



॥ न हि ज्ञानेन सद्शं पवित्रमिह विद्यते ॥

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### Practical No 1

- 1) 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]: import pandas as pd
import numpy as np
from sklearn.linear_model import LinearRegression
from sklearn.ensemble import RandomForestRegressor
from sklearn import metrics
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
import warnings
import seaborn as sns
import matplotlib.pyplot as plt
from matplotlib.cbook import boxplot_stats
import plotly.express as px
from geopy import Point, distance
from math import *
warnings.filterwarnings("ignore")
```



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```
[2]: df = pd.read_csv("F:/11 ANJALI VILAD COLLEGE/11 Prof Anjali Phaltane/MACHINE LEARNING/ML LAB LP-III/LP-III ML CODE/PRACTICAL 1/uber.csv")
```

```
[3]: df.head()
```

[3]:	Unnamed: 0	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
0	24238194	2015-05-07 19:52:06.0000003	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	40.723217	1
1	27835199	2009-07-17 20:04:56.0000002	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	40.750325	1
2	44984355	2009-08-24 21:45:00.00000061	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.962565	40.772647	1
3	25894730	2009-06-26 08:22:21.0000001	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.965316	40.803349	3
4	17610152	2014-08-28 17:47:00.000000188	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.973082	40.761247	5

```
[4]: df = df.drop(["Unnamed: 0", "key"], axis=1)
```

```
[5]: df.head()
```

[5]:	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
0	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	40.723217	1
1	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	40.750325	1
2	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.962565	40.772647	1
3	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.965316	40.803349	3
4	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.973082	40.761247	5

[ ]:

```
[6]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200000 entries, 0 to 199999
Data columns (total 7 columns):
 #   Column           Non-Null Count  Dtype  
 ---  -- 
 0   fare_amount      200000 non-null  float64
 1   pickup_datetime  200000 non-null  object 
 2   pickup_longitude 200000 non-null  float64
 3   pickup_latitude   200000 non-null  float64
 4   dropoff_longitude 199999 non-null  float64
 5   dropoff_latitude  199999 non-null  float64
 6   passenger_count   200000 non-null  int64 
dtypes: float64(5), int64(1), object(1)
memory usage: 10.7+ MB
```

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```
[7]: df["pickup_datetime"] = pd.to_datetime(df["pickup_datetime"], errors="coerce")
```

```
[8]: df.describe().T
```

	count	mean	std	min	25%	50%	75%	max
fare_amount	200000.0	11.359955	9.901776	-52.000000	6.000000	8.500000	12.500000	499.000000
pickup_longitude	200000.0	-72.527638	11.437787	-1340.648410	-73.992065	-73.981823	-73.967154	57.418457
pickup_latitude	200000.0	39.935885	7.720539	-74.015515	40.734796	40.752592	40.767158	1644.421482
dropoff_longitude	199999.0	-72.525292	13.117408	-3356.666300	-73.991407	-73.980093	-73.963658	1153.572603
dropoff_latitude	199999.0	39.923890	6.794829	-881.985513	40.733823	40.753042	40.768001	872.697628
passenger_count	200000.0	1.684535	1.385997	0.000000	1.000000	1.000000	2.000000	208.000000

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```
[9]:
```

```
df.isna().sum()
```

```
[9]: fare_amount      0
pickup_datetime     0
pickup_longitude    0
pickup_latitude     0
dropoff_longitude   1
dropoff_latitude    1
passenger_count     0
dtype: int64
```

```
[ ]:
```

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```
[10]: df = df.dropna()
```

