

Week 5: Deploy the Web App on Azure

Name: Deploy the Web App on Azure

Report date: 06/04/2024

Internship Batch: LISUM33

Version: 1.0

Data intake by: Manhui Zhu

Data Intake reviewer: Data Glacier

Data Storage location:

<https://github.com/Manhui-z/Data-Glacier-Internship/tree/main/Week%204%20Flask>

Data Details:

Name of data	Option_data.csv
Total number of observations	50000
Total number of features	6
Base format of the file	.csv
Size of the data	273.6 + KB

1. Build the ML Model and Save

1.1 Import the Packages

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

from sklearn.model_selection import train_test_split, GridSearchCV, KFold
from sklearn.metrics import mean_squared_error, mean_absolute_error
from sklearn.metrics import r2_score, accuracy_score

from sklearn.ensemble import RandomForestRegressor
```

1] ✓ 21.2s Python

1.2 Data Preprocessing

Data Preprocessing

```
option = pd.read_csv('option_data.csv')
option.head()
```

✓ 0.1s

Python

	Unnamed: 0	Value	S	K	tau	r	BS
0	1	348.500	1394.46	1050	0.128767	0.0116	Under
1	2	149.375	1432.25	1400	0.679452	0.0113	Under
2	3	294.500	1478.90	1225	0.443836	0.0112	Under
3	4	3.375	1369.89	1500	0.117808	0.0119	Over
4	5	84.000	1366.42	1350	0.298630	0.0119	Under

```
option.info()
```

[4] ✓ 0.3s

Python

```
... <class 'pandas.core.frame.DataFrame'>
RangeIndex: 5000 entries, 0 to 4999
Data columns (total 7 columns):
#   Column      Non-Null Count  Dtype
---  ---
0   Unnamed: 0   5000 non-null   int64
1   Value        5000 non-null   float64
2   S            5000 non-null   float64
3   K            5000 non-null   int64
4   tau          5000 non-null   float64
5   r            5000 non-null   float64
6   BS           5000 non-null   object
dtypes: float64(4), int64(2), object(1)
memory usage: 273.6+ KB
```

```
option.isnull().sum()
```

[3]

Python

```
... Unnamed: 0    0
Value          0
S              0
K              0
tau            0
r              0
BS             0
dtype: int64
```

```
option = option.drop(columns = ['Unnamed: 0'])
option.shape
```

[4]

Python

```
... (5000, 6)
```

```
5] X = option.drop(columns = ['Value', 'BS'])
    y = option['Value']

    re_X_train, re_X_test, re_y_train, re_y_test = train_test_split(X, y,
                                                                    test_size=0.2, random_state=42)
```

Python

```
7] re_X_train.shape

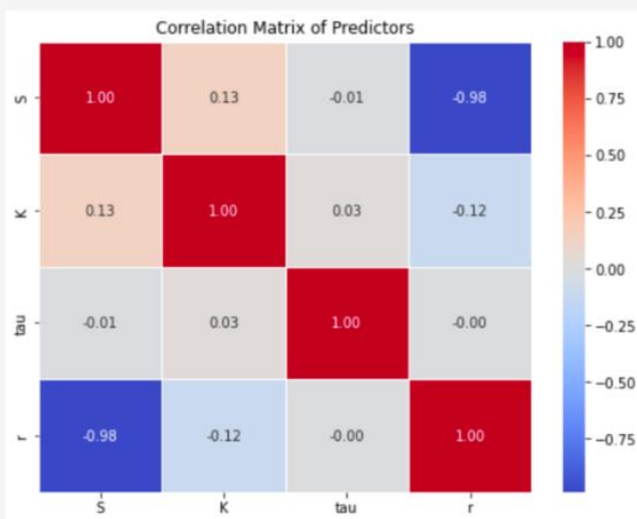
.. (4000, 4)
```

Python

```
correlation_matrix = re_X_train.corr()

# Visualize the correlation matrix as a heatmap
plt.figure(figsize=(8, 6))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt=".2f", linewidths=0.5)
plt.title('Correlation Matrix of Predictors')
plt.show()
```

Python



1.3 Build the Model

Build the Model

