Optimizing Flight Booking Decisions through Machine Learning Price Predictions

1.INTRODUCTION

1.1 Overview

People who work frequently travel through flight will have better knowledge on
best discount and right time to buy the ticket. For the business purpose many
airline companies change prices according to the seasons or time duration. They
will increase the price when people travel more. Estimating the highest prices of
the airlines data for the route is collected with features such as Duration, Source,
Destination, Arrival and Departure. Features are taken from chosen data set and in
the price wherein the airline price ticket costs vary overtime. we have
implemented flight price prediction for users by using KNN, decision tree and
random forest algorithms. Random Forest shows the best accuracy of 80% f or
predicting the flight price. also, we have done correlation tests and metrics for the
statistical analysis

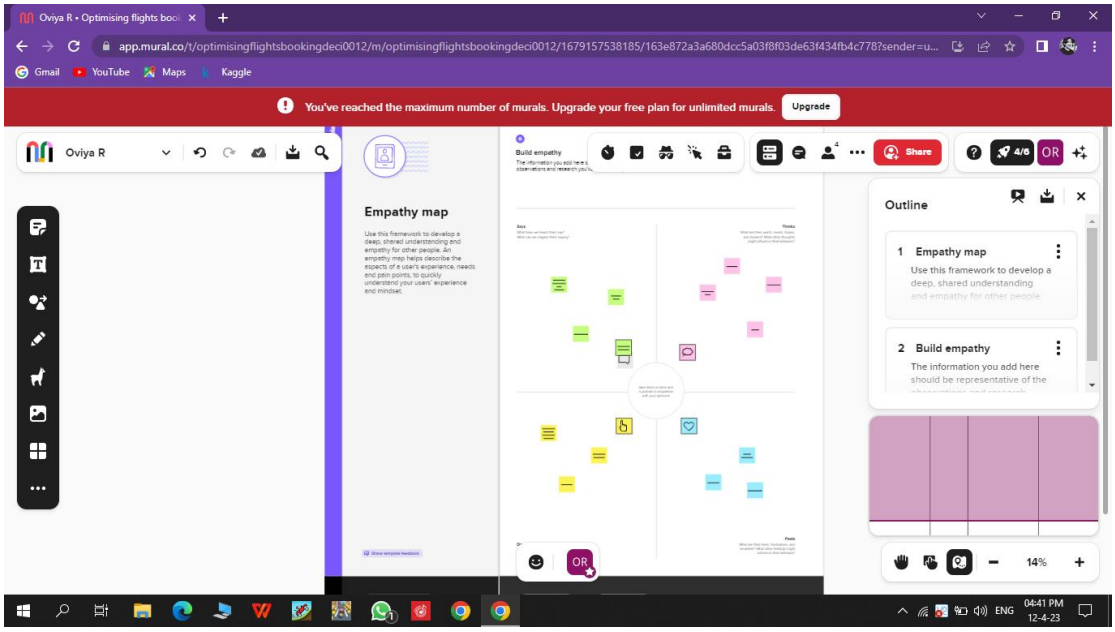
1.2 Purpose

• User interacts with the UI to enter the input. • Entered input is analysed by the
model which is integrated.
• Once model analyses the input the predicon is
showcased on the UI To accomplish this, we have to complete all the activities
listed below,

