Data Intake Report

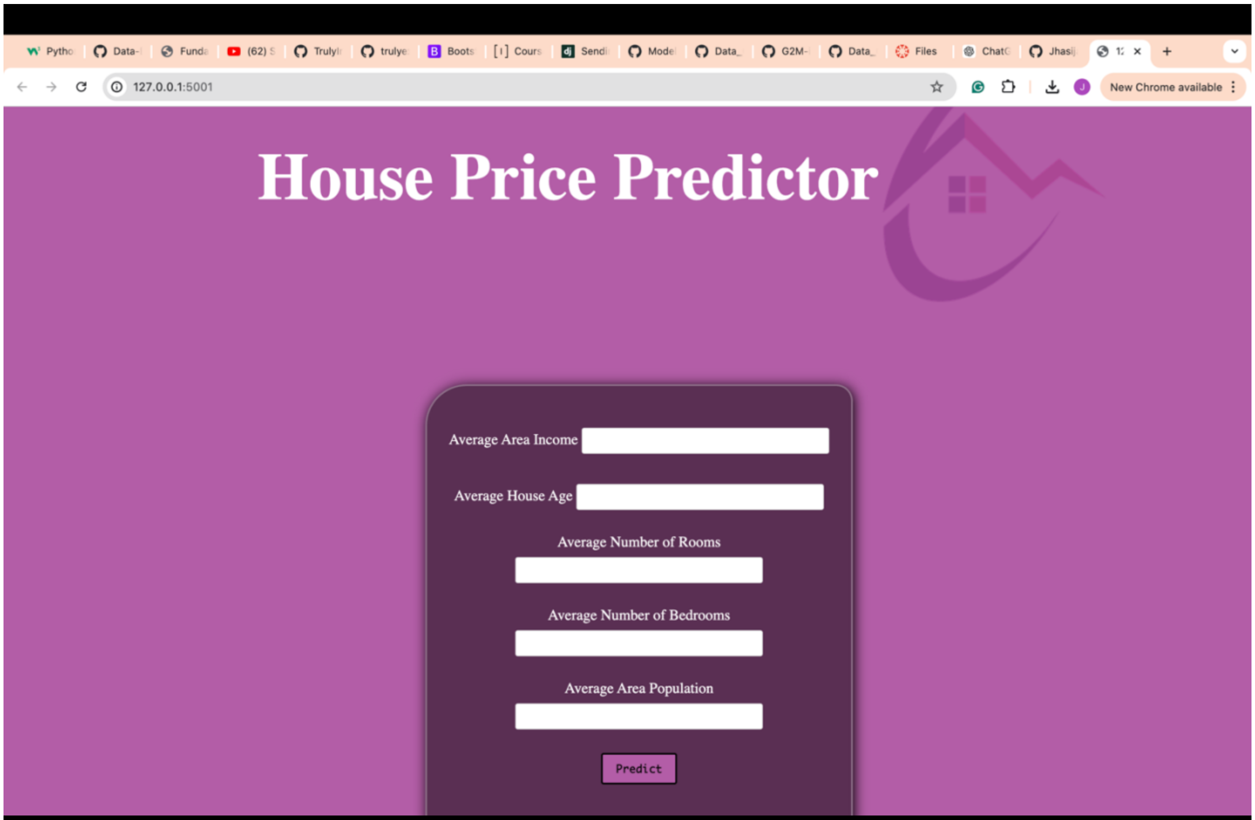
Name: House Prediction
Report date: 29 July
Internship Batch: LISUM35
Version:<1.0>
Data intake by:Janesh Hasija
Data intake reviewer: Data Glacier
Data storage location: https://github.com/Jhasija9/Week-4.git

Tabular data details:

Total number of observations	5000
Total number of files	1
Total number of features	7
Base format of the file	csv
Size of the data	709 KB

Note: Replicate same table with file name if you have more than one file.

Proposed Approach:



