Week 4: Deployment on Flask

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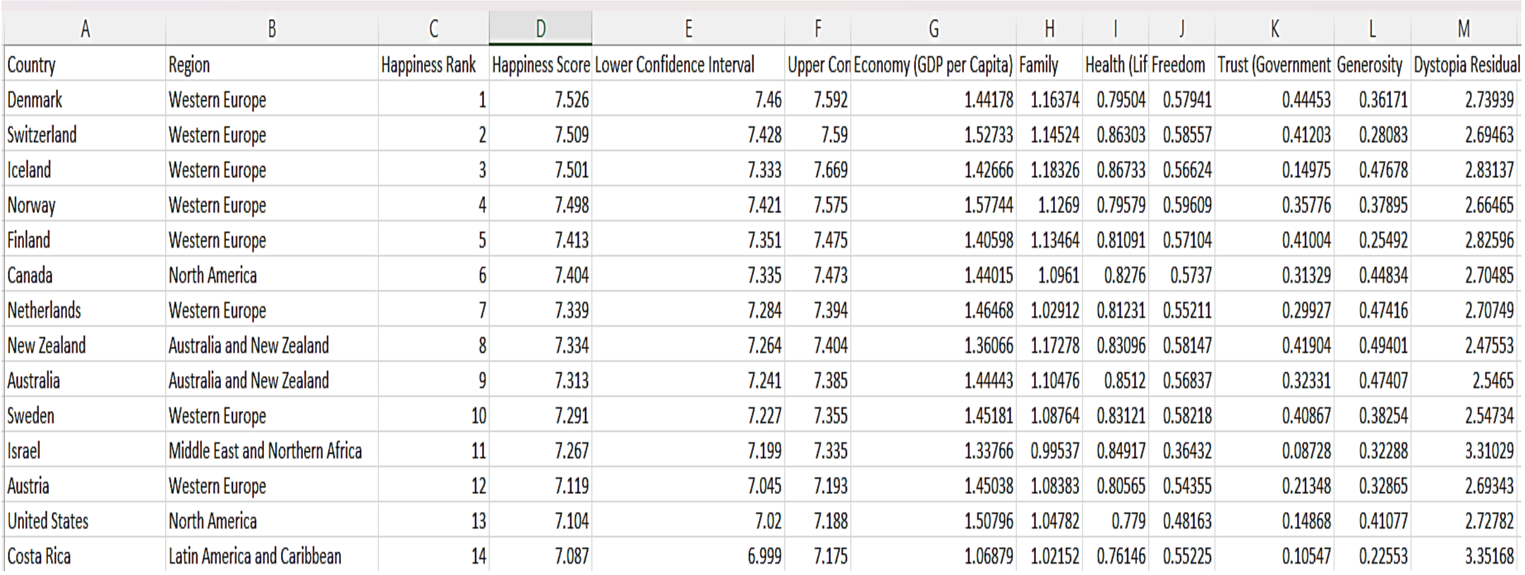
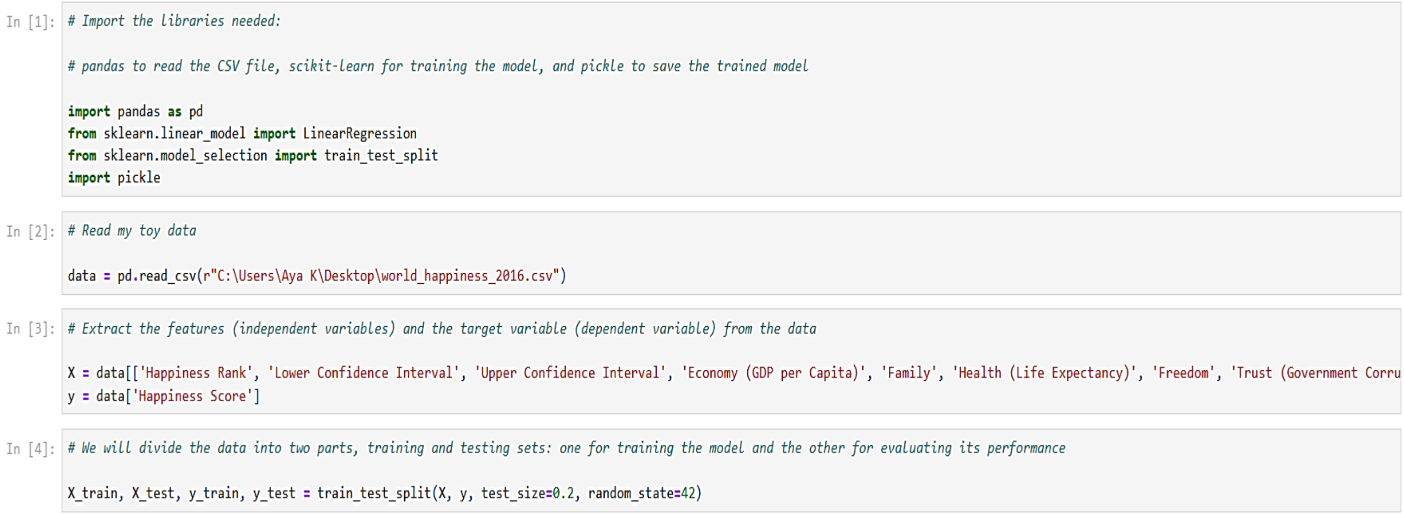
Submitted to: Data Glacier

