Week 5: Model Deployment on Flask

Internship Batch LISUM37

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Data Information
Tabular data details: Medical_insurance

Total number of observations	2772
Total number of files	1
Total number of features	7
Base format of the file	.csv
Size of the data	0.112 MB

Introduction
The aim of the project was to deploy a Linear Regression model that would predict the charges insurance client would pay given certain variables.

Building the Model

In [1]:
```
# import necessary libraries
import pandas as pd
import pickle
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
```

In [2]:
```
# import data
data = pd.read_csv('Medical_insurance.csv')
```

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

Out[3]:

	age	sex	bmi	children	smoker	region	charges
0	19	female	27.900	0	yes	southwest	16884.92400
1	18	male	33.770	1	no	southeast	1725.55230
2	28	male	33.000	3	no	southeast	4449.46200
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.880	0	no	northwest	3866.85520

In [4]:
```
data.describe()
```

Out[4]:

	age	bmi	children	charges
count	2772.000000	2772.000000	2772.000000	2772.000000
mean	39.109668	30.701349	1.101732	13261.369959
std	14.081459	6.129449	1.214806	12151.768945
min	18.000000	15.960000	0.000000	1121.873900
25%	26.000000	26.220000	0.000000	4687.797000
50%	39.000000	30.447500	1.000000	9333.014350
75%	51.000000	34.770000	2.000000	16577.779500
max	64.000000	53.130000	5.000000	63770.428010

In [6]:
```
# Data Preprocessing
from sklearn.preprocessing import LabelEncoder
```

In [7]:
```
encode = LabelEncoder()
```

In [8]:
```
data['sex'] = encode.fit_transform(data['sex'])
data['smoker'] = encode.fit_transform(data['smoker'])
data['region'] = encode.fit_transform(data['region'])
```

In [9]:
```
data
```

Out[9]:

	age	sex	bmi	children	smoker	region	charges
0	19	0	27.900	0	1	3	16884.92400
1	18	1	33.770	1	0	2	1725.55230
2	28	1	33.000	3	0	2	4449.46200
3	33	1	22.705	0	0	1	21984.47061
4	32	1	28.880	0	0	1	3866.85520
...	...	...	...	...	...	...	...
2767	47	0	45.320	1	0	2	8569.86180
2768	21	0	34.600	0	0	3	2020.17700
2769	19	1	26.030	1	1	1	16450.89470
2770	23	1	18.715	0	0	1	21595.38229
2771	54	1	31.600	0	0	3	9850.43200

2772 rows × 7 columns

Create the x and y data necessary for the regression model

In [15]:
```
x = data.drop('charges', axis=1)
y = data['charges']
```

In [16]:
```
x
```

Out[16]:

	age	sex	bmi	children	smoker	region
0	19	0	27.900	0	1	3
1	18	1	33.770	1	0	2
2	28	1	33.000	3	0	2
3	33	1	22.705	0	0	1
4	32	1	28.880	0	0	1
...	...	...	...	...	...	...
2767	47	0	45.320	1	0	2
2768	21	0	34.600	0	0	3
2769	19	1	26.030	1	1	1
2770	23	1	18.715	0	0	1
2771	54	1	31.600	0	0	3

2772 rows × 6 columns

In [17]:
```
y
```

Out[17]:
```
0       16884.92400
1        1725.55230
2        4449.46200
3       21984.47061
4        3866.85520
           ...
2767     8569.86180
2768     2020.17700
2769    16450.89470
2770    21595.38229
2771     9850.43200
Name: charges, Length: 2772, dtype: float64
```

Save model and pickle it

```
In [15]: x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3, random_state=101)

In [16]: print(x_train.shape, x_test.shape)
         print(y_train.shape, y_test.shape)

         (1940, 6) (832, 6)
         (1940,) (832,)

In [17]: regression = LinearRegression()
         regression.fit(x_train, y_train)

Out[17]: LinearRegression()

In [18]: pickle.dump(regression, open('model.pickle', 'wb'))
```