House Price Predictor

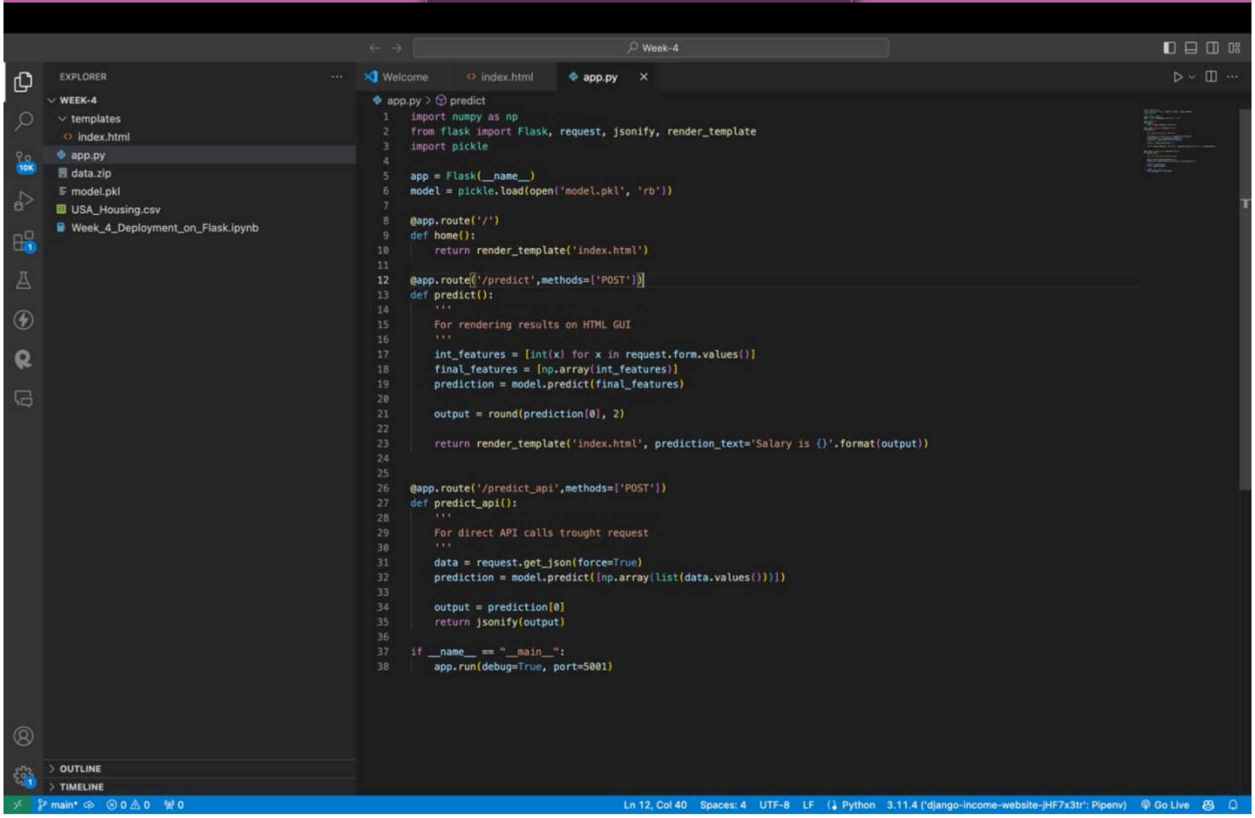
Average Area Income

Average House Age

Average Number of Rooms

Average Number of Bedrooms

Average Area Population



```python
import numpy as np
from flask import Flask, request, jsonify, render_template
import pickle

app = Flask(__name__)
model = pickle.load(open('model.pkl', 'rb'))

@app.route('/')
def home():
    return render_template('index.html')

@app.route('/predict',methods=['POST'])
def predict():
    '''
    For rendering results on HTML GUI
    '''
    int_features = [int(x) for x in request.form.values()]
    final_features = [np.array(int_features)]
    prediction = model.predict(final_features)

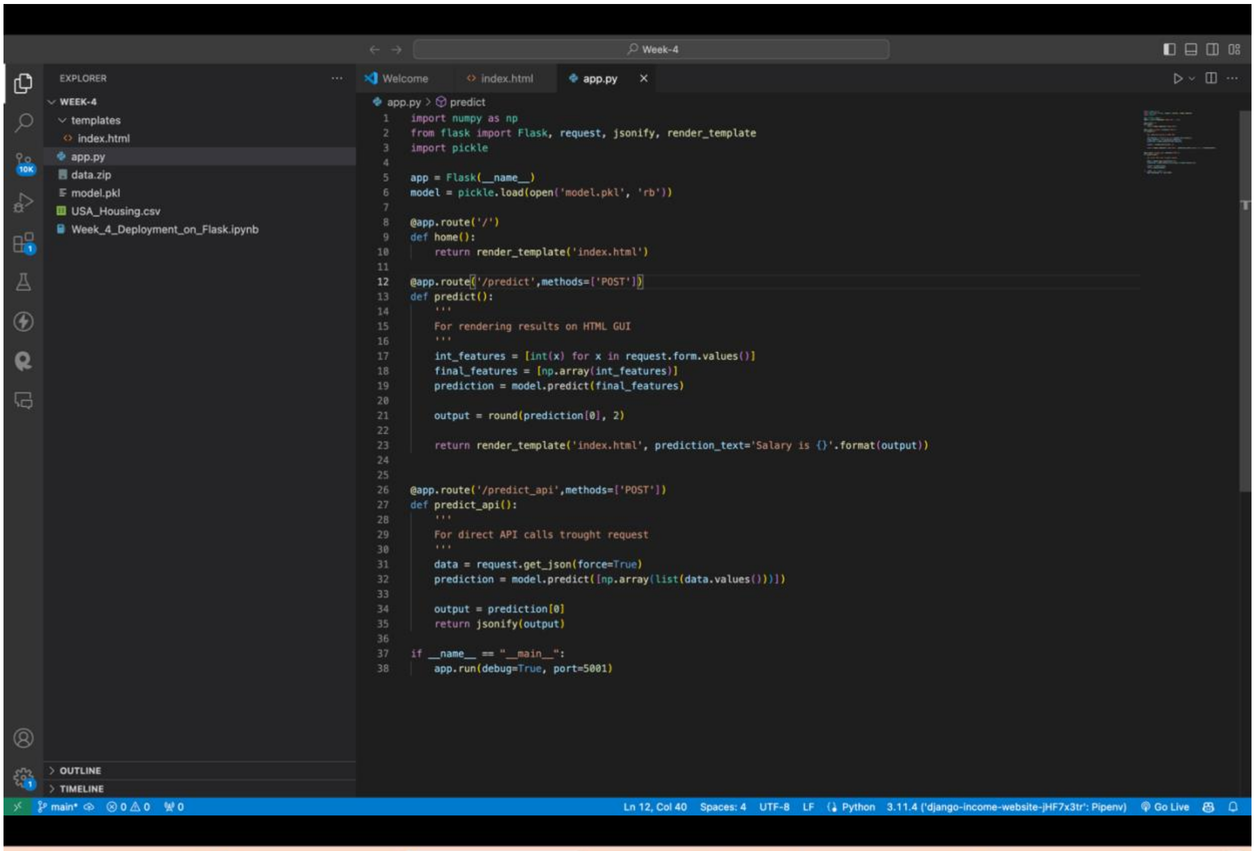
    output = round(prediction[0], 2)

    return render_template('index.html', prediction_text='Salary is {}'.format(output))


@app.route('/predict_api',methods=['POST'])
def predict_api():
    '''
    For direct API calls trought request
    '''
    data = request.get_json(force=True)
    prediction = model.predict([np.array(list(data.values()))])

    output = prediction[0]
    return jsonify(output)

if __name__ == "__main__":
    app.run(debug=True, port=5001)
```



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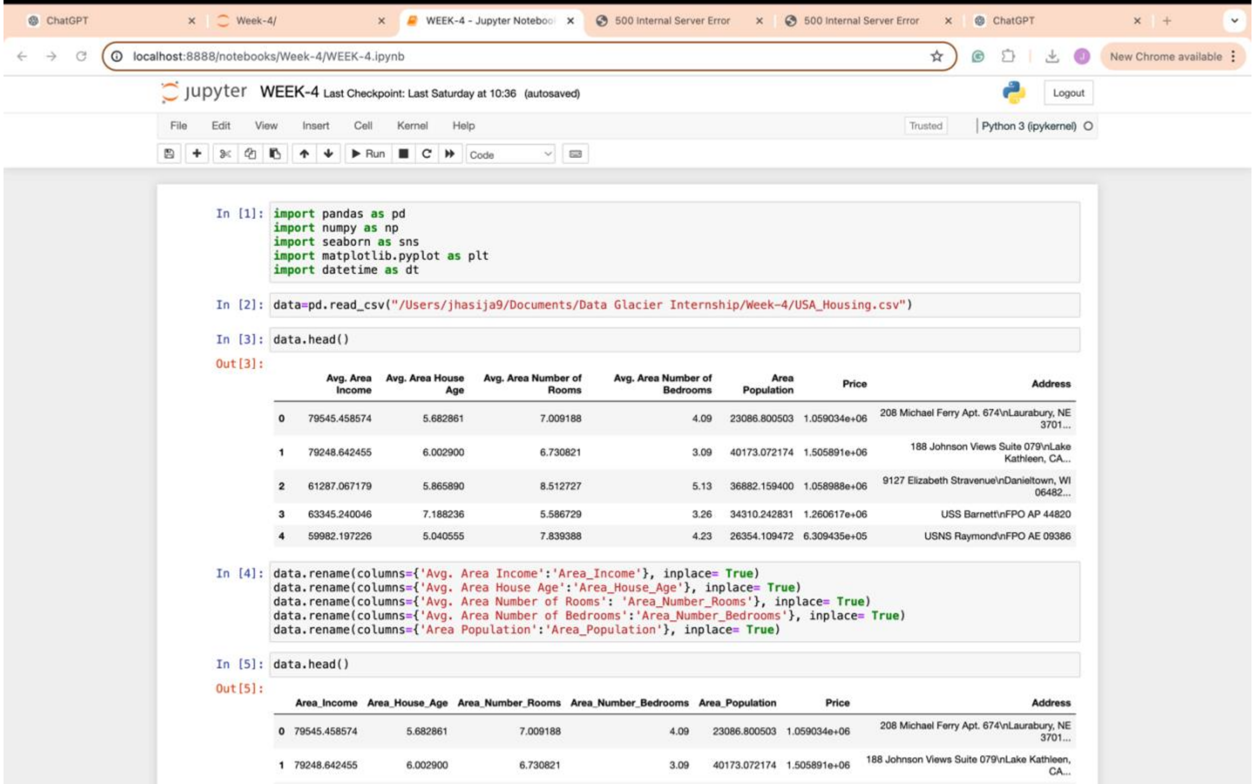
    output = prediction[0]
    return jsonify(output)

if __name__ == "__main__":
    app.run(debug=True, port=5001)
```


ChatGPT
Week-4/
WEEK-4 - Jupyter Noteboo
500 Internal Server Error
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Logout
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Python 3 (ipykernel)
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```
In [1]: import pandas as pd
        import numpy as np
        import seaborn as sns
        import matplotlib.pyplot as plt
        import datetime as dt
```

```
In [2]: data=pd.read_csv("/Users/jhasija9/Documents/Data Glacier Internship/Week-4/USA_Housing.csv")
```

```
In [3]: data.head()
```

