```
import pandas as pd
import numpy as np
import plotly.express as px
data = pd.read_csv("C:\\Users\\s###l\\OneDrive\\Desktop\\Documents\\Project\\machine learning\\deliverytime.txt")
print(data.head())
```

```
ID Delivery_person_ID  Delivery_person_Age  Delivery_person_Ratings  \
0  4607     INDORES13DEL02                 37                      4.9
1  B379     BANGRES18DEL02                 34                      4.5
2  5D6D     BANGRES19DEL01                 23                      4.4
3  7A6A    COIMBRES13DEL02                 38                      4.7
4  70A2     CHENRES12DEL01                 32                      4.6

   Restaurant_latitude  Restaurant_longitude  Delivery_location_latitude  \
0            22.745049             75.892471                   22.765049
1            12.913041             77.683237                   13.043041
2            12.914264             77.678400                   12.924264
3            11.003669             76.976494                   11.053669
4            12.972793             80.249982                   13.012793

   Delivery_location_longitude Type_of_order Type_of_vehicle  Time_taken(min)
0                    75.912471        Snack      motorcycle                24
1                    77.813237        Snack         scooter                33
2                    77.688400       Drinks      motorcycle                26
3                    77.026494       Buffet      motorcycle                21
4                    80.289982        Snack         scooter                30
```

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 45593 entries, 0 to 45592
Data columns (total 11 columns):
 #   Column                       Non-Null Count  Dtype
---  ------                       --------------  -----
 0   ID                           45593 non-null  object
 1   Delivery_person_ID           45593 non-null  object
 2   Delivery_person_Age          45593 non-null  int64
 3   Delivery_person_Ratings      45593 non-null  float64
 4   Restaurant_latitude          45593 non-null  float64
 5   Restaurant_longitude         45593 non-null  float64
 6   Delivery_location_latitude   45593 non-null  float64
 7   Delivery_location_longitude  45593 non-null  float64
 8   Type_of_order                45593 non-null  object
 9   Type_of_vehicle              45593 non-null  object
 10  Time_taken(min)              45593 non-null  int64
dtypes: float64(5), int64(2), object(4)
memory usage: 3.8+ MB
```

```
data.isnull().sum()
```

```
ID                          0
Delivery_person_ID          0
Delivery_person_Age         0
Delivery_person_Ratings     0
Restaurant_latitude         0
Restaurant_longitude        0
Delivery_location_latitude  0
Delivery_location_longitude 0
Type_of_order               0
Type_of_vehicle             0
Time_taken(min)             0
```

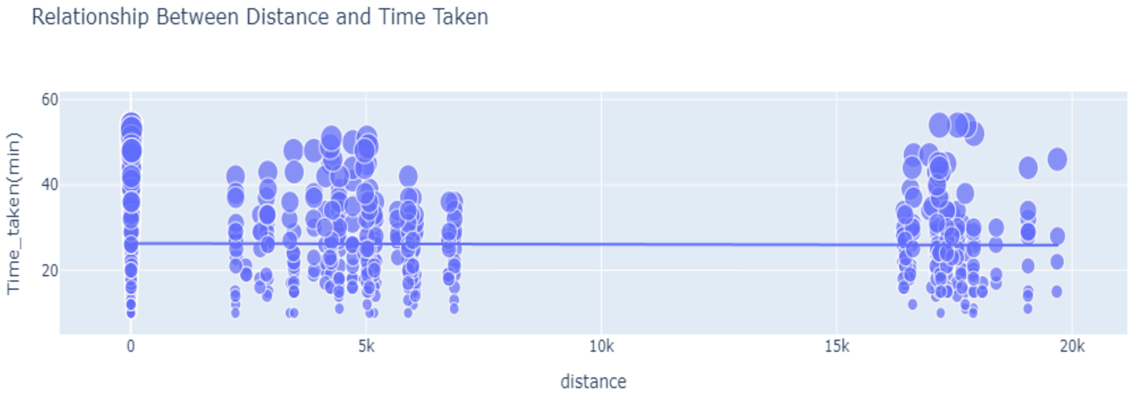
```
# Set the earth's radius (in kilometers)
R = 6371