This is a sample of the toy data I chose to work with. The data represents the 2016 World Happiness by country and region using a variety of different variables such as Life Expectancy, Family, Economy, Generosity, Freedom, etc.



A	B	C	D	E	F	G	H	I	J	K	L	M
Country	Region	Happiness Rank	Happiness Score	Lower Confidence Interval	Upper Con	Economy (GDP per Capita)	Family	Health (Lif	Freedom	Trust (Government	Generosity	Dystopia Residual
Denmark	Western Europe	1	7.526	7.46	7.592	1.44178	1.16374	0.79504	0.57941	0.44453	0.36171	2.73939
Switzerland	Western Europe	2	7.509	7.428	7.59	1.52733	1.14524	0.86303	0.58557	0.41203	0.28083	2.69463
Iceland	Western Europe	3	7.501	7.333	7.669	1.42666	1.18326	0.86733	0.56624	0.14975	0.47678	2.83137
Norway	Western Europe	4	7.498	7.421	7.575	1.57744	1.1269	0.79579	0.59609	0.35776	0.37895	2.66465
Finland	Western Europe	5	7.413	7.351	7.475	1.40598	1.13464	0.81091	0.57104	0.41004	0.25492	2.82596
Canada	North America	6	7.404	7.335	7.473	1.44015	1.0961	0.8276	0.5737	0.31329	0.44834	2.70485
Netherlands	Western Europe	7	7.339	7.284	7.394	1.46468	1.02912	0.81231	0.55211	0.29927	0.47416	2.70749
New Zealand	Australia and New Zealand	8	7.334	7.264	7.404	1.36066	1.17278	0.83096	0.58147	0.41904	0.49401	2.47553
Australia	Australia and New Zealand	9	7.313	7.241	7.385	1.44443	1.10476	0.8512	0.56837	0.32331	0.47407	2.5465
Sweden	Western Europe	10	7.291	7.227	7.355	1.45181	1.08764	0.83121	0.58218	0.40867	0.38254	2.54734
Israel	Middle East and Northern Africa	11	7.267	7.199	7.335	1.33766	0.99537	0.84917	0.36432	0.08728	0.32288	3.31029
Austria	Western Europe	12	7.119	7.045	7.193	1.45038	1.08383	0.80565	0.54355	0.21348	0.32865	2.69343
United States	North America	13	7.104	7.02	7.188	1.50796	1.04782	0.779	0.48163	0.14868	0.41077	2.72782
Costa Rica	Latin America and Caribbean	14	7.087	6.999	7.175	1.06879	1.02152	0.76146	0.55225	0.10547	0.22553	3.35168

In this next step, I have performed all required code on Jupyter Notebook needed to import and read my toy data using Pandas and extract features needed to build the model, train my data using a linear regression machine learning model using Sklearn, and finally save my model using Pickle as “happiness_model”.



```
In [1]: # Import the libraries needed:

        # pandas to read the CSV file, scikit-learn for training the model, and pickle to save the trained model

        import pandas as pd
        from sklearn.linear_model import LinearRegression
        from sklearn.model_selection import train_test_split
        import pickle

In [2]: # Read my toy data

        data = pd.read_csv(r"C:\Users\Aya K\Desktop\world_happiness_2016.csv")

In [3]: # Extract the features (independent variables) and the target variable (dependent variable) from the data

        X = data[['Happiness Rank', 'Lower Confidence Interval', 'Upper Confidence Interval', 'Economy (GDP per Capita)', 'Family', 'Health (Life Expectancy)', 'Freedom', 'Trust (Government Corru
        y = data['Happiness Score']

In [4]: # We will divide the data into two parts, training and testing sets: one for training the model and the other for evaluating its performance

        X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

In [5]:

```
# We will use the training data to train a machine learning model. In this case, we'll use linear regression

model = LinearRegression()
model.fit(X_train, y_train)
```

Out[5]:

```
▾ LinearRegression
LinearRegression()
```

In [6]:

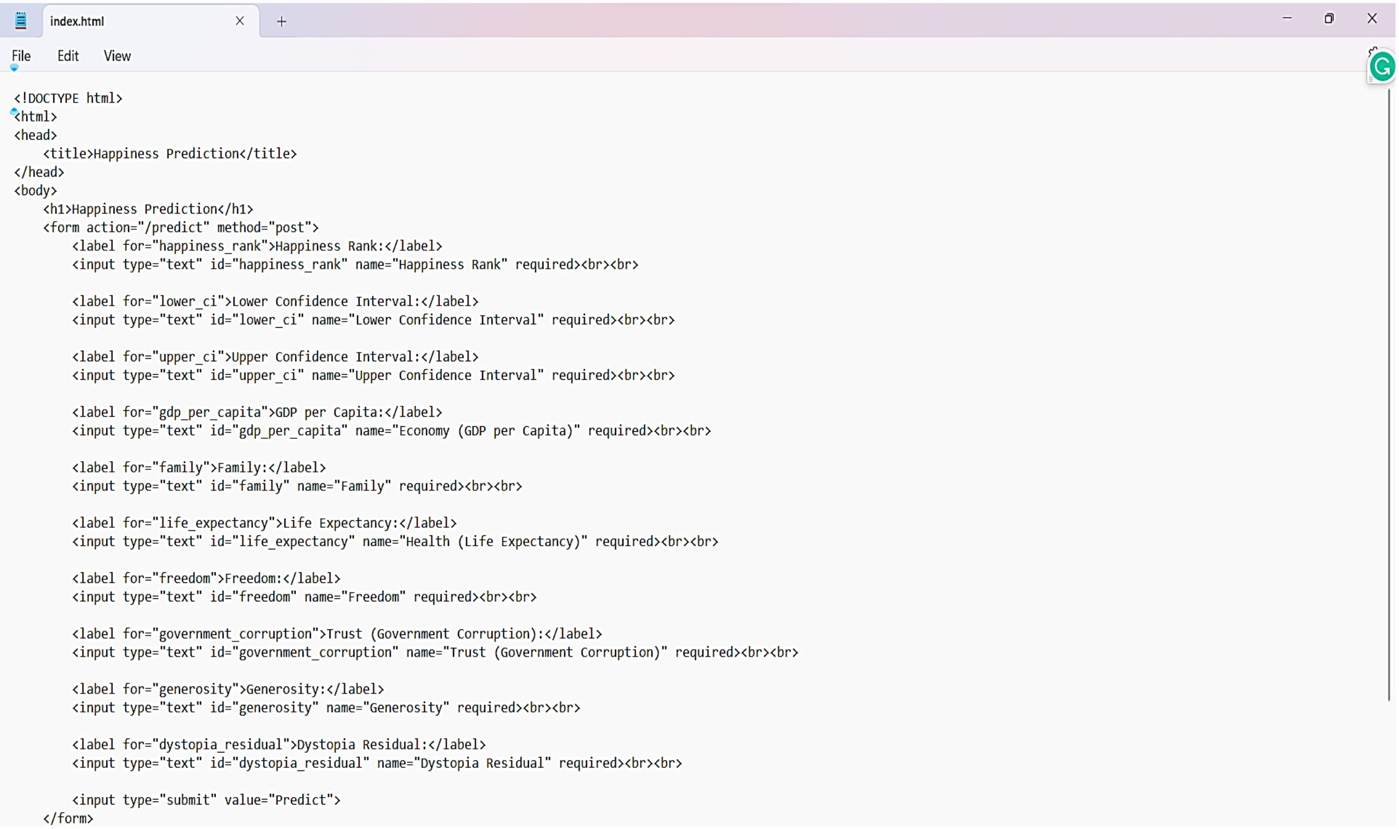
```
# We will calculate the model's accuracy or any other appropriate metric to assess its performance