Out[3]:

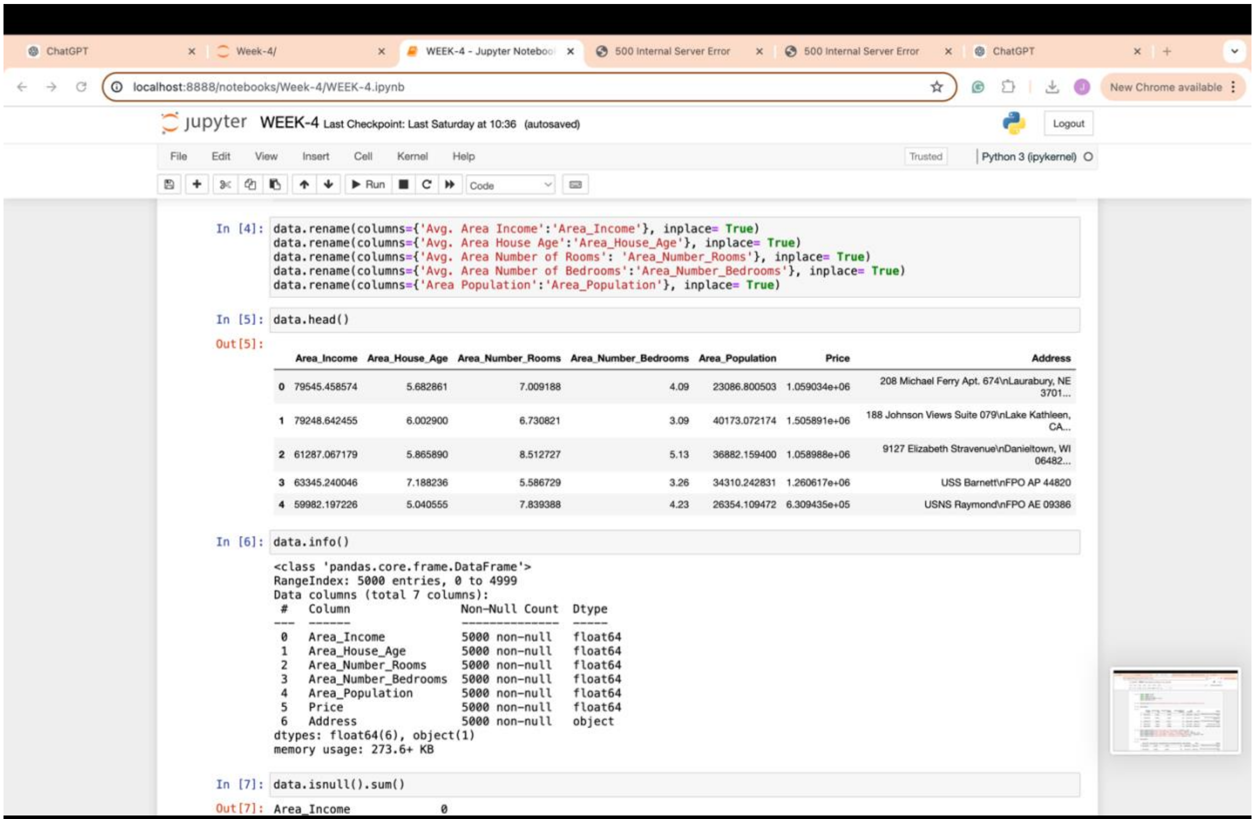
	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price	Address
0	79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06	208 Michael Ferry Apt. 674\nLaurabury, NE 3701...
1	79248.642455	6.002900	6.730821	3.09	40173.072174	1.505891e+06	188 Johnson Views Suite 079\nLake Kathleen, CA...
2	61287.067179	5.865890	8.512727	5.13	36882.159400	1.058988e+06	9127 Elizabeth Stravenue\nDanieltown, WI 06482...
3	63345.240046	7.188236	5.586729	3.26	34310.242831	1.260617e+06	USS Barnett\nFPO AP 44820
4	59982.197226	5.040555	7.839388	4.23	26354.109472	6.309435e+05	USNS Raymond\nFPO AE 09386

```
In [4]: data.rename(columns={'Avg. Area Income':'Area_Income'}, inplace= True)
        data.rename(columns={'Avg. Area House Age':'Area_House_Age'}, inplace= True)
        data.rename(columns={'Avg. Area Number of Rooms': 'Area_Number_Rooms'}, inplace= True)
        data.rename(columns={'Avg. Area Number of Bedrooms':'Area_Number_Bedrooms'}, inplace= True)
        data.rename(columns={'Area Population':'Area_Population'}, inplace= True)
```

```
In [5]: data.head()
```

Out[5]:

	Area_Income	Area_House_Age	Area_Number_Rooms	Area_Number_Bedrooms	Area_Population	Price	Address
0	79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06	208 Michael Ferry Apt. 674\nLaurabury, NE 3701...
1	79248.642455	6.002900	6.730821	3.09	40173.072174	1.505891e+06	188 Johnson Views Suite 079\nLake Kathleen, CA...


ChatGPT
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```
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        data.rename(columns={'Avg. Area Number of Bedrooms':'Area_Number_Bedrooms'}, inplace= True)
        data.rename(columns={'Area Population':'Area_Population'}, inplace= True)
```