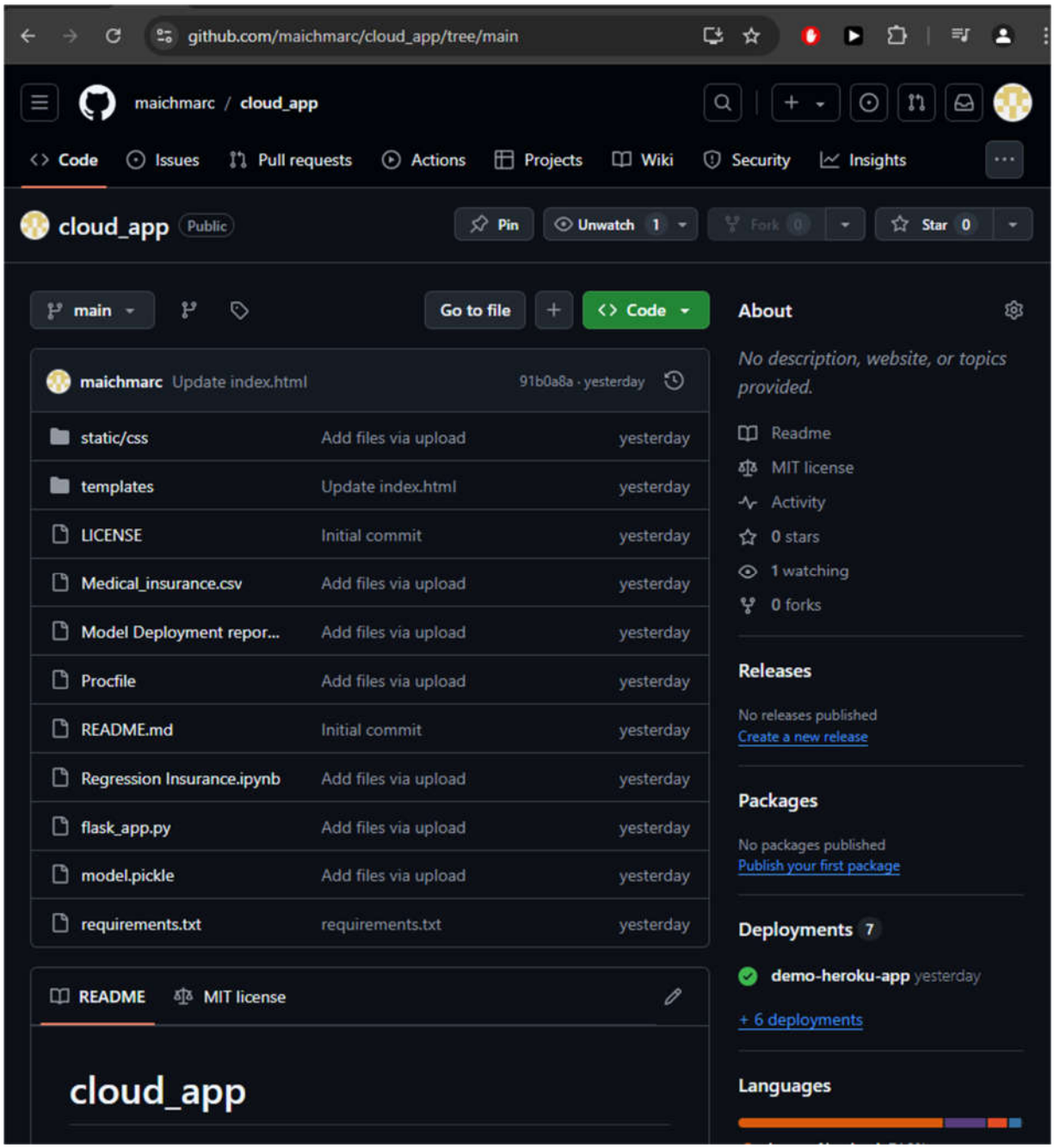
Create the Index HTML file

```
<!DOCTYPE html>


<head>
    <meta charset="UTF-8">
    <title>ML API</title>
    <link href='https://fonts.googleapis.com/css?family=Pacifico' rel="stylesheet" type="text/css">
<link href='https://fonts.googleapis.com/css?family=Arimio' rel="stylesheet" type="text/css">
<link href='https://fonts.googleapis.com/css?family=Mind:300' rel="stylesheet" type="text/css">
<link href='https://fonts.googleapis.com/css?family=Open+Sans+Condensed:300' rel="stylesheet" type="text/css">
<link rel="stylesheet" href="{{ url_for('static', filename='css/style.css')}}">

</head>

<body>
    <div class='login'>
        <h1>Predict Insurance Charges</h1>
<!--    Main input for receiving query to our ML-->
    <form action="/predict" method="post">
        <input type='text' name='age' placeholder='income' required='required'/>
        <input type='text' name='sex' placeholder='sex' required='required'/>
        <input type='text' name='bmi' placeholder='bmi' required='required'/>
        <input type='text' name='children' placeholder='children' required='required'/>
        <input type='text' name='smoker' placeholder='smoker' required='required'/>
        <input type='text' name='region' placeholder='region' required='required'/>


        <button type="submit" class="btn btn-primary btn-block btn-large">Predict</button>
    </form>
    <br>
    <br>
    {{ prediction_text}}
    </div>

</body>
```