```
random_forest_regressor = RandomForestRegressor(n_estimators=50, random_state=42)

# Fit the Random Forest regressor to the training data
random_forest_regressor.fit(re_X_train, re_y_train)

# Predict on the testing set
predictions = random_forest_regressor.predict(re_X_test)

# result table
result = re_X_test
result['Value'] = re_y_test
result['Predicted_Value'] = predictions.tolist()
result.head()
```

Python

	S	K	tau	r	Value	Predicted_Value
1501	1401.44	1625	0.090411	0.0116	1.000	1.4550
2586	1527.46	1350	0.232877	0.0106	224.000	219.4900
2653	1329.78	1300	0.676712	0.0123	147.625	154.8975
1055	1424.24	1375	0.358904	0.0114	116.000	120.9100
705	1341.93	1200	0.295890	0.0122	174.375	169.4900

```
# Calculate evaluation metrics
rf_mse = mean_squared_error(re_y_test, predictions)
print("Mean Squared Error: ", rf_mse)

rf_r2 = r2_score(re_y_test, predictions)
print("R-squared (Random Forest):", rf_r2)
```

Python

Mean Squared Error: 55.937986762109375

R-squared (Random Forest): 0.9964970515427147

1.4 Save the model

Save the model

```
import pickle
```

[11]

Python

```
pickle.dump(random_forest_regressor, open('model.pkl', 'wb'))
```

[12]

Python

2. Deploy the ML Model on Flask (Web App)

2.1 app.py

```
import os
os.chdir('/Users/zhumanhui/Desktop/Data Glacier/Week 4 Flask/')
print("Current Working Directory:", os.getcwd())

import pandas as pd
import numpy as np
from flask import Flask, request, render_template, url_for
import pickle

app = Flask(__name__) # app name

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

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

# set a post method to yield predictions on page
@app.route('/predict', methods = ['POST'])
def predict():

    # obtain value of all predictors and place them in array
    int_features = [float(x) for x in request.form.values()]
    # combine them all into a final numpy array
    final_features = [np.array(int_features)]
    # predict the option values by given input predictors
    prediction = model.predict(final_features)[0]

    # if the output is negative, the predictor values entered are unreasonable
    if prediction < 0:
        return render_template('index.html',
                               prediction_text = 'Predicted option value is negative, values entered is unreasonable')
    # if the output is greater than 0, return prediction
    else:
        return render_template('index.html',
                               prediction_text = 'Predicted option value is: $ {}'.format(prediction))

# run app
if __name__ == '__main__':
    app.run(port = 5000, debug = True)
```

Output on my Terminal:

```
zhumanhui@shus-MacBook-Pro ~ % /usr/local/bin/python3 "/Users/zhumanhui/Desktop/Data Glacier/Week 4 Flask/app.py"
Current Working Directory: /Users/zhumanhui/Desktop/Data Glacier/Week 4 Flask
* Serving Flask app 'app' (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: on
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
* Restarting with stat
Current Working Directory: /Users/zhumanhui/Desktop/Data Glacier/Week 4 Flask
* Debugger is active!
* Debugger PIN: 841-984-386
127.0.0.1 - - [28/May/2024 01:16:12] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [28/May/2024 01:16:12] "GET /favicon.ico HTTP/1.1" 404 -
```

2.2 Build the html file

```
<html>

  <head>
    <meta charset="UTF-8">
    <style>
      /*This section involves the overall style of main tags*/

      * {
        font-family: Lucida Handwriting;
      }

      body {
        background-color: ■rgb(12, 138, 211);
        background-size: cover;
      }

      form {
        text-align: center;
      }

      h1 {
        color: □white;
        text-align: center;
        font-family: Lucida Handwriting;
        font-size: 500%;
      }
    </style>
  </head>
</html>
```

```
button {
    font-weight: bold;
    background-color: #0070C0;
    padding: 8px 16px;
    display: inline-block;
    text-decoration: none;
    border-radius: 3px;
    color: black;
    border-color: black;
    font-family: Monaco;
    border-style: solid;
}

input {
    padding: 12px 20px;
    margin: 8px 0;
    box-sizing: border-box;
}

label {
    color: white;
}

/*Margin, layout and design of paragraphs and structures*/

.para {
    text-align: center;
}

.result {
    font-weight: bold;
    background-color: #0070C0;
    padding: 8px 16px;
    display: inline-block;
    text-decoration: none;
    border-radius: 3px;
    color: black;
    border-color: black;
    font-family: Monaco;
    border-style: solid;
}