```
In [5]: data.head()
```

Out[5]:

	Area_Income	Area_House_Age	Area_Number_Rooms	Area_Number_Bedrooms	Area_Population	Price	Address
0	79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06	208 Michael Ferry Apt. 674\nLaurabury, NE 3701...
1	79248.642455	6.002900	6.730821	3.09	40173.072174	1.505891e+06	188 Johnson Views Suite 079\nLake Kathleen, CA...
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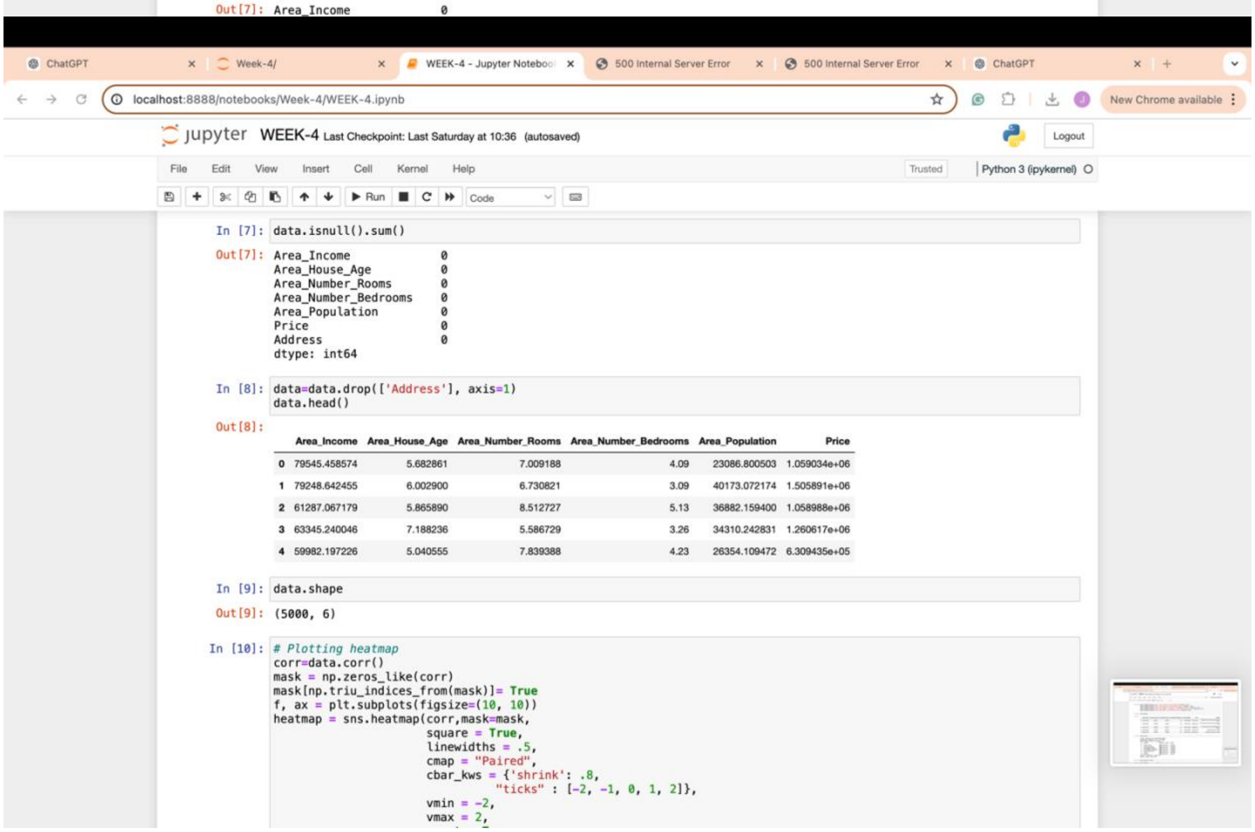
4	59982.197226	5.040555	7.839388	4.23	26354.109472	6.309435e+05	USNS Raymond\nFPO AE 09386

```
In [6]: data.info()

        <class 'pandas.core.frame.DataFrame'>
        RangeIndex: 5000 entries, 0 to 4999
        Data columns (total 7 columns):
         #   Column                Non-Null Count  Dtype
        ---  ------                --------------  -----
         0   Area_Income           5000 non-null   float64
         1   Area_House_Age        5000 non-null   float64
         2   Area_Number_Rooms     5000 non-null   float64
         3   Area_Number_Bedrooms  5000 non-null   float64
         4   Area_Population       5000 non-null   float64
         5   Price                 5000 non-null   float64
         6   Address               5000 non-null   object
        dtypes: float64(6), object(1)
        memory usage: 273.6+ KB
```

```
In [7]: data.isnull().sum()

Out[7]: Area_Income            0
```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```
In [7]: data.isnull().sum()

Out[7]: Area_Income             0
        Area_House_Age          0
        Area_Number_Rooms       0
        Area_Number_Bedrooms    0
        Area_Population         0
        Price                   0
        Address                 0
        dtype: int64
```

```
In [8]: data=data.drop(['Address'], axis=1)
        data.head()
```

Out[8]:

	Area_Income	Area_House_Age	Area_Number_Rooms	Area_Number_Bedrooms	Area_Population	Price
0	79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06
1	79248.642455	6.002900	6.730821	3.09	40173.072174	1.505891e+06
2	61287.067179	5.865890	8.512727	5.13	36882.159400	1.058988e+06
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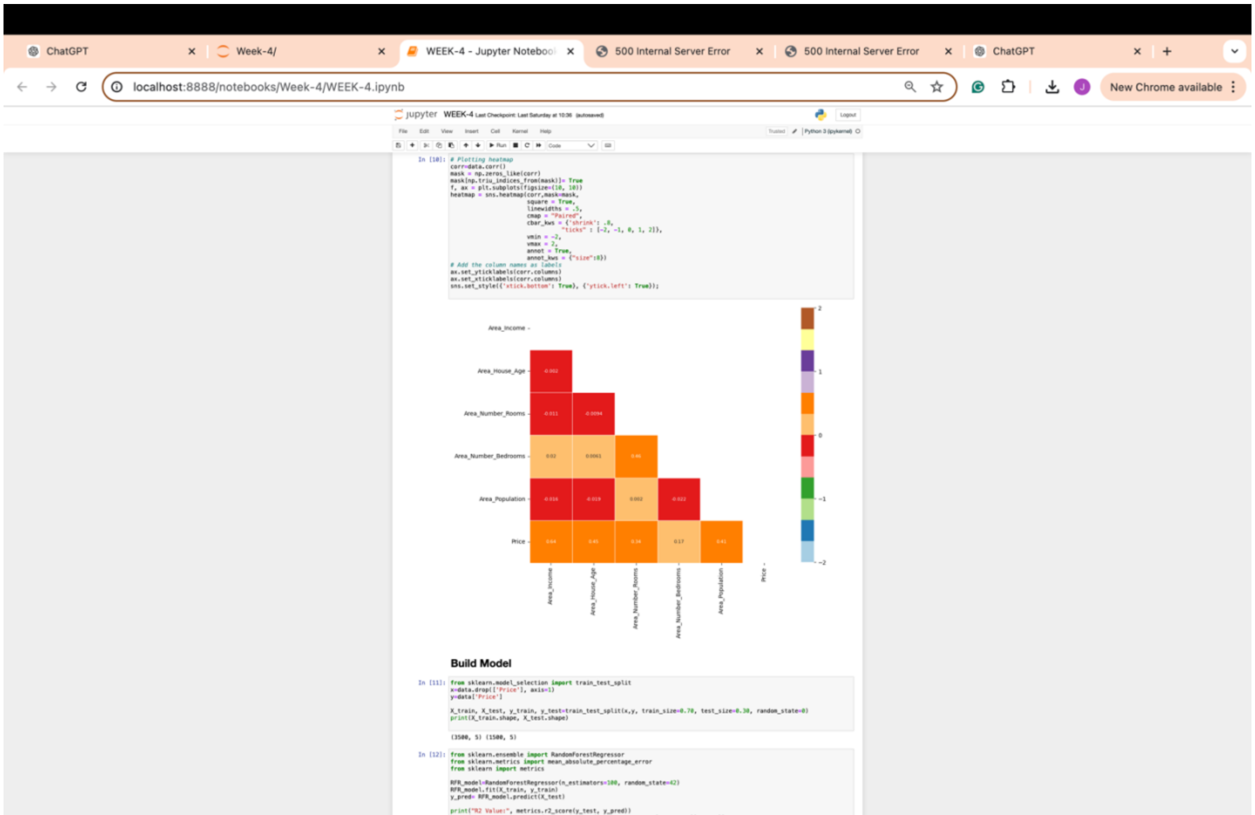
4	59982.197226	5.040555	7.839388	4.23	26354.109472	6.309435e+05

```
In [9]: data.shape

Out[9]: (5000, 6)
```

```
In [10]: # Plotting heatmap
         corr=data.corr()
         mask = np.zeros_like(corr)
         mask[np.triu_indices_from(mask)]= True
         f, ax = plt.subplots(figsize=(10, 10))
         heatmap = sns.heatmap(corr,mask=mask,
                               square = True,
                               linewidths = .5,
                               cmap = "Paired",
                               cbar_kws = {'shrink': .8,
                                         "ticks" : [-2, -1, 0, 1, 2]},
                               vmin = -2,
                               vmax = 2,
```



```
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         f, ax = plt.subplots(figsize=(10, 10))
         heatmap = sns.heatmap(corr,mask=mask,
                               square = True,
                               linewidths = .5,
                               cmap = "Paired",
                               cbar_kws = {'shrink': .8,
                                           "ticks" : [-2, -1, 0, 1, 2]},
                               vmin = -2,
                               vmax = 2,
                               annot = True,
                               annot_kws = {"size":8})
         # Add the column names as labels
         ax.set_yticklabels(corr.columns)
         ax.set_xticklabels(corr.columns)
         sns.set_style({'xtick.bottom': True}, {'ytick.left': True});
```