# Convert degrees to radians
def deg_to_rad(degrees):
  return degrees * (np.pi/180)

# Function to calculate the distance between two points using the haversine formula
def distcalculate(lat1, lon1, lat2, lon2):
  d_lat = deg_to_rad(lat2-lat1)
  d_lon = deg_to_rad(lon2-lon1)
  a = np.sin(d_lat/2)**2 + np.cos(deg_to_rad(lat1)) * np.cos(deg_to_rad(lat2)) * np.sin(d_lon/2)**2
  c = 2 * np.arctan2(np.sqrt(a), np.sqrt(1-a))
  return R * c

# Calculate the distance between each pair of points
data['distance'] = np.nan

for i in range(len(data)):
  data.loc[i, 'distance'] = distcalculate(data.loc[i, 'Restaurant_latitude'],
                                          data.loc[i, 'Restaurant_longitude'],
                                          data.loc[i, 'Delivery_location_latitude'],
                                          data.loc[i, 'Delivery_location_longitude'])
print(data.head())
```

```
ID Delivery_person_ID  Delivery_person_Age  Delivery_person_Ratings  \
0  4607     INDORES13DEL02                   37                      4.9
1  B379     BANGRES18DEL02                   34                      4.5
2  5D6D     BANGRES19DEL01                   23                      4.4
3  7A6A    COIMBRES13DEL02                   38                      4.7
4  70A2     CHENRES12DEL01                   32                      4.6

   Restaurant_latitude  Restaurant_longitude  Delivery_location_latitude  \
0            22.745049             75.892471                   22.765049
```

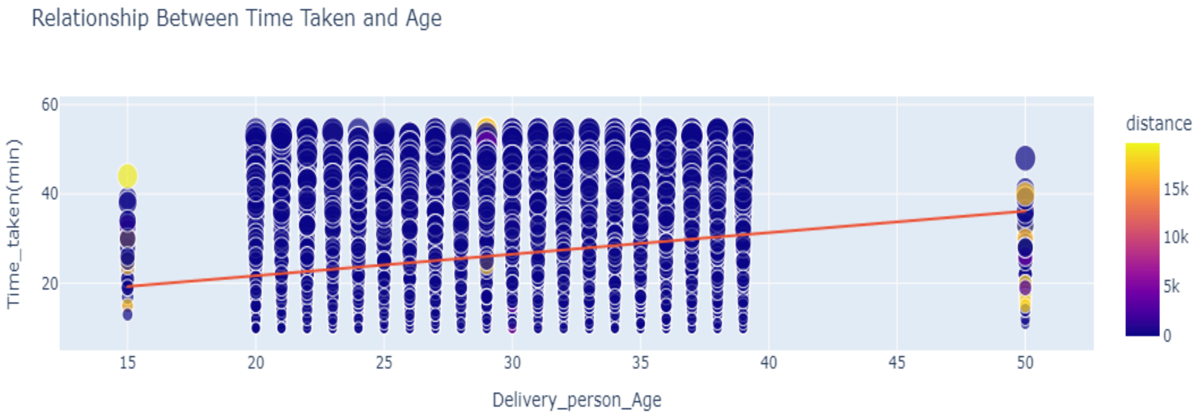
```
1        12.913041         77.683237                 13.043041
2        12.914264         77.678400                 12.924264
3        11.003669         76.976494                 11.053669
4        12.972793         80.249982                 13.012793

  Delivery_location_longitude Type_of_order Type_of_vehicle  Time_taken(min)  \
0                   75.912471       Snack      motorcycle               24
1                   77.813237       Snack         scooter               33
2                   77.688400      Drinks      motorcycle               26
3                   77.026494      Buffet      motorcycle               21
4                   80.289982       Snack         scooter               30