accuracy = model.score(X_test, y_test)
print("Model Accuracy:", accuracy)
```

```
Model Accuracy: 1.0
```

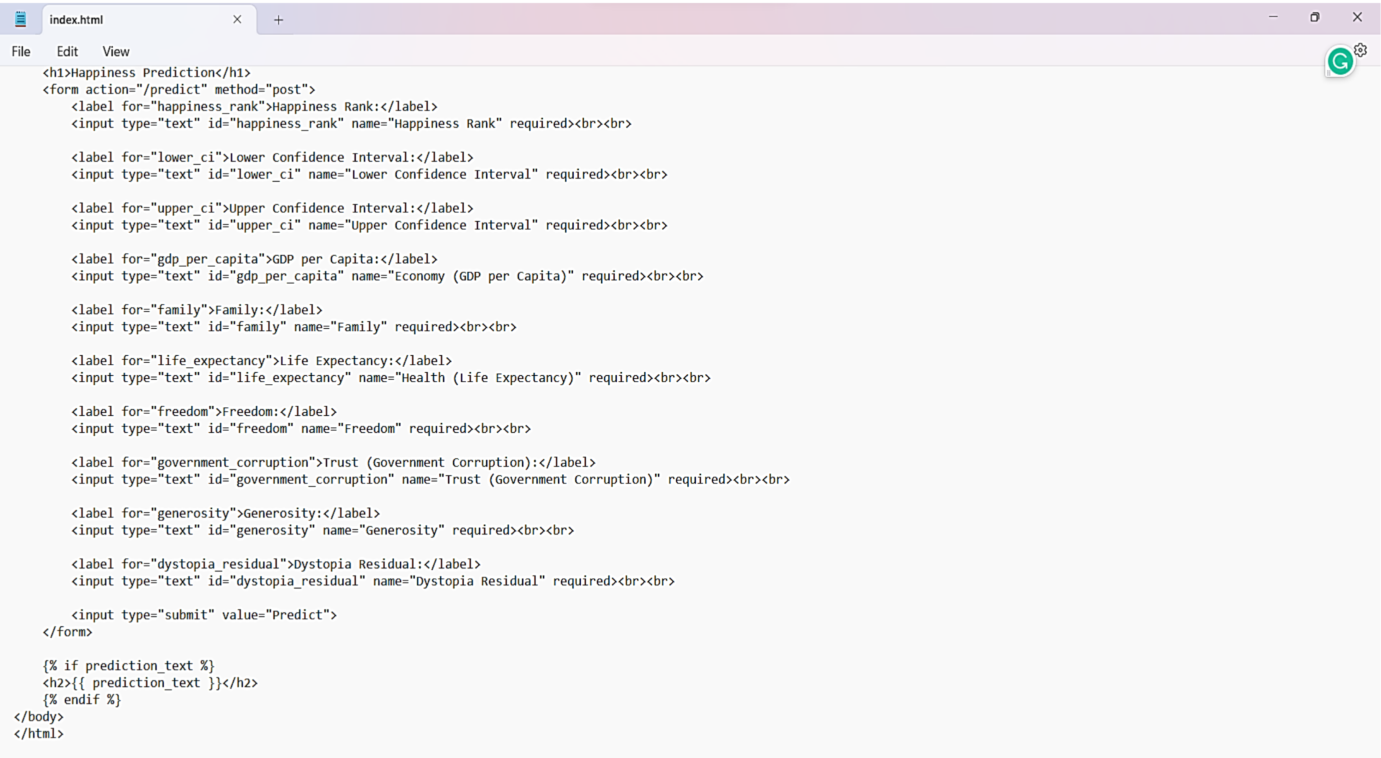
In [7]:

```
# Save the model using pickle

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

Before using Flask to deploy my web app, I will create a file as index.html to help create the web design and application and also include some of the variables from the toy data so the user can predict them.