```
[13]: def distance_transform(longitude1, latitude1, longitude2, latitude2):
        distance = []
        for pos in range(len(longitude1)):
            long1,lat1,long2,lat2 = map(radians,[longitude1[pos],latitude1[pos],longitude2[pos],latitude2[pos]])
            dist_long = long2 - long1
            dist_lat = lat2 - lat1
            a = sin(dist_lati/2)**2 + cos(lat1) * cos(lat2) * sin(dist_long/2)**2
            c = 2 * asin(sqrt(a))*6371
            distance.append(c)
        return distance
    df["distance_km"] = distance_transform(df["pickup_longitude"].to_numpy(), df["pickup_latitude"].to_numpy(),
                                            df["dropoff_longitude"].to_numpy(), df["dropoff_latitude"].to_numpy())
    df = df.assign(pickup_hr = df.pickup_datetime.dt.hour,
                  day= df.pickup_datetime.dt.day,
                  month = df.pickup_datetime.dt.month,
                  year = df.pickup_datetime.dt.year,
                  day_of_week = df.pickup_datetime.dt.dayofweek,
                  day_name=df.pickup_datetime.dt.day_name())
df.head()
```

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[13]:	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	pickup_hr	day	month	year	day_of_week
0	7.5	2015-05-07 19:52:06+00:00	-73.999817	40.738354	-73.999512	40.723217	1	19	7	5	2015	3
1	7.7	2009-07-17 20:04:56+00:00	-73.994355	40.728225	-73.994710	40.750325	1	20	17	7	2009	4
2	12.9	2009-08-24 21:45:00+00:00	-74.005043	40.740770	-73.962565	40.772647	1	21	24	8	2009	0
3	5.3	2009-06-26 08:22:21+00:00	-73.976124	40.790844	-73.965316	40.803349	3	8	26	6	2009	4
4	16.0	2014-08-28 17:47:00+00:00	-73.925023	40.744085	-73.973082	40.761247	5	17	28	8	2014	3

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```
[14]: def find_outliers(df):
    q1 = df.quantile(0.25)
    q3 = df.quantile(0.75)
    IQR = q3-q1
    outliers = df[((df<(q1-1.5*IQR)) | (df>(q3+1.5*IQR)))]
    return outliers
outliers = find_outliers(df['fare_amount'])
print('number of outliers:' + str(len(outliers)))
print('max outlier value:' + str(outliers.max()))
print('min outlier value:' + str(outliers.min()))
outliers
```

number of outliers:17166  
max outlier value:499.0  
min outlier value:-52.0

```
[14]: 6      24.50
30     25.70
34     39.50
39     29.00
48     56.80
...
199976 49.70
199977 43.50
199982 57.33
199985 24.00
199997 30.90
Name: fare_amount, Length: 17166, dtype: float64
```

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```
[15]: outliers = find_outliers(df['passenger_count'])
print('number of outliers:' + str(len(outliers)))
print('max outlier value:' + str(outliers.max()))
print('min outlier value:' + str(outliers.min()))
outliers
```