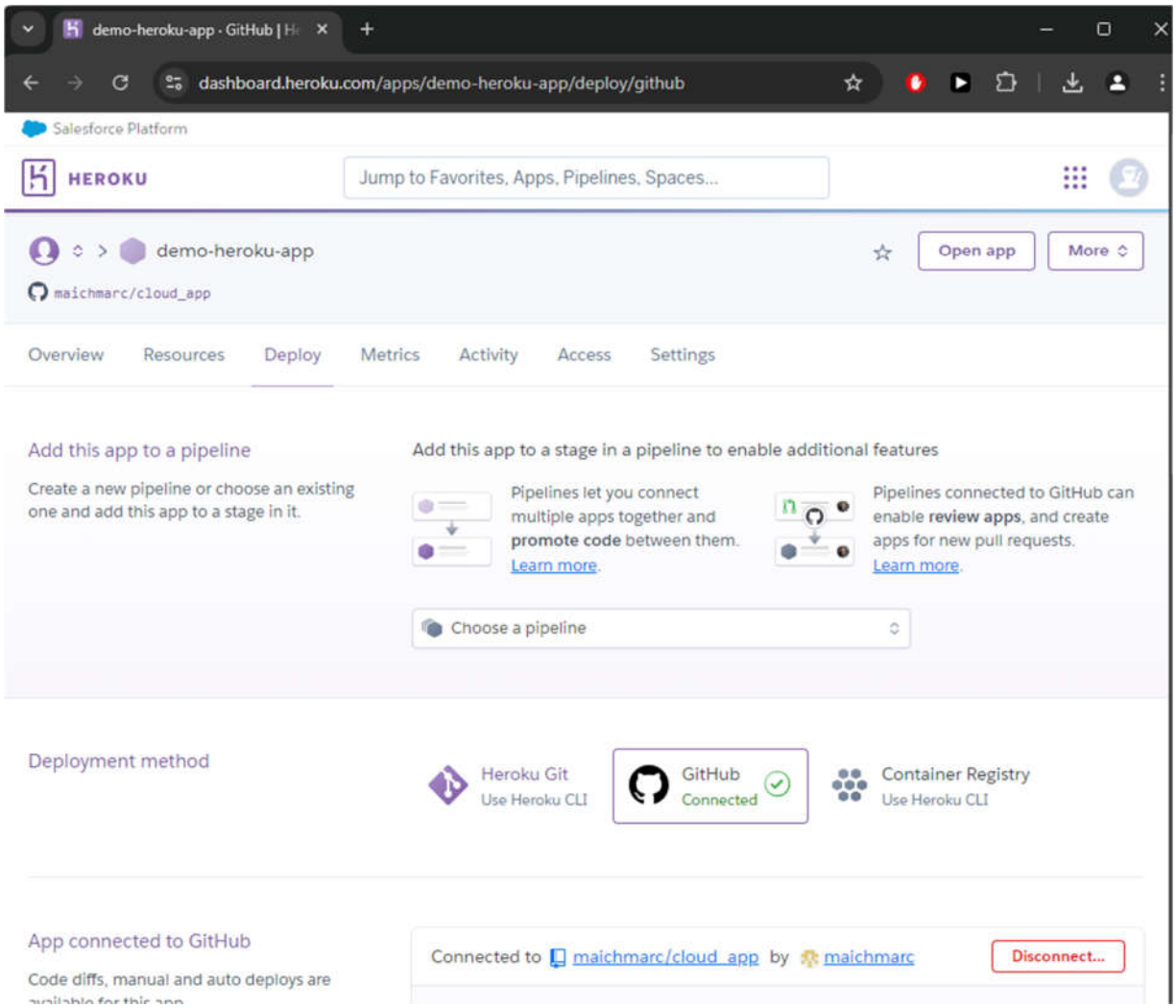
Create the Flask app

```python
# Using flask app to make an api
# import necessary libraries
from flask import Flask, jsonify, request, render_template
import pickle
import pandas as pd
from sklearn.preprocessing import LabelEncoder

# create a Flask app
app = Flask(__name__)


@app.route('/')  # , methods=['GET', 'POST'])