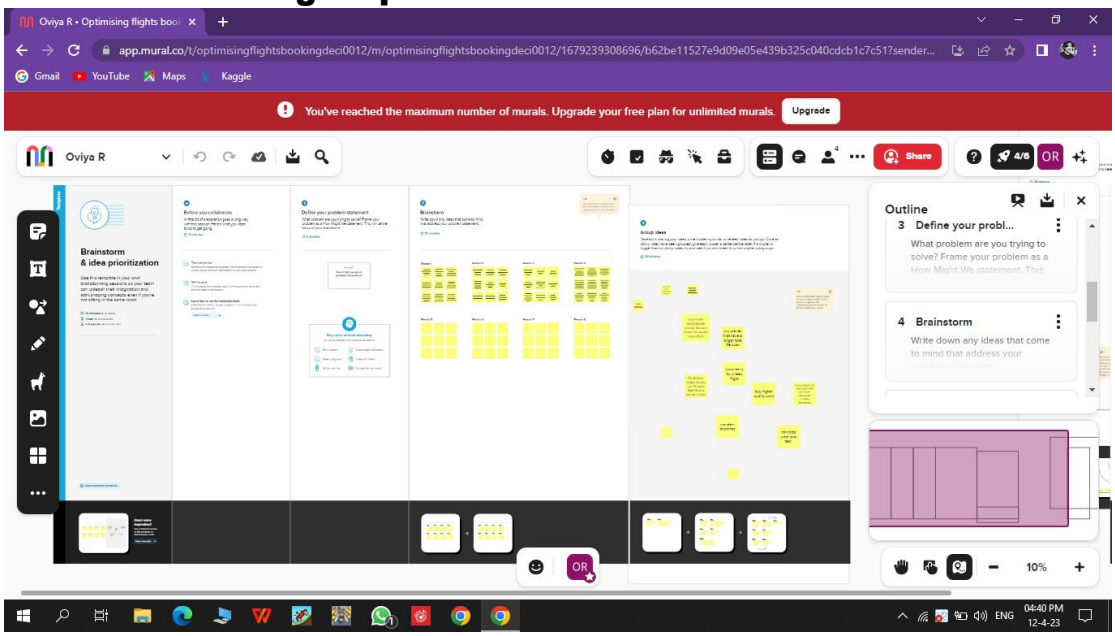
- **Defined Problem / Problem Understanding**
  - **Specify the business problem**
  - **Business requirements**
  - **Literature Survey**
  - **Social or Business Impact.**
- **Data Collection & Preparation**
  - **Collect the data set**
  - **Data Preparation**
- **Exploratory Data Analysis**
  - **Descriptive stustical**
  - **Visual Analysis**
- **Model Building**
  - **Training the model in multiple algorithms**
  - **Testing the model**
- **Performance Testing & Hyper parameter Tuning**
  - **Testing model with multiple evaluation metrics**
  - **Comparing model accuracy before & after applying Hyper parameter tuning**
- **Model Deployment**
  - **Save the best model**
  - **Integrate with Web Framework**
- **Project Demonstration & Documentation Record**