```
number of outliers:22557
max outlier value:208
min outlier value:4
[15]:   4      5
       6      5
      12      5
      24      5
      29      5
      ..
199958      5
199959      5
199962      4
199969      5
199985      5
```

Name: passenger\_count, Length: 22557, dtype: int64

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[ ]:

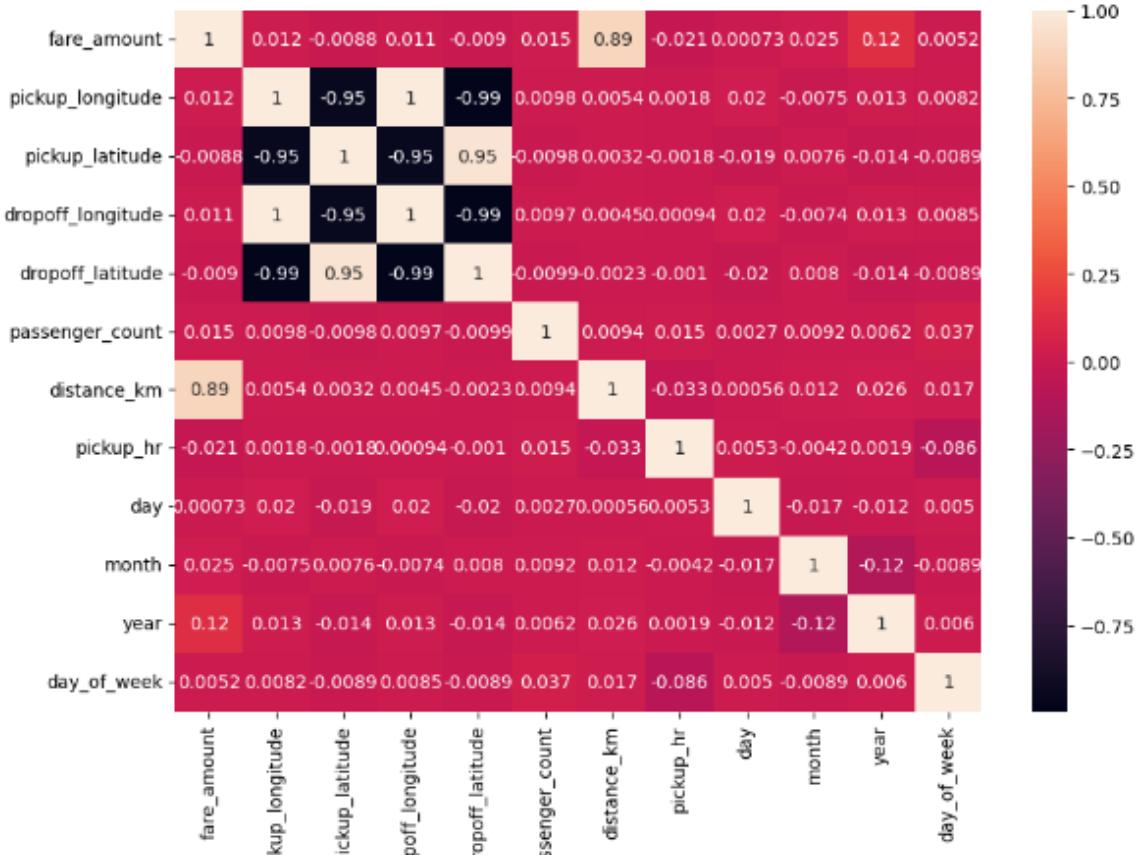
```
[19]: df.drop(df[df['distance_km'] == 0].index, inplace = True)
df.drop(df[df['distance_km'] > 60].index, inplace = True)
df.drop(df[df['fare_amount'] > 100].index, inplace = True)
df.drop(df[df['fare_amount'] < 0].index, inplace = True)
df.drop(df[df['passenger_count'] > 6].index, inplace = True)
plt.figure(figsize=(10,7))
sns.heatmap(df.corr(), annot=True)
plt.show()
plt.figure(figsize=(10,7))
sns.heatmap(df.corr(), annot=True)
plt.show()
```



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```
In [55]: x = df[["year", "distance_km"]]
y = df["fare_amount"]

In [57]: scaler = StandardScaler()

In [59]: x = scaler.fit_transform(x)

In [63]: x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3, random_state=42)

In [64]: model = LinearRegression()
model.fit(x_train, y_train)

Out[64]: LinearRegression()
In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.
```



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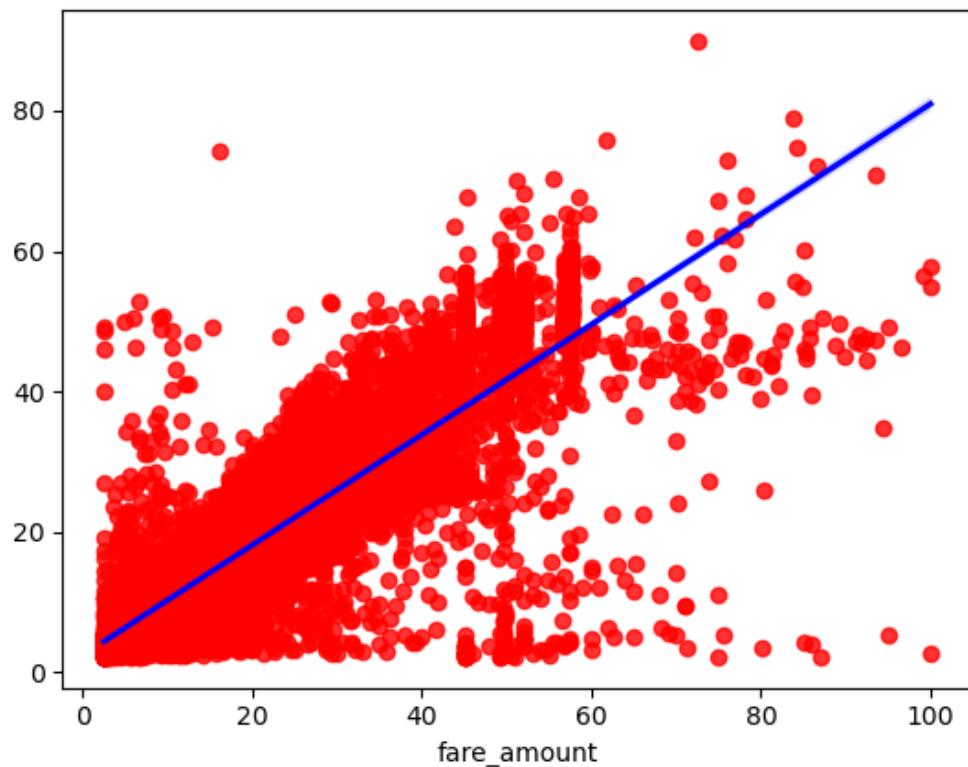