def home():
    return render_template('index.html')


@app.route('/predict', methods=['POST'])
def price_predict():
    model = pickle.load(open('model.pickle', 'rb'))
    age = request.form.get('age')
    sex = request.form.get('sex')
    bmi = request.form.get('bmi')
    children = request.form.get('children')
    smoker = request.form.get('smoker')
    region = request.form.get('region')
    encoder = LabelEncoder()

    test_df = pd.DataFrame({'age': [age], 'sex': [sex], 'bmi': [bmi], 'children': [children], 'smoker': [smoker],
                            'region': [region]})
    test_df['sex'] = encoder.fit_transform(test_df['sex'])
    test_df['smoker'] = encoder.fit_transform(test_df['smoker'])
    test_df['region'] = encoder.fit_transform(test_df['region'])
    pred_price = model.predict(test_df)
    output = round(pred_price[0], 2)
    return render_template('index.html', prediction_text='Charges should be ${}'.format(output))


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

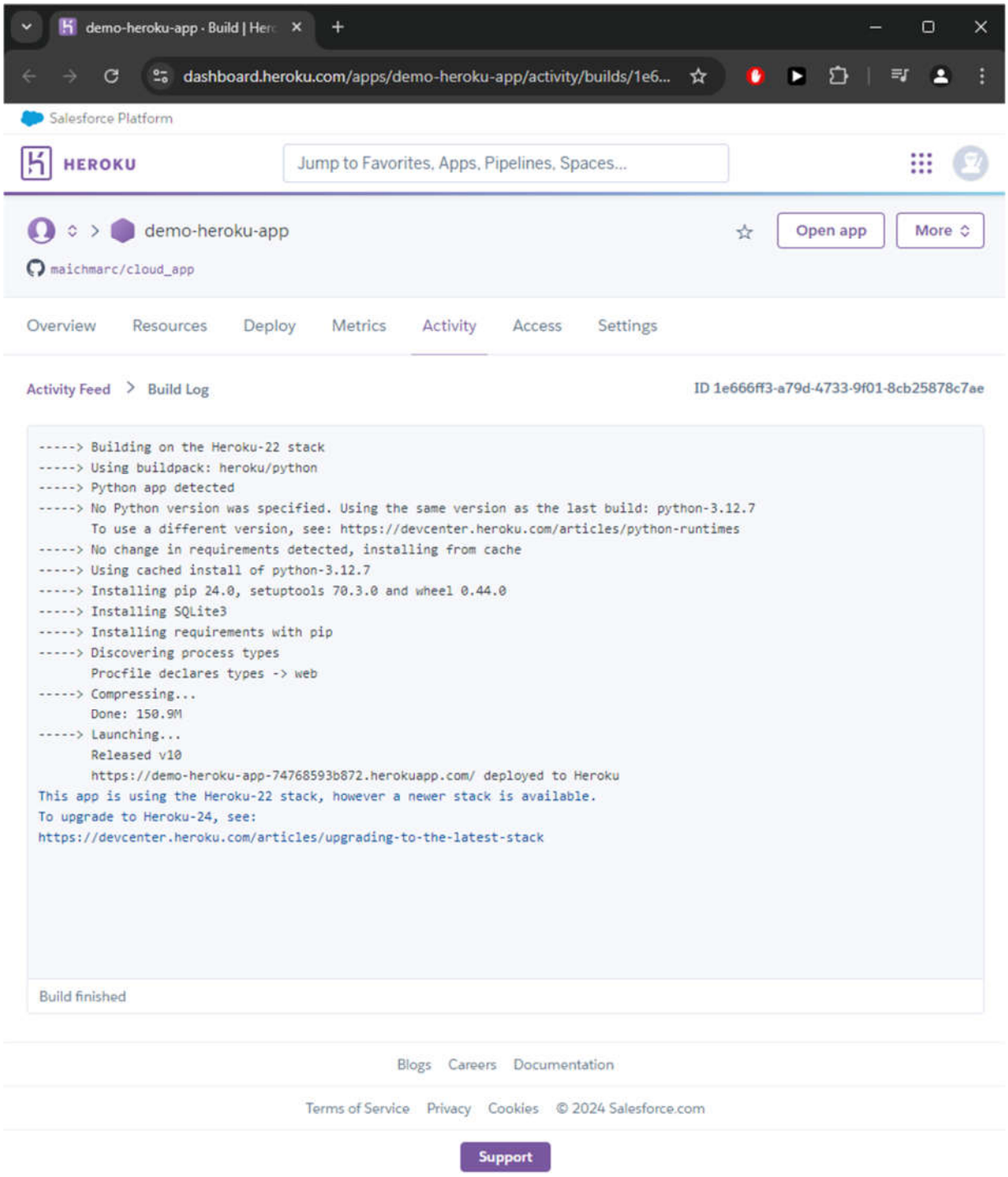