Build Model

```
In [11]: from sklearn.model_selection import train_test_split
         x=data.drop(['Price'], axis=1)
         y=data['Price']

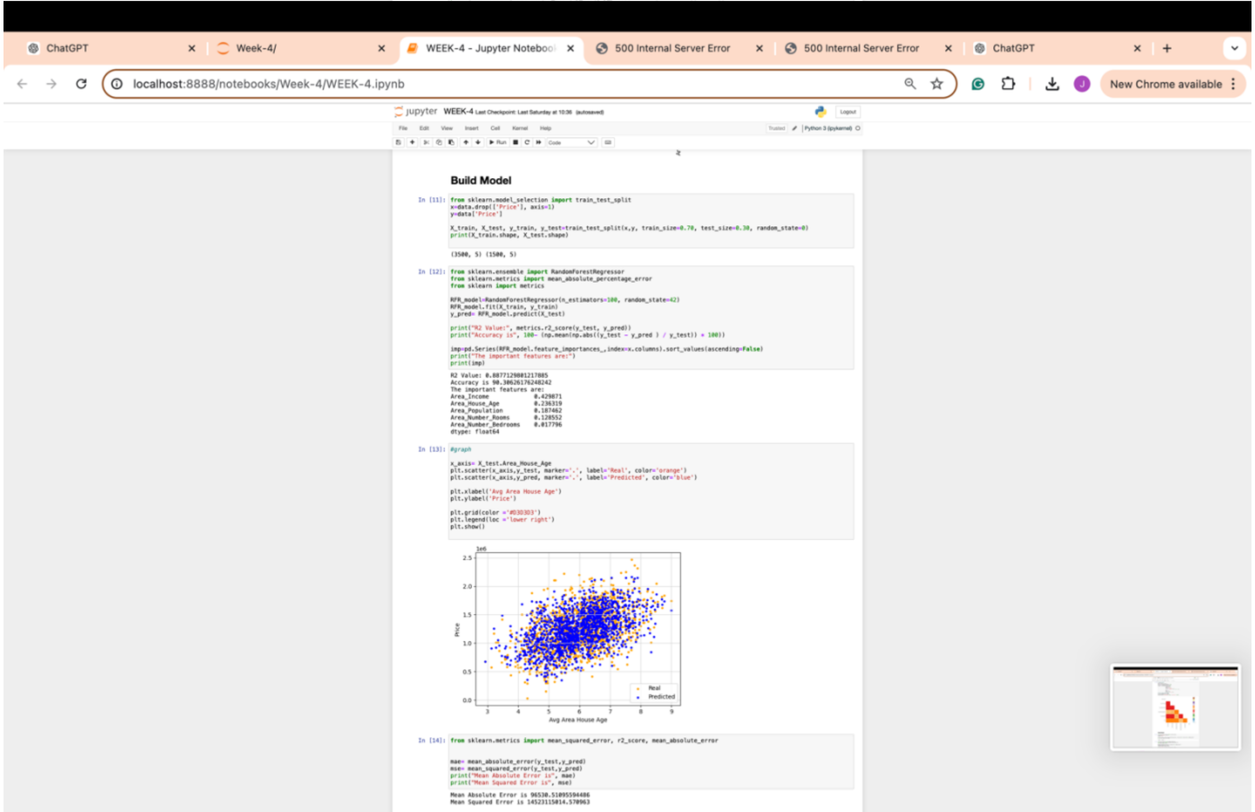
         X_train, X_test, y_train, y_test=train_test_split(x,y, train_size=0.70, test_size=0.30, random_state=0)
         print(X_train.shape, X_test.shape)

         (3500, 5) (1500, 5)
```

```
In [12]: from sklearn.ensemble import RandomForestRegressor
         from sklearn.metrics import mean_absolute_percentage_error
         from sklearn import metrics

         RFR_model=RandomForestRegressor(n_estimators=100, random_state=42)
         RFR_model.fit(X_train, y_train)
         y_pred= RFR_model.predict(X_test)

         print("R2 Value:", metrics.r2_score(y_test, y_pred))
```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1e6
2.5
2.0
1.5
1.0
0.5
0.0
Price
3
4
5
6
7
8
9
Avg Area House Age
Real
Predicted

Build Model

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         (3500, 5) (1500, 5)
```

```
In [12]: from sklearn.ensemble import RandomForestRegressor
         from sklearn.metrics import mean_absolute_percentage_error
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         RFR_model=RandomForestRegressor(n_estimators=100, random_state=42)
         RFR_model.fit(X_train, y_train)
         y_pred= RFR_model.predict(X_test)

         print("R2 Value:", metrics.r2_score(y_test, y_pred))
         print("Accuracy is", 100- (np.mean(np.abs((y_test - y_pred ) / y_test)) * 100))

         imp=pd.Series(RFR_model.feature_importances_,index=x.columns).sort_values(ascending=False)
         print("The important features are:")
         print(imp)

         R2 Value: 0.8877129801217885
         Accuracy is 90.30626176248242
         The important features are:
         Area_Income             0.429871
         Area_House_Age          0.236319
         Area_Population         0.187462
         Area_Number_Rooms       0.128552
         Area_Number_Bedrooms    0.017796
         dtype: float64
```

```
In [13]: #graph

         x_axis= X_test.Area_House_Age
         plt.scatter(x_axis,y_test, marker='.', label='Real', color='orange')
         plt.scatter(x_axis,y_pred, marker='.', label='Predicted', color='blue')