Problem Definition & Design Thinking

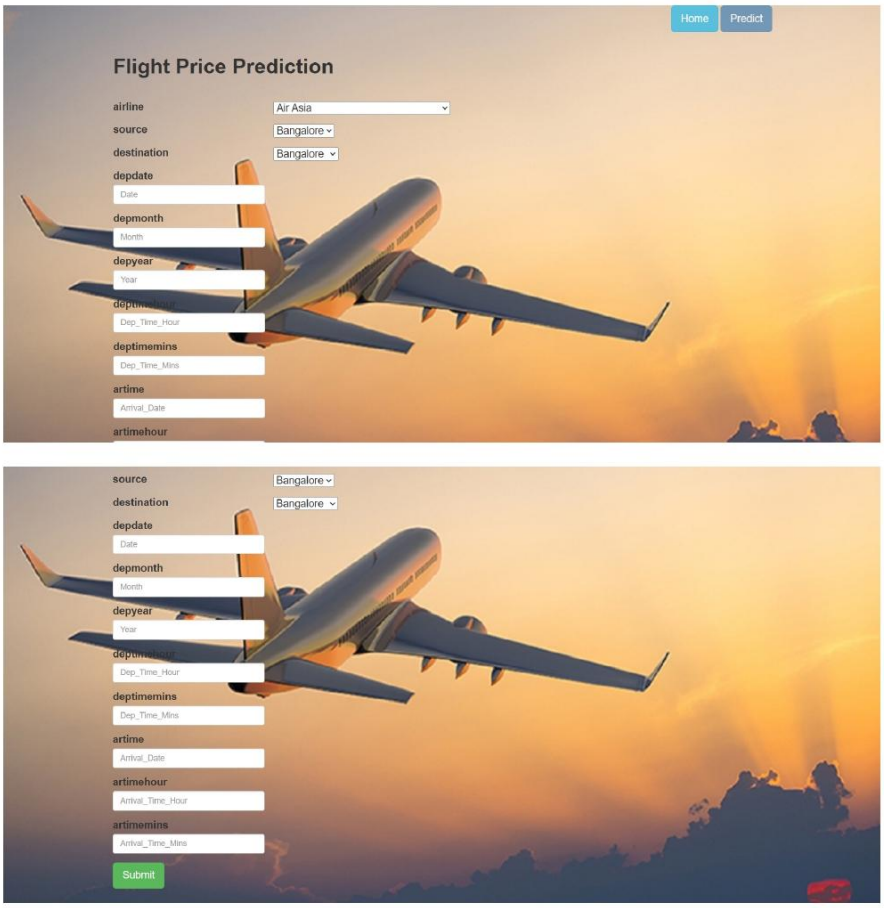
2.1 Empathy Map



2.2 Ideation & Brainstroming Map



3.RESULT



Input 1- Now, the user will give inputs to get the predicted result after clicking onto the submit button.

ADVANTAGES & DISADVANTAGES

It seems that online booking systems are the way of the future.

Does that make the transition to cloud-based tools an inevitable necessity if you want your business to succeed in the future?

Outside of helping you stand out from your competition, what are the benefits of offering online booking options for your players? Do the

Before making your decision, consider the advantages and

CONCLUSION

Machine Learning algorithms are applied on the dataset to predict the dynamic fare of flights.
This gives the predicted values of flight fare to get a flight ticket at minimum cost.
Data is collected from the websites which sell the flight tickets so only limited information can be accessed.
The values of R-squared obtained from the algorithm give the accuracy of the model.
In the future, if more data could be accessed such as the current availability of seats, the predicted results will be more accurate.
Finally, we have created the entire process of predicting an airline ticket and given a proof of our predictions based on the previous trends with our prediction.

FUTURE SCOPE

To evaluate the conventional algorithm, a dataset is built for route BOMBAY to DELHI and studied a trend of price variation for the period of limited days.