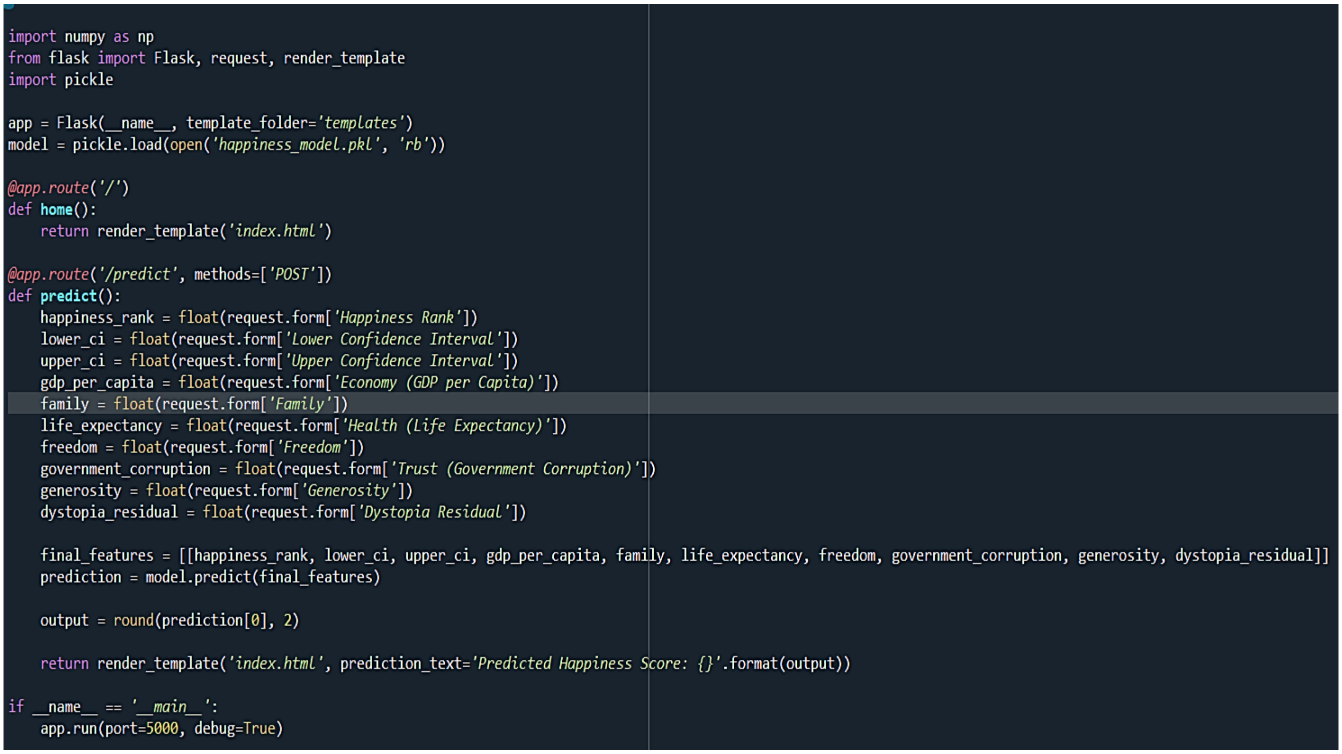


```
<!DOCTYPE html>
<html>
<head>
    <title>Happiness Prediction</title>
</head>
<body>
    <h1>Happiness Prediction</h1>
    <form action="/predict" method="post">
        <label for="happiness_rank">Happiness Rank:</label>
        <input type="text" id="happiness_rank" name="Happiness Rank" required><br><br>

        <label for="lower_ci">Lower Confidence Interval:</label>
        <input type="text" id="lower_ci" name="Lower Confidence Interval" required><br><br>

        <label for="upper_ci">Upper Confidence Interval:</label>
        <input type="text" id="upper_ci" name="Upper Confidence Interval" required><br><br>

        <label for="gdp_per_capita">GDP per Capita:</label>
        <input type="text" id="gdp_per_capita" name="Economy (GDP per Capita)" required><br><br>

        <label for="family">Family:</label>
        <input type="text" id="family" name="Family" required><br><br>

        <label for="life_expectancy">Life Expectancy:</label>
        <input type="text" id="life_expectancy" name="Health (Life Expectancy)" required><br><br>

        <label for="freedom">Freedom:</label>
        <input type="text" id="freedom" name="Freedom" required><br><br>

        <label for="government_corruption">Trust (Government Corruption):</label>
        <input type="text" id="government_corruption" name="Trust (Government Corruption)" required><br><br>

        <label for="generosity">Generosity:</label>
        <input type="text" id="generosity" name="Generosity" required><br><br>

        <label for="dystopia_residual">Dystopia Residual:</label>
        <input type="text" id="dystopia_residual" name="Dystopia Residual" required><br><br>

        <input type="submit" value="Predict">