.pred {
    text-align: center;
}

.intro {
    font-size: 20px;
}
```

*/*This section involves the design of the inputs in the form*/*

```
input#s {  
    width: 300px;  
    border: 1px solid #ddd;  
    border-radius: 3px;  
    outline: 0;  
    padding: 7px;  
    color: black;  
    box-shadow: insert 1px 1px 5px rgba(0, 0, 0, 0.3);  
}
```

```
input#k {  
    width: 300px;  
    border: 1px solid #ddd;  
    border-radius: 3px;  
    outline: 0;  
    padding: 7px;  
    background-color: #fff;  
    box-shadow: insert 1px 1px 5px rgba(0, 0, 0, 0.3);  
}
```

```
input#tau {  
    width: 300px;  
    border: 1px solid #ddd;  
    border-radius: 3px;  
    outline: 0;  
    padding: 7px;  
    background-color: #fff;  
    box-shadow: insert 1px 1px 5px rgba(0, 0, 0, 0.3);  
}
```

```
input#r {  
    width: 300px;  
    border: 1px solid #ddd;  
    border-radius: 3px;  
    outline: 0;  
    padding: 7px;  
    background-color: #fff;  
    box-shadow: insert 1px 1px 5px rgba(0, 0, 0, 0.3);  
}
```



```

    /*Responsible for shadow backgrounds*/

    .table {
        display: table;
        margin: 0 auto;
        margin-left: 33.85%;
    }

    ul#horizontal-list {
        min-width: 696px;
        list-style: none;
    }

    /*This section is concerned with the link layout*/

    div.title img {
        display: inline-block;
        vertical-align: middle;
    }

    div.title h1 {
        margin-left: 150px;
        display: inline-block;
        vertical-align: middle;
        padding-left: 10%;
        font-family: "Lucida Handwriting";
    }
</style>
</head>

```

```

<body>
    <!--Initialize structure of Title and house picture-->
    <div class="title">
        <h1>Option Value Predictor</h1>
        
    </div>

```

3. Create the requirement.txt

```
!pip install pipreqs
```

Python

... *Output exceeds the [size limit](#). Open the full output data [in a text editor](#)*

```
Collecting pipreqs
  Downloading pipreqs-0.5.0-py3-none-any.whl.metadata (7.9 kB)
Collecting docopt==0.6.2 (from pipreqs)
  Downloading docopt-0.6.2.tar.gz (25 kB)
  Installing build dependencies ... Getting requirements to build wheel ... Installing backend depende
  Downloading ipython-8.12.3-py3-none-any.whl.metadata (5.7 kB)
Collecting nbconvert<8.0.0,>=7.11.0 (from pipreqs)
  Downloading nbconvert-7.16.4-py3-none-any.whl.metadata (8.5 kB)
Collecting yarg==0.1.9 (from pipreqs)
  Downloading yarg-0.1.9-py2.py3-none-any.whl.metadata (4.6 kB)
Requirement already satisfied: backcall in /Users/zhumanhui/Library/Python/3.10/lib/python/site-packages (
Requirement already satisfied: decorator in /Users/zhumanhui/Library/Python/3.10/lib/python/site-packages
Requirement already satisfied: jedi>=0.16 in /Users/zhumanhui/Library/Python/3.10/lib/python/site-packages
Requirement already satisfied: matplotlib-inline in /Users/zhumanhui/Library/Python/3.10/lib/python/site-p
Requirement already satisfied: pickleshare in /Users/zhumanhui/Library/Python/3.10/lib/python/site-package
Collecting prompt-toolkit!=3.0.37,<3.1.0,>=3.0.30 (from ipython==8.12.3->pipreqs)
```