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APPENDIX

```
import numby as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import
train_test_split
from sklearn.ensemble import
RandomForestClassifier,GrandientBooting
```

```
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbours import KNeighboursClassifier
from sklearn.metrics import f1_score
from sklearn.metrics import classification_report,
confusion_matrix
import warnings
import pickle
from scipy import stats
warnings.filterwarnings('ignore')
plt.style.use('fivethirrtyright')

data=pd.red_csv)("Data_Train.csv")
data.head()
for i in category:
print(i, data[i].unique())
data.Date_of_journey=data.Date_of_journey.str.split(/’)
data['date']=data.Date_of_journey.str[0]
data['Month']=data.Date_of_journey.str[1]
data['Year']=data.Date_of_journey.str[2]
data.Total_Stops.unique()
data.Route=data.Route.str.split('->')
data.Route
data['City1']=data.Route.str[0]
data['City2']=data.Route.str[1]
data['City3']=data.Route.str[2]
data['City4']=data.Route.str[3]
data['City5']=data.Route.str[4]
data['City6']=data.Route.str[5]
data.Dep_Time=data.Dep_Time.str.split(':')
data['Dep_Time_Hour']=data.Dep_Time.str[0]
data['Dep_Time_Mins']=data.Dep_Time.str[1]
data['Arrival_date']=data.Arrival_Time.str[1]
data['Time_of_Arrival']=data.Arrival_Time.str[2]
data.Total_Stops.unique()
data.Route=data.Route.str.split('->')
data.Route
data['City1']=data.Route.str[0]
data['City2']=data.Route.str[1]
data['City3']=data.Route.str[2]
data['City4']=data.Route.str[3]
```

```
data['City5']=data.Route.str[4]
data['City6']=data.Route.str[5]
data.Dep_Time=data.Dep_Time.str.split(':')
data['Dep_Time_Hour']=data.Dep_Time.str[0]
data['Dep_Time_Mins']=data.Dep_Time.str[1]
data['Arrival_date']=data.Arrival_Time.str[1]
data['Time_of_Arrival']=data.Arrival_Time.str[2]
data['Time_of_Arrival']=data.Time_of_Arrival.str.splite(':')
data['Arrival_Time_Hour']=data.Time_of_Arrival.str[0]
data['Arrival_Time_Mins']=data.Time_of_Arrival.str[1]
data.Duration=data.Duration.str.split(' ')
data['Travel_Hours']=data.Duration.str[0]
data['Travel_Hours']=data.['Travel_Hours'].str.split('h')
data['Travel_Hours']=data.['Travel_Hours'].str[0]
data.Travel_Hours=data.Travel_Hours
data['Travel_Mins']=data.Duration.str[1]
data.Travel_Mins=data.Travel_Mins.st.split('m')
data.Travel_Mins=data.Travel_Mins.str[0]
data.Total_Stops.replace('non_stop',0,inplace=True)
data.Total_Stops=data.Total_Stops.str.split(' ')
data.Total_Stops=data.Total_Stops.str[0]
data.Total_Stops.replace('non_stop',0,inplace=True)
data.Total_Stops=data.Total_Stops.str.split(' ')
data.Total_Stops=data.Total_Stops.str[0]
data.Additional_Info.unique()
data.Additional_Info.replace('No Info','No info',inplace=True)
data.isnull().sum()
data.drop(['City4','City5','city6'],axis=1,inplace=True)
data.drop(['Date_of_journey','Route','Dep_Time','Arriva_Time','D
uratio
n'],axis=1, inplace=True)
data.drop(['Time_of_Arrival'],axis=1,inplace=True)
data.isnull().sum
data['City3'].fillna('None',inplace=True)
data['Arrival_date'].fillna(data['Date'],inplace=True)
data['Travel_Mins'].fillna(0,inplace=True)
data.info()
data.Date=date.Date.astype('int64')
data.Month=data.Month.astype('int64')
data.Year=data.year.astype('int64')
data.Dep_Time_Hour=data.Dep_Time_Hour.astype('int64')
```

```
data.Dep_Time_Hour=data.Dep_Time_HOur.astype('int64')
data.Dep_Time_Mins=data.Dep_Time_Mins.astype('int64')
data.Arrival_date=data.Arrival_date.astype('int64')
data.Arrival_Time_Hour=data.Arrival_Time_Hour.astype('int64')
data.Arrival_Time_Mins=data.Arrival_Time_Mins.astype('int64')
data.Travel_Mins=data.Travel_Mins.astype('int64')
data[data['Travel_Hours']=='5m']
data.drop(index=6474,inplace=True,axis=0)
data.Travel_Hours=data.Travel_Hours.astype('int64')


from sklearn.preprocessing import LabelEncoder
le=LabelEncoder()

data.Airline=le.fit_transform(data.Airline)
data.Source=le.fit_transform(data.Source)
data.Destination=le.fit_transform(data.Destination)
data.Total_Stops=le.fit_transform(data.Total_Stops)
data.City1-*=le.fit_transform(data.city1-*)
data.city2=le.fit_transform(data.city2)
data.city3=le.fit_transform(data.city3)
data.Additional_Info=le.fit_transform(data.Additional_Info)
data.head()

data=data[('Airline','source','Destrination','Date','Month','Year','
Dep_Ti
me_Hour','Dep_Time_Min','Arrival_date','Arrival_Time_
data.head()
#plotting Countplots for Categeorical Data
import seanorn as ns
c=1
plt.figure(figsize=(20,45))


for i in categorical:
plt.subplot(6,3,c)
sns.countplot(data[i])