    </form>
```



```html
    <h1>Happiness Prediction</h1>
    <form action="/predict" method="post">
        <label for="happiness_rank">Happiness Rank:</label>
        <input type="text" id="happiness_rank" name="Happiness Rank" required><br><br>

        <label for="lower_ci">Lower Confidence Interval:</label>
        <input type="text" id="lower_ci" name="Lower Confidence Interval" required><br><br>

        <label for="upper_ci">Upper Confidence Interval:</label>
        <input type="text" id="upper_ci" name="Upper Confidence Interval" required><br><br>

        <label for="gdp_per_capita">GDP per Capita:</label>
        <input type="text" id="gdp_per_capita" name="Economy (GDP per Capita)" required><br><br>

        <label for="family">Family:</label>
        <input type="text" id="family" name="Family" required><br><br>

        <label for="life_expectancy">Life Expectancy:</label>
        <input type="text" id="life_expectancy" name="Health (Life Expectancy)" required><br><br>

        <label for="freedom">Freedom:</label>
        <input type="text" id="freedom" name="Freedom" required><br><br>

        <label for="government_corruption">Trust (Government Corruption):</label>
        <input type="text" id="government_corruption" name="Trust (Government Corruption)" required><br><br>

        <label for="generosity">Generosity:</label>
        <input type="text" id="generosity" name="Generosity" required><br><br>

        <label for="dystopia_residual">Dystopia Residual:</label>
        <input type="text" id="dystopia_residual" name="Dystopia Residual" required><br><br>

        <input type="submit" value="Predict">
    </form>

    {% if prediction_text %}
    <h2>{{ prediction_text }}</h2>
    {% endif %}
</body>
</html>
```