In [65]:

```
y_pred = model.predict(x_test)
```

In [70]:

```
sns.regplot(x=y_test, y=y_pred, color="red", line_kws={"color" : "blue"})
plt.show()
```





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In [71]:

```
print(f"Mean absolute error {metrics.mean_absolute_error(y_test, y_pred)}")
print(f"Mean squared error {metrics.mean_squared_error(y_test, y_pred)}")
print(f"Root mean squared error {np.sqrt(metrics.mean_squared_error(y_test, y_pred))}")
```

```
Mean absolute error 2.243879503459476
Mean squared error 18.32381910645457
Root mean squared error 4.280633026370582
```

In [72]:

```
model = RandomForestRegressor()
model.fit(x_train, y_train)
```

Out[72]: RandomForestRegressor()

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.  
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [73]:

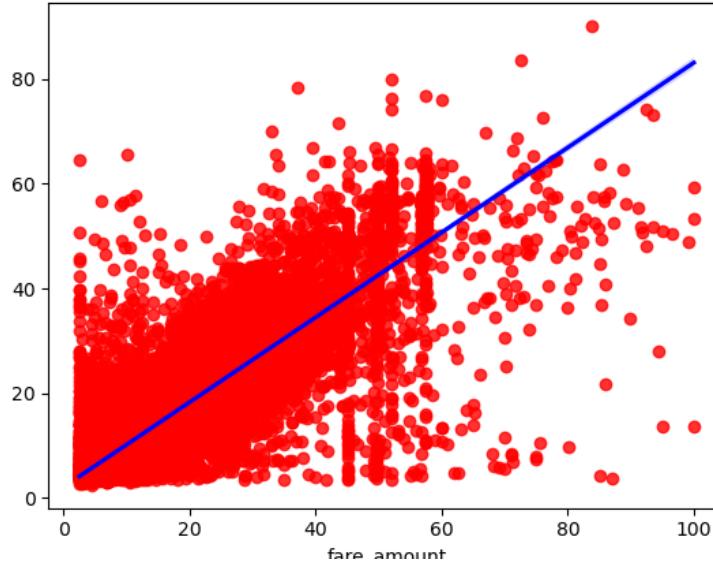
```
y_pred = model.predict(x_test)
```

In [74]:

```
sns.regplot(x=y_test, y=y_pred, color="red", line_kws={"color" : "blue"})
plt.show()
```

In [74]:

```
sns.regplot(x=y_test, y=y_pred, color="red", line_kws={"color" : "blue"})
plt.show()
```



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In [75]:

```
print(f"Mean absolute error {metrics.mean_absolute_error(y_test, y_pred)}")
print(f"Mean squared error {metrics.mean_squared_error(y_test, y_pred)}")
print(f"Root mean squared error {np.sqrt(metrics.mean_squared_error(y_test, y_pred))}")
```

```
Mean absolute error 2.500337233122361
Mean squared error 21.283639254402114
Root mean squared error 4.613419475226821
```