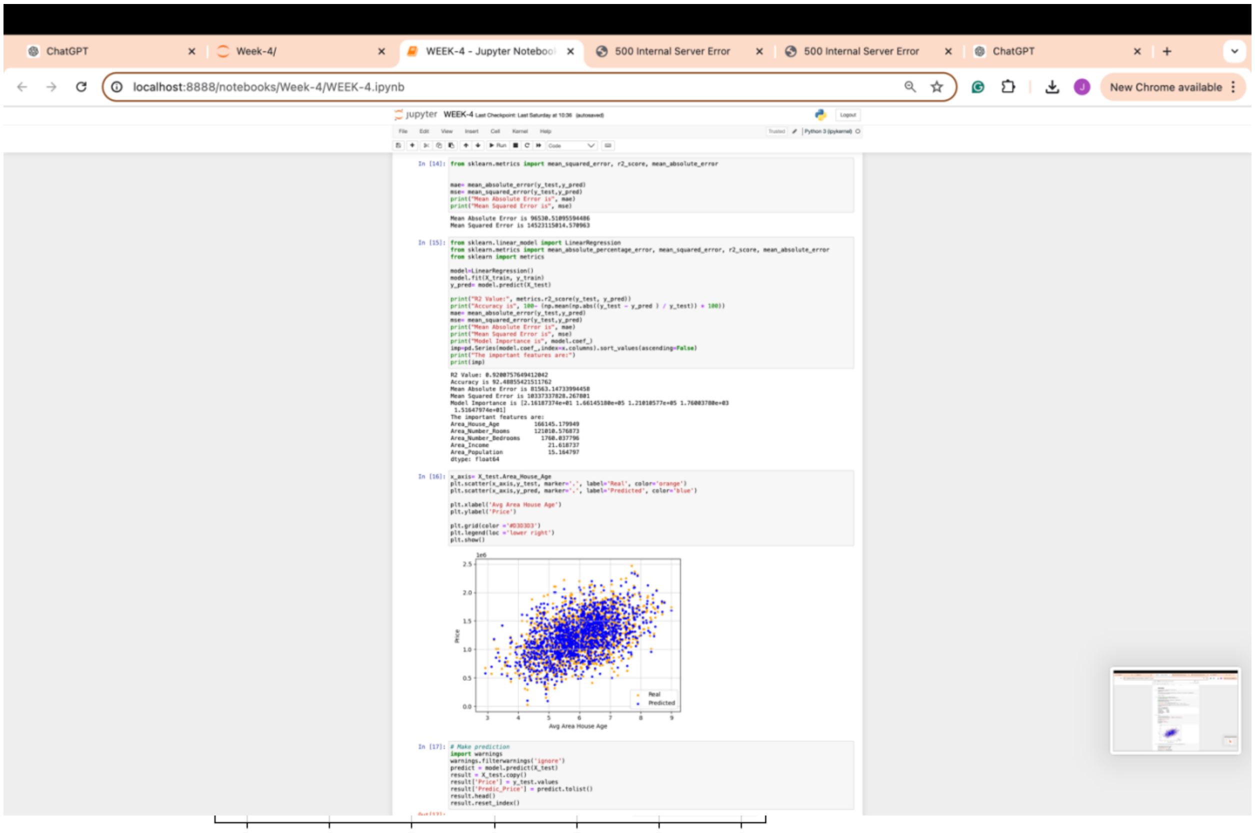
         plt.xlabel('Avg Area House Age')
         plt.ylabel('Price')

         plt.grid(color ='#030303')
         plt.legend(loc ='lower right')
         plt.show()
```

```
In [14]: from sklearn.metrics import mean_squared_error, r2_score, mean_absolute_error


         mae= mean_absolute_error(y_test,y_pred)
         mse= mean_squared_error(y_test,y_pred)
         print("Mean Absolute Error is", mae)
         print("Mean Squared Error is", mse)

         Mean Absolute Error is 96530.51095594486
         Mean Squared Error is 14523115014.570963
```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         print("Mean Absolute Error is", mae)
         print("Mean Squared Error is", mse)

         Mean Absolute Error is 96530.51095594486
         Mean Squared Error is 14523115014.570963

In [15]: from sklearn.linear_model import LinearRegression
         from sklearn.metrics import mean_absolute_percentage_error, mean_squared_error, r2_score, mean_absolute_error
         from sklearn import metrics

         model=LinearRegression()
         model.fit(X_train, y_train)
         y_pred= model.predict(X_test)

         print("R2 Value:", metrics.r2_score(y_test, y_pred))
         print("Accuracy is", 100- (np.mean(np.abs((y_test - y_pred ) / y_test)) * 100))
         mae= mean_absolute_error(y_test,y_pred)
         mse= mean_squared_error(y_test,y_pred)
         print("Mean Absolute Error is", mae)
         print("Mean Squared Error is", mse)
         print("Model Importance is", model.coef_)
         imp=pd.Series(model.coef_,index=x.columns).sort_values(ascending=False)
         print("The important features are:")
         print(imp)

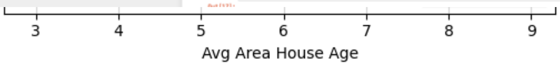
         R2 Value: 0.9200757649412042
         Accuracy is 92.48855421511762
         Mean Absolute Error is 81563.14733994458
         Mean Squared Error is 10337337828.267801
         Model Importance is [2.16187374e+01 1.66145180e+05 1.21010577e+05 1.76003780e+03
          1.51647974e+01]
         The important features are:
         Area_House_Age          166145.179949
         Area_Number_Rooms       121010.576873
         Area_Number_Bedrooms      1760.037796
         Area_Income                 21.618737
         Area_Population             15.164797
         dtype: float64

In [16]: x_axis= X_test.Area_House_Age
         plt.scatter(x_axis,y_test, marker='.', label='Real', color='orange')
         plt.scatter(x_axis,y_pred, marker='.', label='Predicted', color='blue')

         plt.xlabel('Avg Area House Age')
         plt.ylabel('Price')

         plt.grid(color ='#030303')
         plt.legend(loc ='lower right')
         plt.show()
```

```
In [17]: # Make prediction
         import warnings
         warnings.filterwarnings('ignore')
         predict = model.predict(X_test)
         result = X_test.copy()
         result['Price'] = y_test.values
         result['Predic_Price'] = predict.tolist()
         result.head()
         result.reset_index()
```



```
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         warnings.filterwarnings('ignore')
         predict = model.predict(X_test)
         result = X_test.copy()
         result['Price'] = y_test.values
         result['Predic_Price'] = predict.tolist()
         result.head()
         result.reset_index()
```

Out[17]:

	index	Area_Income	Area_House_Age	Area_Number_Rooms	Area_Number_Bedrooms	Area_Population	Price	Predic_Price
0	398	61200.726175	5.299694	6.234615	4.23	42789.692217	8.942511e+05	9.696083e+05
1	3833	63380.814670	5.344664	6.001574	2.45	40217.333577	9.329794e+05	9.538682e+05
2	4836	71208.269301	5.300326	6.077989	4.01	25696.361741	9.207479e+05	9.075063e+05
3	4572	50343.763518	6.027468	5.160240	4.35	27445.876739	6.918549e+05	4.933253e+05
4	636	54535.453719	5.278065	6.871038	4.41	30852.207006	7.327332e+05	7.182212e+05
...	...	...	...	...	...	...	...	...
1495	4554	75654.777016	7.077079	6.501047	3.15	49451.178541	1.900789e+06	1.708751e+06
1496	4807	81742.851389	5.796218	7.222546	6.18	40562.498774	1.630435e+06	1.585405e+06
1497	1073	63324.581619	7.725266	6.213021	4.42	43281.572742	1.372994e+06	1.423701e+06
1498	2906	54673.521184	4.496193	7.081934	5.31	39160.553270	7.707706e+05	7.444009e+05
1499	1357	40185.733891	5.949763	5.753579	4.01	37766.667572	5.292821e+05	4.885258e+05