plt.xticks(rotation=90)
plt.tight_layout(pad=3.0)
c=c+1
```

```
plt.show()
#Ditribution of 'PRICE' Column
plt.figure(figsize=(15,8)
sns.distplot(data.Price)
sns.heatmap(data.corr(),annot=True)
import seaborn as ns

sns.boxplot(data['Price'])
y = data['Price']
x = data.drop(columns=['Price'],axis=1

from sklearn.preprocessing import StandardsScaler
ss=StandardScaler()
x_scaled = ss.fit_transform(x)
x_scaled = ss.fit_transform(x)
x_scaled.head()
from sklearn.model_selection import train_test_split
x_train,x
_test,y_train=train_test_split(x,y,test_size=0.2,random_state=4
2)
x_train.head()

from sklearn.ensemble import RandomForestRegressor,
GrandientBoostingRegressor, AdaBoostRegressor
rft=RandomForestRegressor()
gb=GrandientBoostingRegressor()
ad=AdaBoostRegressor()

from sklearn.metrics import
r2_score,mean_absolte_error,mean_squard_error

for i in [rfr,gb,ad]:
i.fit(x_train,y_train)
y_pred=i.predict(x_test)
test_score=r2_score(y_test,y_pred)
train_score=r2_score(y_train, i.predict(x_train))
if abs(train_score-test_score)<=0.2:
print(i)
print("R2 score is", r2_score(y_test,y_pred))
print("R2 for train data",r2_score(y_train, i.predict(x_train)))
```

```
print("Mean Absolute Error is",
mean_absolute_error(y_pred,y_test))

print("Mean Squared Error is", mean_squared
error(y_pred,y_test))
print("Root Mean Squared Error
is",(mean_squared_error(y_pred,y_test,squared=False)))
from sklearn.neighbours import KNeighboursRegressor
from sklearn.svm import SVR
from sklearn.tree import DecisionTreeRegressor

from sklearn.metrics import
r2_score,mean_absolute_error,mean_squared_error

from sklearn.metrics import
r2_score,mean_absolute_error,mean_squared_error

knn=KNeighboursRegressor()
svr=SVR()
dt=DecisionTreeRegressor()

for i in [knn.svr,dt]:
i.fit(x_train,y_train)
y_pred=i.predict(x_test)
test_score=r2_score(y_test,y_pred)
train_score=r2_score(y_train,i.predct(x_train))

if abs(train_score-test_score)<=0.1:
print(i)
print('R2 Score is',r2_score(y_test,y_pred))
print('R2 Score for train
data',r2_score(y_train,i.prectict(x_train)))
print('Mean Absolute Error
is',mean_absolute)_error(y_test,y_pred))
print('Mean Squared Error
is',mean_squared_error(y_test,y_pred))
print('Root Mean Squared Error
is',(mean_squared_error(y_test,y_pred,squared=False)))


from sklearn.model_selection import cross_val_score
```

```
for i in range(2,5):
cv=cross_val_score(rfr,x,y,cv=i)
print(rfr,cv.mean())

from sklearn.model_selection import RandomizedSerachCV
param_grid={'n_estimators':[10,30,50,70,100],'max_depth':[Non
e,1,2,3
]

'max+_features':['auto','sqrt']}
rfr=RandomForestRegressor()

rf_res=RandomizedSeaerchCV(estimator=rfr,param_distribution
=param
_grid,cv=3,verbose=2,n_jobs=-1)

rf_res.fit(x_train,y_train)
gb=GradientBootingRegresor()

gb_res=RandomizedSearchCV(estimator=gb,param_distribution
=param
_grid,cv=3,verbose=2,n_jobs=-1)
gb_res.fit(x_train,y_train)

rfr=RandomForestRegressor(n_estimators=10,max_feature='sq
rt',max_
depth=none)
rfr,fit(x_train,y_train)
y_train_pred=rfr,predict(x_train)
y_test_pred=rfr,predict(x_test)
print("train accuracy",r2_score(y_train_)prend,y_train))
print("test accuracy",r2_score(y_test_pred,y_test))


knn=KNeighboursRegressor(n_neighbours=2,algrithm='auto',m
etric_pa
rams=None,n_jobs=-1)
knn.fit(x_train,y_train)
y_train_pred=knn.predict(x_train)
y_test_pred=knn.predict(x_test)
print("train accuracy",r2_score(y_train_pred,y_train))
```

```
print("test accuracy",r2_score(y_test,y_test))


rfr=RandomForestRegressor(n_estimators=10,max_features='s
qrt',max
_depth=None)
rfr.fit(x_train,y_train)
y_train_pred=rfr.predict(x_train)
y_test_pred=rfr.predict(x_test)
print("train accuracy",r2_score(y_train_pred,y_train))
print("test accuracy",r2_score(y_test_pred,y_test))
price_list=pd.DataFrame({'Price':prices})
price_list


import pickle
pickle.dump(rfr,open('model1.pkl','wb'))
import pickle
pickle.dump(rfr,open('model1.pkl','wb'))
from flask import Flask, render_template,request
import numby as np
import pickle
model = pickle.load(open(r"model1.pkl",'rb'))
@app.route("/home")
def home():
return render_template('home.html')
@app.route("/predict")
def home1():
return render_template('predict.html')

@app.route("/pred", methods=['POST','GET'])
def predict():
x=[[int(x)for x in request.form.values()]]
print(x)
x = np,array(x)
print(x.shap
print(x)
pred = model.predict(x)
print(pred)
return render_template('submit.html',
prediction_text=pred)
```

```
if _ _ name_ _ == "" _ _main_ _":
app.run(debug=False)
```