    distance
0   3.025149
1  20.183530
2   1.552758
3   7.790401
4   6.210138
```

Data Exploration

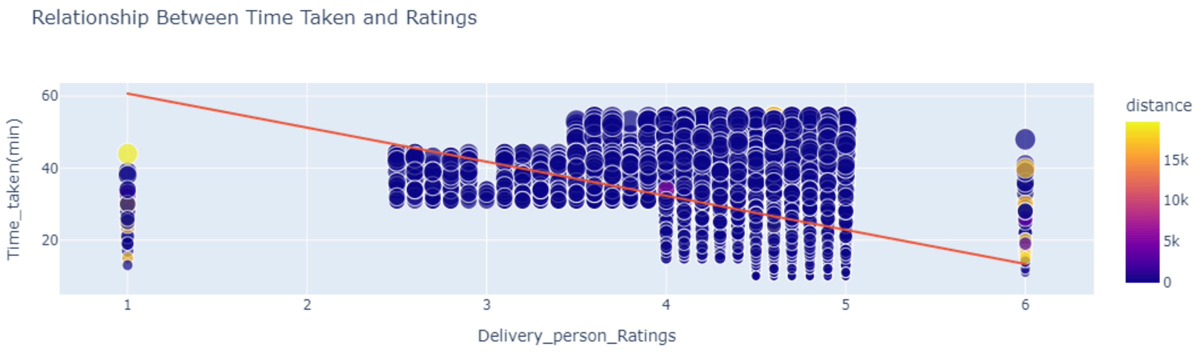
```
# Relationship between the distance and time taken to deliver the food

figure = px.scatter(data_frame = data,
                    x="distance",
                    y="Time_taken(min)",
                    size="Time_taken(min)",
                    trendline="ols",
                    title = "Relationship Between Distance and Time Taken")
figure.show()
```



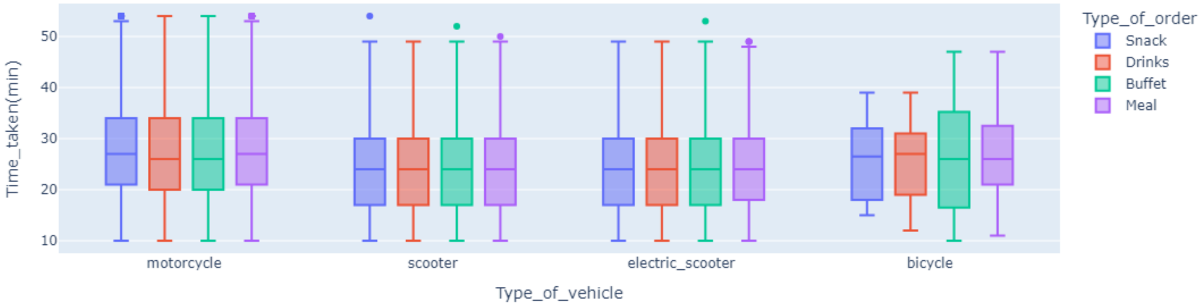
```
#relationship between the time taken to deliver the food and the age of the delivery partner

figure = px.scatter(data_frame = data,
                    x="Delivery_person_Age",
                    y="Time_taken(min)",
                    size="Time_taken(min)",
                    color = "distance",
                    trendline="ols",
                    title = "Relationship Between Time Taken and Age")
figure.show()
```



```
# relationship between the time taken to deliver the food and the ratings of the delivery partner

figure = px.scatter(data_frame = data,
                    x="Delivery_person_Ratings",
                    y="Time_taken(min)",
                    size="Time_taken(min)",
                    color = "distance",
                    trendline="ols",
                    title = "Relationship Between Time Taken and Ratings")
figure.show()
```



```
# type of food ordered by the customer and the type of vehicle used by the delivery partner
affects the delivery time or not

fig = px.box(data,
             x="Type_of_vehicle",
             y="Time_taken(min)",
             color="Type_of_order")
fig.show()
```



Food Delivery Time Prediction Model

Machine Learning model using an LSTM neural network model for the task of food delivery time prediction

```
#splitting data
from sklearn.model_selection import train_test_split
x = np.array(data[["Delivery_person_Age",
                   "Delivery_person_Ratings",
                   "distance"]])
y = np.array(data[["Time_taken(min)"]])
xtrain, xtest, ytrain, ytest = train_test_split(x, y,
                                                test_size=0.10,
                                                random_state=42)

# creating the LSTM neural network model
from keras.models import Sequential
from keras.layers import Dense, LSTM
model = Sequential()
model.add(LSTM(128, return_sequences=True, input_shape= (xtrain.shape[1], 1)))
model.add(LSTM(64, return_sequences=False))
model.add(Dense(25))
model.add(Dense(1))
model.summary()
```