1500 rows × 8 columns

```
In [18]: #saving the model
         import pickle
         pickle.dump(model, open('model.pkl', 'wb'))
```

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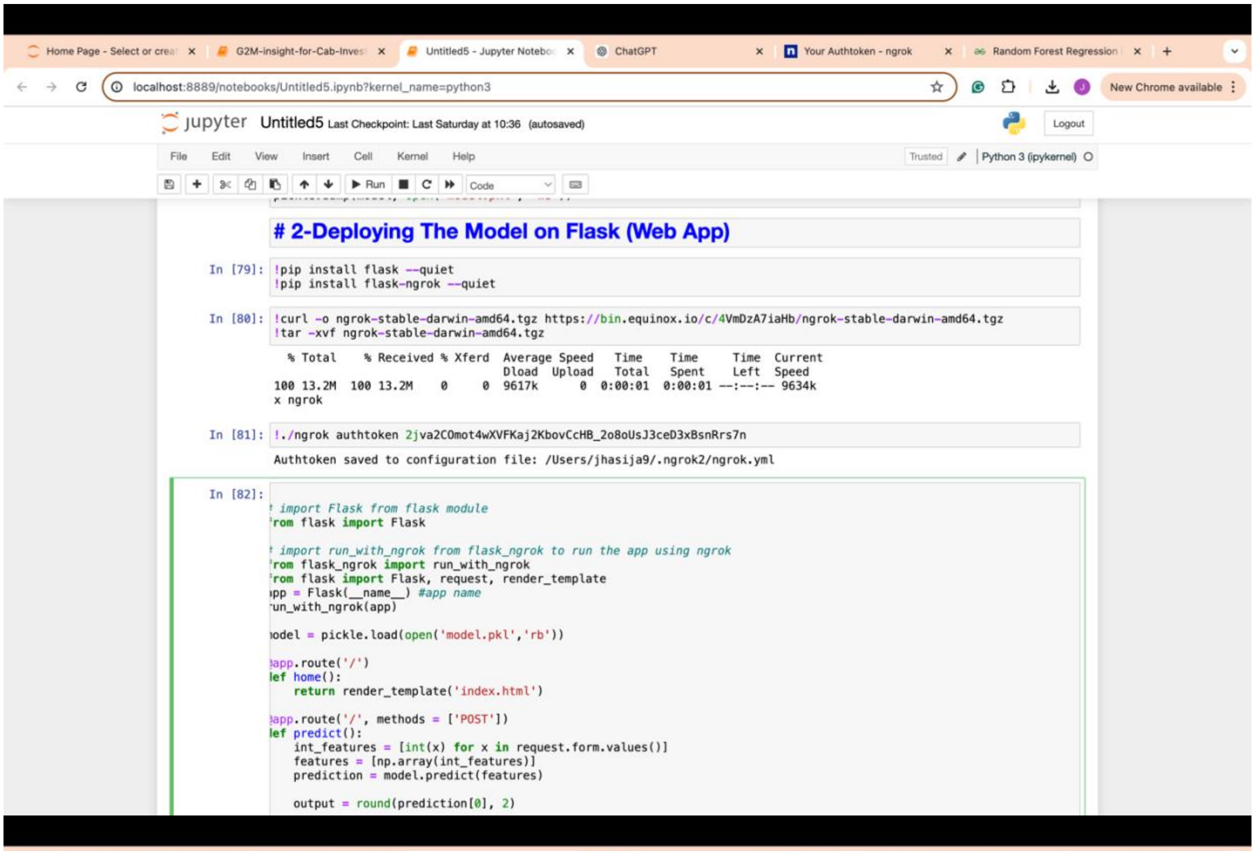
In [ ]: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G2M-insight-for-Cab-Inves
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Random Forest Regression
localhost:8889/notebooks/Untitled5.ipynb?kernel_name=python3
New Chrome available
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File
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View
Insert
Cell
Kernel
Help
Trusted
Python 3 (ipykernel)
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Code

2-Deploying The Model on Flask (Web App)

```
In [79]: !pip install flask --quiet
         !pip install flask-ngrok --quiet
```

```
In [80]: !curl -o ngrok-stable-darwin-amd64.tgz https://bin.equinox.io/c/4VmDzA7iaHb/ngrok-stable-darwin-amd64.tgz
         !tar -xvf ngrok-stable-darwin-amd64.tgz

  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 13.2M  100 13.2M    0     0  9617k      0  0:00:01  0:00:01 --:--:-- 9634k
x ngrok
```

```
In [81]: !./ngrok authtoken 2jva2COmot4wXVFKaj2KbovCcHB_2o8oUsJ3ceD3xBsnRrs7n

Authtoken saved to configuration file: /Users/jhasija9/.ngrok2/ngrok.yml
```

```
In [82]:
: import Flask from flask module
'rom flask import Flask

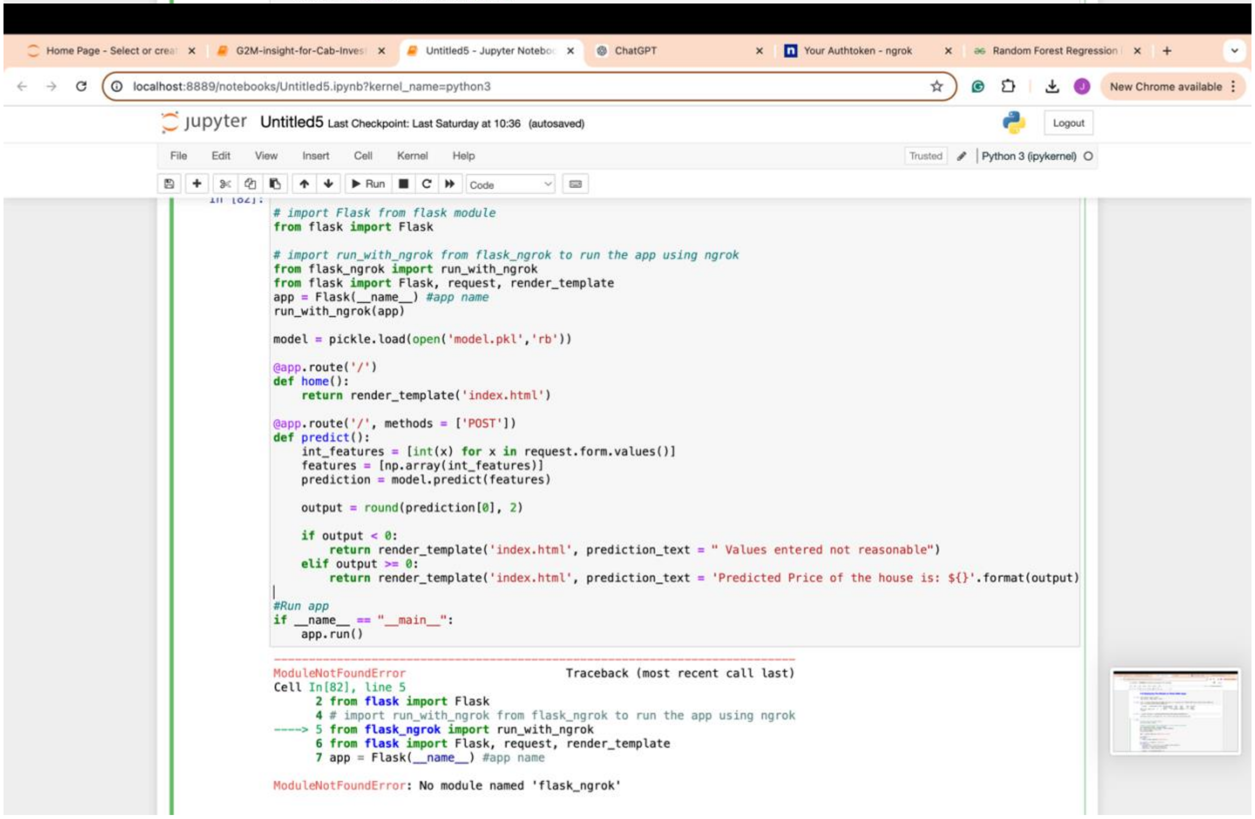
: import run_with_ngrok from flask_ngrok to run the app using ngrok
'rom flask_ngrok import run_with_ngrok
'rom flask import Flask, request, render_template
ıpp = Flask(__name__) #app name
'un_with_ngrok(app)

ıodel = pickle.load(open('model.pkl','rb'))

ıapp.route('/')
lef home():
    return render_template('index.html')

ıapp.route('/', methods = ['POST'])
lef predict():
    int_features = [int(x) for x in request.form.values()]
    features = [np.array(int_features)]
    prediction = model.predict(features)

    output = round(prediction[0], 2)
```


