sum()
```

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```
pickup_latitude     0
dropoff_longitude   0
dropoff_latitude    0
passenger_count     0
dtype: int64
```

```
1 X = df.iloc[:, :-1].values
2 y = df.iloc[:, -1].values
3
4 #x = df[['pickup_longitude','pickup_latitude','dropoff_longitude','dropoff_latitude','passenger_count','hour','d
```

```
1 #y = df['fare_amount']
```

Dividing the dataset into training and testing dataset

```
1 from sklearn.model_selection import train_test_split
2 X_train,X_test,y_train,y_test = train_test_split(X,y,test_size = 0.30)
```

```
1 X_train
```

```
array([[  6.9      , -73.976309 ,  40.755542 , -73.999377 ,  40.76129  ],
       [  6.       , -73.962055 ,  40.776427 , -73.952213 ,  40.787342 ],
       [ 18.5      , -74.002847 ,  40.723358 , -73.975907 ,  40.75785  ],
       ...,
```

```
[ 11.5      , -73.951395 ,  40.770132 , -73.976775 ,  40.78026  ],
[ 10.5      , -73.971915 ,  40.757187 , -73.992037 ,  40.74269  ],
[ 23.25     , -73.9299405,  40.77417  , -73.979281 ,  40.762337 ]])
```

Linear Regression

```
1 from sklearn.linear_model import LinearRegression
2 regression = LinearRegression()
```

```
1 regression.fit(X_train,y_train)
```

```
LinearRegression()
```

```
1 regression.intercept_ #To find the linear intercept
```

```
-36.99163580975869
```

```
1 regression.coef_ #To find the linear coeeficient
```

```
array([ 0.00279521, -0.42759057, -0.27323316, -0.26854322, -0.04632836])
```

```
1 prediction = regression.predict(X_test) #To predict the target values
```

```
1 print(prediction)
```

```
57 ... 1.52928663 1.49801616 1.51254106]
```

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```
1 y_test
```

```
array([1., 1., 1., ..., 1., 1., 1.])
```

Metrics Evaluation using R2, Mean Squared Error, Root Mean Sqared Error

```
1 from sklearn.metrics import r2_score
```

```
1 r2_score(y_test,prediction)
```

```
0.0003531071428344301
```

```
1 from sklearn.metrics import mean_squared_error
```

```
1 MSE = mean_squared_error(y_test,prediction)
```

```
1 MSE
```

```
0.7587261028954677
```

```
1 RMSE = np.sqrt(MSE)
```

```
1 RMSE
```

```
0.8710488521865279
```

Random Forest Regression

```
1 from sklearn.ensemble import RandomForestRegressor
```

```
1 rf = RandomForestRegressor(n_estimators=100) #Here n_estimators means number of trees you want to build before m
```

```
1 rf.fit(X_train,y_train)
```

```
RandomForestRegressor()
```

```
1 y_pred = rf.predict(X_test)
```

```
1 y_pred
```

```
array([1.46      , 1.615     , 1.38      , ..., 1.64290476, 1.455     ,
       1.615     ])
```

Metrics evaluatin for Random Forest

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```
d)
```

```
1 R2_Random
```

```
-0.06550647590096692
```

```
1 MSE_Random = mean_squared_error(y_test,y_pred)
```

```
1 MSE_Random
```

```
0.8087131384559171
```

```
1 RMSE_Random = np.sqrt(MSE_Random)
```

```
1 RMSE_Random
```

```
0.8992847927413857
```

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