```
Model: "sequential"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━┓
┃ Layer (type)                         ┃ Output Shape              ┃         Param # ┃
│ lstm (LSTM)                          │ (None, 3, 128)            │          66,560 │
├──────────────────────────────────────┼───────────────────────────┼─────────────────┤
│ lstm_1 (LSTM)                        │ (None, 64)                │          49,408 │
├──────────────────────────────────────┼───────────────────────────┼─────────────────┤
│ dense (Dense)                        │ (None, 25)                │           1,625 │
├──────────────────────────────────────┼───────────────────────────┼─────────────────┤
│ dense_1 (Dense)                      │ (None, 1)                 │              26 │
└──────────────────────────────────────┴───────────────────────────┴─────────────────┘

Total params: 117,619 (459.45 KB)

Trainable params: 117,619 (459.45 KB)

Non-trainable params: 0 (0.00 B)
```

```
# training the model
model.compile(optimizer='adam', loss='mean_squared_error')
model.fit(xtrain, ytrain, batch_size=1, epochs=9)
```

```
Epoch 1/9
41033/41033 ━━━━━━━━━━━━━━━━━━━━ 181s 4ms/step - loss: 75.4289
Epoch 2/9
41033/41033 ━━━━━━━━━━━━━━━━━━━━ 227s 6ms/step - loss: 64.1557
Epoch 3/9
41033/41033 ━━━━━━━━━━━━━━━━━━━━ 231s 5ms/step - loss: 62.9455
Epoch 4/9
41033/41033 ━━━━━━━━━━━━━━━━━━━━ 130s 3ms/step - loss: 60.2791
Epoch 5/9
41033/41033 ━━━━━━━━━━━━━━━━━━━━ 125s 3ms/step - loss: 60.3116
Epoch 6/9
41033/41033 ━━━━━━━━━━━━━━━━━━━━ 116s 3ms/step - loss: 59.7868
Epoch 7/9
41033/41033 ━━━━━━━━━━━━━━━━━━━━ 122s 3ms/step - loss: 59.9221
Epoch 8/9
41033/41033 ━━━━━━━━━━━━━━━━━━━━ 103s 3ms/step - loss: 59.1420
Epoch 9/9
41033/41033 ━━━━━━━━━━━━━━━━━━━━ 103s 3ms/step - loss: 59.5391

<keras.src.callbacks.history.History at 0x1f936d42350>
```

```
# testing the performance of the model by giving inputs to predict the food delivery time

print("Food Delivery Time Prediction")
a = int(input("Age of Delivery Partner: "))
b = float(input("Ratings of Previous Deliveries: "))
c = int(input("Total Distance: "))

features = np.array([[a, b, c]])
print("Predicted Delivery Time in Minutes = ", model.predict(features))
```

```
Food Delivery Time Prediction

Age of Delivery Partner:  25
Ratings of Previous Deliveries:  3
Total Distance:  5

1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 303ms/step
Predicted Delivery Time in Minutes =  [[41.020985]]
```

```
print("Food Delivery Time Prediction")
a = int(input("Age of Delivery Partner: "))
b = float(input("Ratings of Previous Deliveries: "))
c = int(input("Total Distance: "))

features = np.array([[a, b, c]])
print("Predicted Delivery Time in Minutes = ", model.predict(features))
```

```
Food Delivery Time Prediction

Age of Delivery Partner:  20
Ratings of Previous Deliveries:  4
Total Distance:  5

1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 17ms/step
Predicted Delivery Time in Minutes =  [[32.06838]]
```

```
print("Food Delivery Time Prediction")
a = int(input("Age of Delivery Partner: "))
b = float(input("Ratings of Previous Deliveries: "))
c = int(input("Total Distance: "))

features = np.array([[a, b, c]])
print("Predicted Delivery Time in Minutes = ", model.predict(features))
```

```
Food Delivery Time Prediction

Age of Delivery Partner:  35
Ratings of Previous Deliveries:  4
Total Distance:  15

1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 22ms/step
Predicted Delivery Time in Minutes =  [[38.81349]]
```