Home Page - Select or crea
G2M-insight-for-Cab-Inves
Untitled5 - Jupyter Notebo
ChatGPT
Your Authtoken - ngrok
Random Forest Regression
localhost:8889/notebooks/Untitled5.ipynb?kernel_name=python3
New Chrome available
jupyter
Untitled5 Last Checkpoint: Last Saturday at 10:36 (autosaved)
Logout
File
Edit
View
Insert
Cell
Kernel
Help
Trusted
Python 3 (ipykernel)
Run
Code

```
# import Flask from flask module
from flask import Flask

# import run_with_ngrok from flask_ngrok to run the app using ngrok
from flask_ngrok import run_with_ngrok
from flask import Flask, request, render_template
app = Flask(__name__) #app name
run_with_ngrok(app)

model = pickle.load(open('model.pkl','rb'))

@app.route('/')
def home():
    return render_template('index.html')

@app.route('/', methods = ['POST'])
def predict():
    int_features = [int(x) for x in request.form.values()]
    features = [np.array(int_features)]
    prediction = model.predict(features)

    output = round(prediction[0], 2)

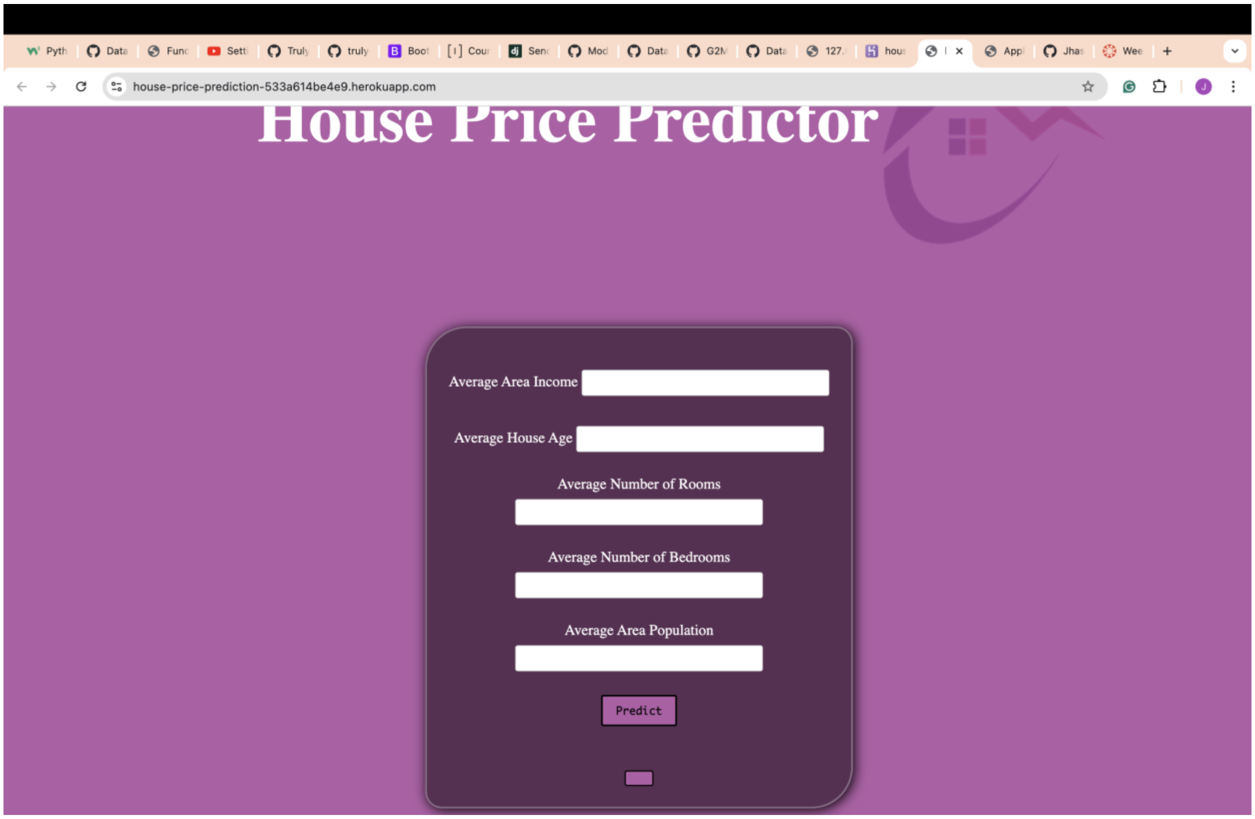
    if output < 0:
        return render_template('index.html', prediction_text = " Values entered not reasonable")
    elif output >= 0:
        return render_template('index.html', prediction_text = 'Predicted Price of the house is: ${}'.format(output)

#Run app
if __name__ == "__main__":
    app.run()
```

```
---------------------------------------------------------------------------
ModuleNotFoundError                       Traceback (most recent call last)
Cell In[82], line 5
      2 from flask import Flask
      4 # import run_with_ngrok from flask_ngrok to run the app using ngrok
----> 5 from flask_ngrok import run_with_ngrok
      6 from flask import Flask, request, render_template
      7 app = Flask(__name__) #app name

ModuleNotFoundError: No module named 'flask_ngrok'
```

Deployment link:
https://house-price-prediction-533a614be4e9.herokuapp.com/


house-price-prediction-533a614be4e9.herokuapp.com
House Price Predictor
Average Area Income
Average House Age
Average Number of Rooms
Average Number of Bedrooms
Average Area Population
Predict