Upload app to Github repository



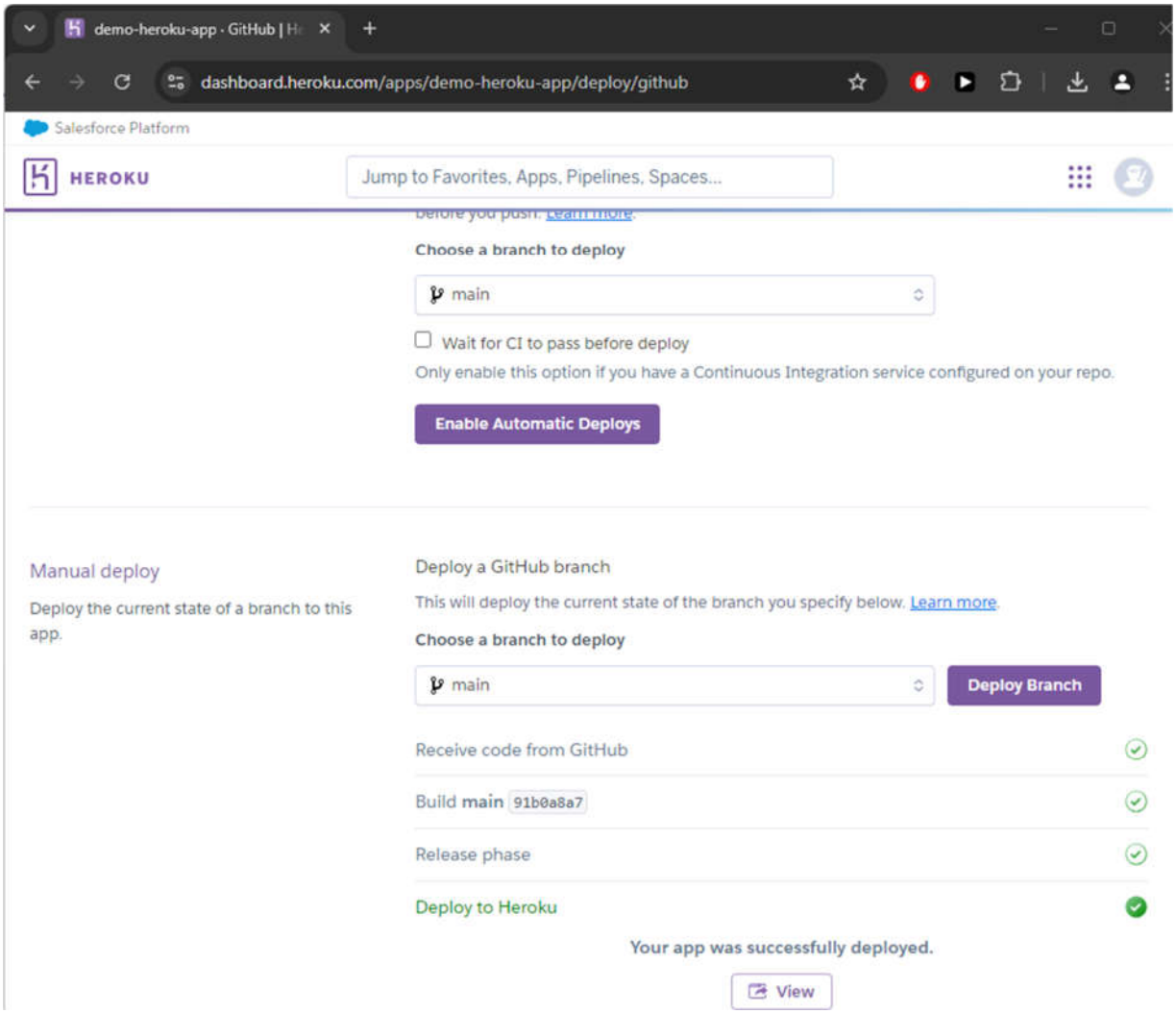
Connect Heroku to Github



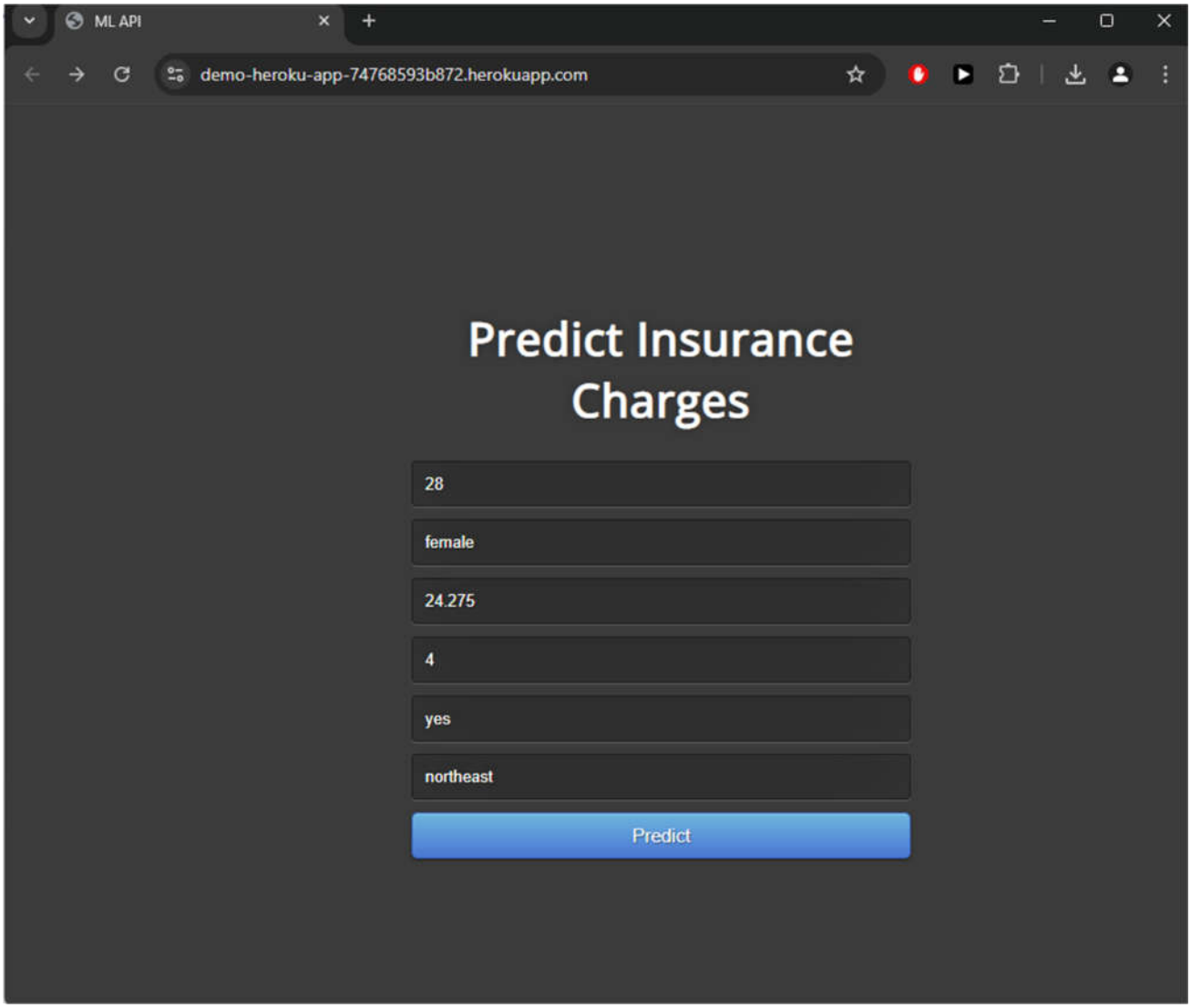
Build the model on Heroku



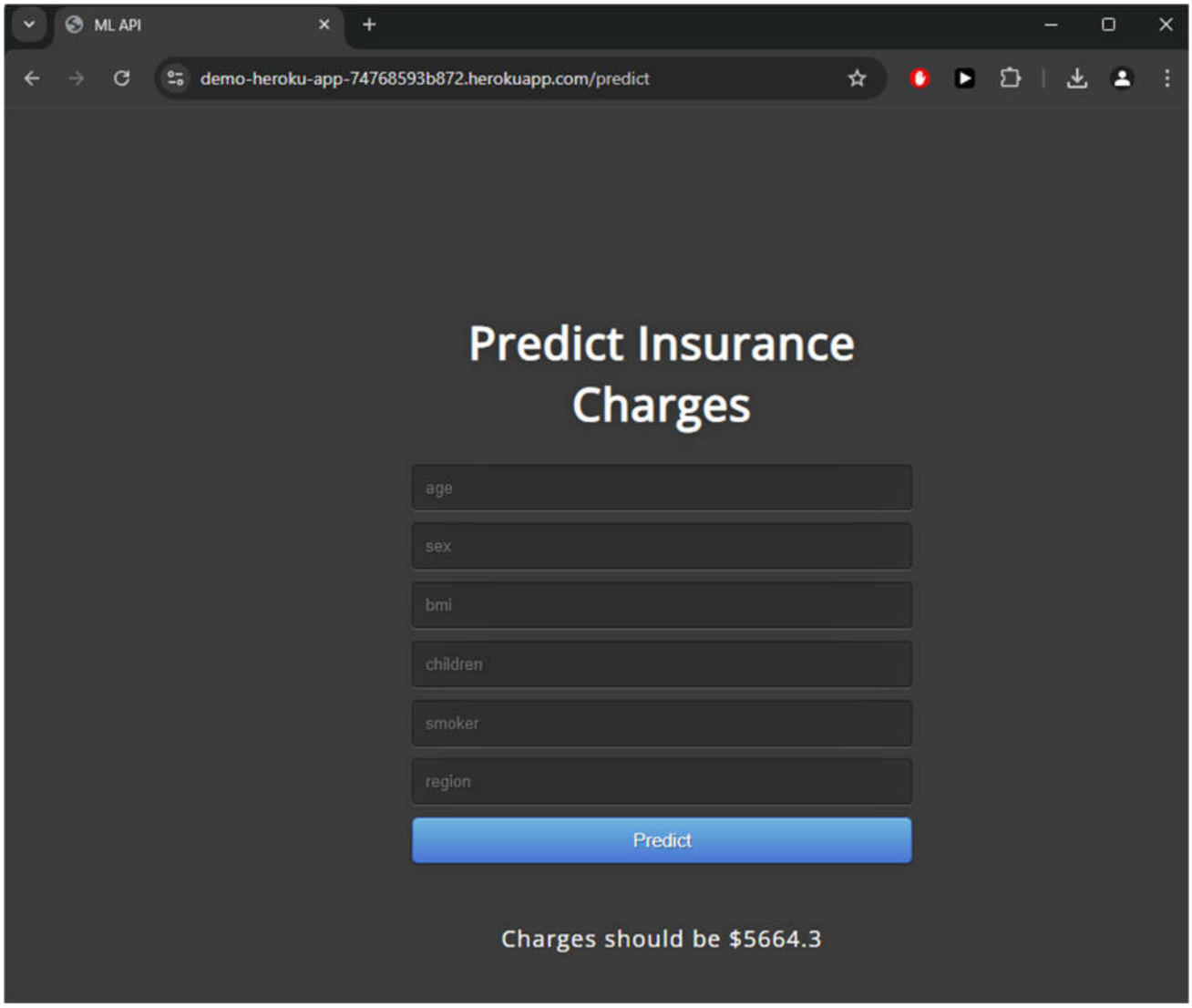
Deploy the app on Heroku



Using the url provided by Heroku open the app on browser



Input variables



Predicted value