After preparing all files needed, I will start my deploying code on Spyder using Flask and Pickle.

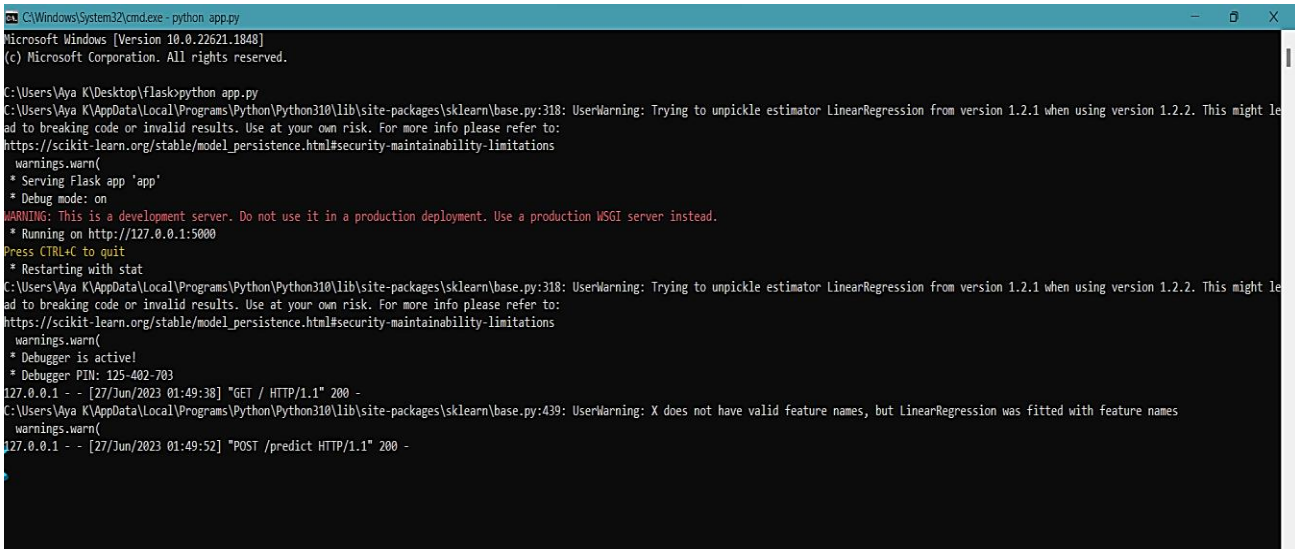


```
import numpy as np
from flask import Flask, request, render_template
import pickle

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

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

@app.route('/predict', methods=['POST'])
def predict():
    happiness_rank = float(request.form['Happiness Rank'])
    lower_ci = float(request.form['Lower Confidence Interval'])
    upper_ci = float(request.form['Upper Confidence Interval'])
    gdp_per_capita = float(request.form['Economy (GDP per Capita)'])
    family = float(request.form['Family'])
    life_expectancy = float(request.form['Health (Life Expectancy)'])
    freedom = float(request.form['Freedom'])
    government_corruption = float(request.form['Trust (Government Corruption)'])
    generosity = float(request.form['Generosity'])
    dystopia_residual = float(request.form['Dystopia Residual'])

    final_features = [[happiness_rank, lower_ci, upper_ci, gdp_per_capita, family, life_expectancy, freedom, government_corruption, generosity, dystopia_residual]]
    prediction = model.predict(final_features)

    output = round(prediction[0], 2)

    return render_template('index.html', prediction_text='Predicted Happiness Score: {}'.format(output))

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

Using the command prompt for my specified directory, I will get the HTTP access to my trained web app.

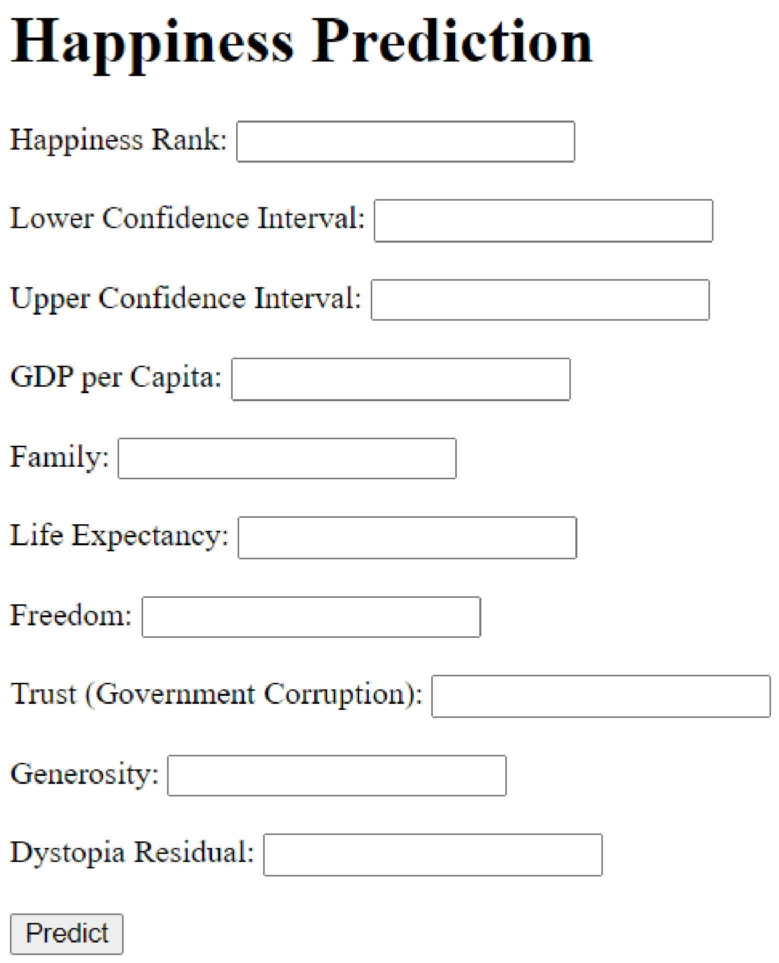
As per the picture below, I will copy this link to my Chrome browser to access the web app.

http://127.0.0.1:5000/