```
!pipreqs
```

Python

```
INFO: Not scanning for jupyter notebooks.
WARNING: Import named "numpy" not found locally. Trying to resolve it at the PyPI server.
WARNING: Import named "numpy" was resolved to "numpy:1.26.4" package (https://pypi.org/project/numpy/).
Please, verify manually the final list of requirements.txt to avoid possible dependency confusions.
INFO: Successfully saved requirements file in /Users/zhumanhui/Desktop/Data Glacier/Week 4
Flask/requirements.txt
```

4. Deploy the App on Azure

4.1 Create a new Azure app service

Microsoft Azure

Show portal menu

Search resources, services, and docs (G+/)

[Home](#) > [App Services](#) >

Create Web App

App Service Web Apps lets you quickly build, deploy, and scale enterprise-grade web, mobile, and API apps running on any platform. Meet rigorous performance, scalability, security and compliance requirements while using a fully managed platform to perform infrastructure maintenance. [Learn more](#)

Project Details

Select a subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription *

Azure subscription 1

Resource Group *

option_price_prediction

[Create new](#)

Instance Details

Name *

option-price-prediction

.azurewebsites.net

Publish *

☒ Code ☐ Container ☐ Static Web App

Runtime stack *

Python 3.10

Operating System *

☒ Linux ☐ Windows

Region *

East US

Not finding your App Service Plan? Try a different region or select your App Service Environment.

Overview of web app:

^ Essentials

Resource group [\(move\)](#)
[option_price_prediction](#)

Status
Running

Location [\(move\)](#)
East US

Subscription [\(move\)](#)
[Azure subscription 1](#)

Subscription ID
2e8734f8-0b92-49f1-b1d5-c59c375f7229

Tags [\(edit\)](#)
data-glacier-intern :

Default domain
[option-price-prediction.azurewebsites.net](#)

App Service Plan
[ASP-optionpriceprediction-bacb \(B1: 1\)](#)

Operating System
Linux

Health Check
[Not Configured](#)

GitHub Project
[https://github.com/Manhui-z/Deploy-Web-App-in-Azure](#)

Properties


Monitoring

Logs

Capabilities

Notifications


Recommendations

 Web app

Name
option-price-prediction


Publishing model
Code

Runtime Stack
Python - 3.10

 Domains

Default domain
[option-price-prediction.azurewebsites.net](#)

Custom domain
[Add custom domain](#)

 Hosting


Plan Type
App Service plan

Name
[ASP-optionpriceprediction-bacb](#)

Operating System
Linux


Instance Count
1

SKU and size
Basic (B1) [Scale up](#)

 Deployment Center

Deployment logs
[View logs](#)

Last deployment

 Successful on Tuesday, June 4, 06:54:04 PM [Refresh](#)

Deployment provider
GitHubAction



Application Insights

Name

Not supported. [Learn more](#)



Networking

Virtual IP address

20.119.0.44

Outbound IP addresses

20.253.59.135,20.253.59.138,20.253.59.... [Show More](#)

Additional Outbound IP addresses

20.253.59.135,20.253.59.138,20.253.59.... [Show More](#)

Virtual network integration

Not configured

4.2 Deploy it

[Code](#) [Issues](#) [Pull requests](#) [Actions](#) [Projects](#) [Wiki](#) [Security](#) [Insights](#) [Settings](#)

← Build and deploy Python app to Azure Web App - option-price-prediction

✓ Add or update the Azure App Service build and deployment workflow config #1

Re-run all jobs

Summary

Jobs

- ✓ build
- ✓ deploy

Run details

- Usage
- Workflow file

Triggered via push 32 minutes ago

Manhui-z pushed → 6337bf5 main

Status

Success

Total duration

5m 29s

Artifacts

1

main_option-price-prediction.yml

on: push

✓ build23s

→

✓ deploy4m 49s

https://option-price-prediction.azurewe...

Artifacts

Produced during runtime

Name	Size
python-app	15.8 MB

5. Test the website

S: Current Asset Value

1401.44

K: Strike price of Option

1625

tau: Time to maturity (in years)

0.090411

r: Annual interest rate

0.0116

Predict

S: Current Asset Value

K: Strike price of Option

tau: Time to maturity (in years)

r: Annual interest rate

Predict

Predicted option value is: \$ 1.455