```
Microsoft Windows [Version 10.0.22621.1848]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Aya K\Desktop\flask>python app.py
C:\Users\Aya K\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\base.py:318: UserWarning: Trying to unpickle estimator LinearRegression from version 1.2.1 when using version 1.2.2. This might le
ad to breaking code or invalid results. Use at your own risk. For more info please refer to:
https://scikit-learn.org/stable/model_persistence.html#security-maintainability-limitations
  warnings.warn(
 * Serving Flask app 'app'
 * Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
 * Restarting with stat
C:\Users\Aya K\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\base.py:318: UserWarning: Trying to unpickle estimator LinearRegression from version 1.2.1 when using version 1.2.2. This might le
ad to breaking code or invalid results. Use at your own risk. For more info please refer to:
https://scikit-learn.org/stable/model_persistence.html#security-maintainability-limitations
  warnings.warn(
 * Debugger is active!
 * Debugger PIN: 125-402-703
127.0.0.1 - - [27/Jun/2023 01:49:38] "GET / HTTP/1.1" 200 -
C:\Users\Aya K\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\base.py:439: UserWarning: X does not have valid feature names, but LinearRegression was fitted with feature names
  warnings.warn(
127.0.0.1 - - [27/Jun/2023 01:49:52] "POST /predict HTTP/1.1" 200 -
```

This is the displayed result upon access to the link:



Happiness Prediction

Happiness Rank:

Lower Confidence Interval:

Upper Confidence Interval:

GDP per Capita:

Family:

Life Expectancy:

Freedom:

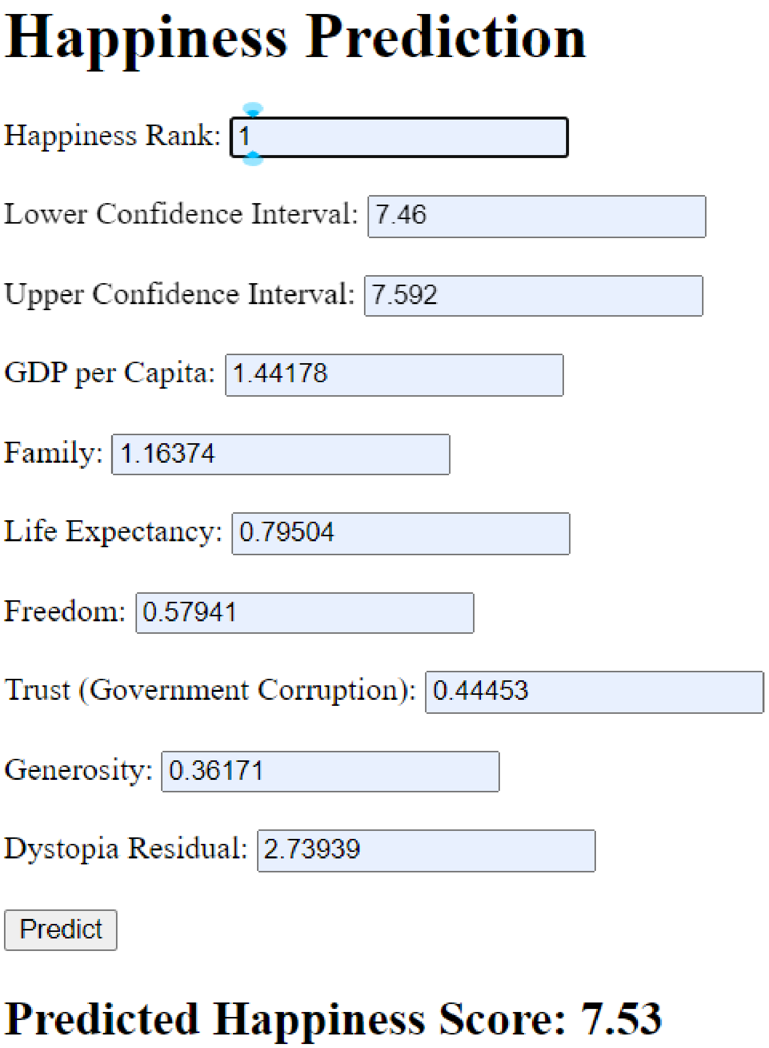
Trust (Government Corruption):

Generosity:

Dystopia Residual:

I tried to test the accuracy of my web app results by using the data from Denmark.

My web app shows high accuracy of predicted results.



Happiness Prediction

Happiness Rank: 1

Lower Confidence Interval: 7.46

Upper Confidence Interval: 7.592

GDP per Capita: 1.44178

Family: 1.16374

Life Expectancy: 0.79504

Freedom: 0.57941

Trust (Government Corruption): 0.44453

Generosity: 0.36171

Dystopia Residual: 2.73939

Predicted Happiness Score: 7.53