Project：Machine Learning Model Deployment Using Flask

Data Science Virtual Internship Program

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Submitted to: Data Glazier

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Agenda

- Executive Summary
- Business Understanding
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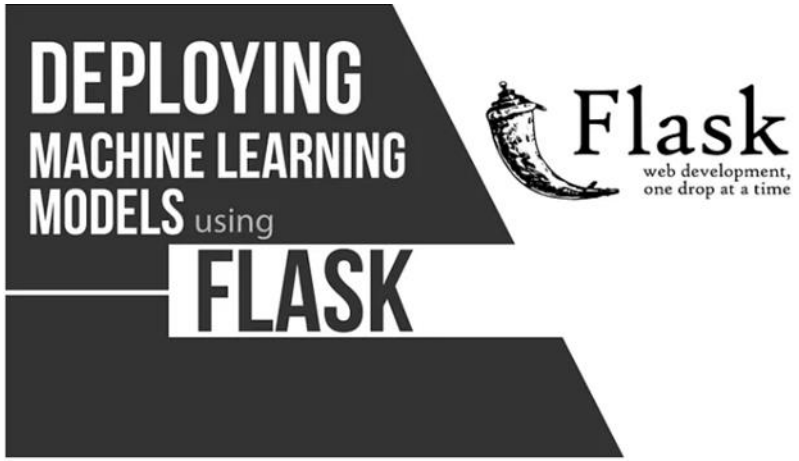
- Data modelling
- Evaluation
- Deployment



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Executive Summary

The main idea of this project is to develop a machine learning algorithm using one of the common toy data set called the iris data and then deploying it on a webserver using Flask.
Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries and It's a lightweight WSGI (web server gateway interface)

Machine learning is the ability of computers to learn from a given set of data, and to mimic humans to deploy desired outcomes without being programmed.

Machine learning falls under three categories:

- Supervised learning
- Unsupervised Learning
- Reinforcement learning

Model deployment is the process of putting machine learning models into production. The reason why we deploy machine learning models is to make them available for users, developers or systems to interact with the applications thereby making good business decision with it's main goal of solving a problem
There are many ways to deploy machine Learning models, examples are StreamLit, AWS(Amazon Web Services), Flask to name a few. In this project, we will be using flask to deploy models on to the web.

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Business Understanding

The main objective of this project is to examine the iris data using data mining techniques available, to find an optimal algorithm to correctly predict a plant specie based on their distinctive feature and measurements. In this work, there are four different classifier namely RandomForest, Decision Tree, Logistics Regression and K-nearest Neighbours that will be used to classify the iris dataset.

The idea is to automatically predict which class of species at a given time the iris plant belongs to based on their respectively measurement properties by using a machine learning algorithm derived from the iris data set.

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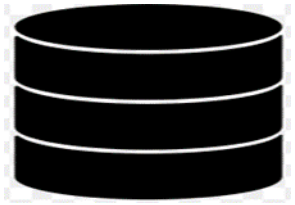
Data Understanding

Iris data set



The iris is an open access flower based dataset and is normally available on UCI dataset, kaggle or from the scikit-learn website . The dataset consist 150 observations with five different attributes/features i.e.,

- Sepal length
- Sepal width
- Petal length
- Petal width
- Class.

This is perhaps the best known data set to be used in pattern recognition settings. The data set contains 3 classes of 50 observations each, where each class refers to a type of iris plant. These types are:

- Iris setosa
- Iris virginica
- Iris versicolor

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Data Preparation

This is the most complex and tedious stage of the process where the data collected needs to be prepared in line with the business plan.

In this stage, the main objective includes cleaning the data, dealing with missing and unknown values, reducing data dimensionality, transforming data values, and sometimes reformatting the data to suite the desired mining solution. Other operations performed under this stage includes data aggregation, normalisation, and attribute creation i.e., making new variables to tackle specific business queries.

The features of the data set, are renamed for simplicity and to make the web application interface more readable.

This is a simple toy data set with no missing values, and no anomalies to the data set ,hence it provides a solid base to be used for the sake of this project

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Data modelling

In this stage, the sole concern is to select a data mining technique from a list of possible mining tasks, activities like generating a test design/modelling solution is sort and a model is built to see how the data performs.
Other activity considered in this stage is the setting of model parameters. Also results should be assessed by all stakeholders to make sure that model can meet data mining objectives

This the post-processing stage where these discovered patterns from mining the data are analysed. These results are evaluated, and the mining process is reviewed and checked against the outcome to determine the best results.

Four algorithms were chosen for this modelling stage namely RandomForest, Decision Tree, Logistics Regression and K-nearest Neighbours.

Steps taken for the modelling stage

- The feature of the data set are put into independent and dependent variables for the model building.
- The iris data was standardised using a standard scaler technique in python
- The iris data set was split into training and testing data in the ratio 0.70: 0.30, 70% for training the data and 30% for testing the outcome.

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Evaluation

Model Evaluation plays a crucial role in the model development process, where it helps to find the best model that fit and represents the data set in question. These models are assessed based on their performance. Data mining is an iterative process; hence the generated modelling results should be evaluated against the business objectives, and sometimes should the accuracy of the mining model be poor, the whole mining process needs to be revisited starting from the business point and understanding of the data.

The iris data was trained with four algorithms/classifiers namely RandomForest, Decision Tree, Logistics Regression and K-nearest Neighbours

Below are the outcome of the results of the classifiers

FLOWER CLASS PREDICTION		
Classifier	**Classifier Name**	**Accuracy_Score**
Classifier1	RandomForest RF	0.9555
Classifier2	Decision Tree DT	0.9555
Classifier3	Logistics Regression LR	0.9777
Classifier4	K-nearest neighbours KNN	0.9555

Clearly the Logistics Regression classifier out performed the rest so far with an accuracy score of 97%, while the rest achieved an accuracy score of 95%, hence this will be the best model classifier that could be used to learn from the iris data.

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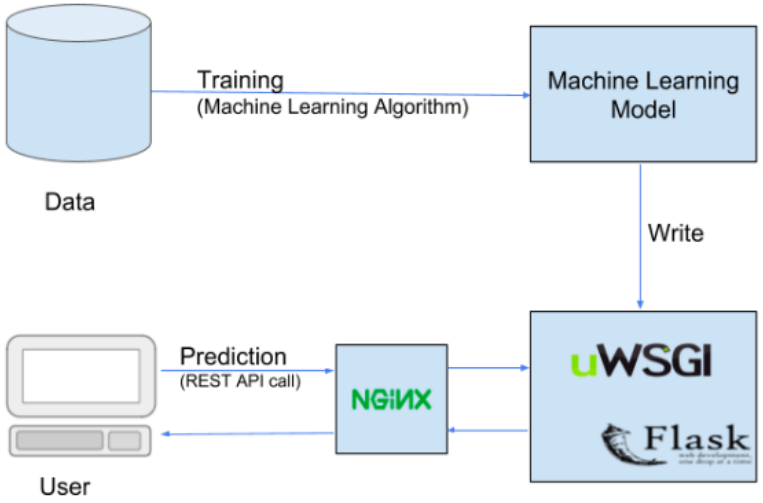
Deployment

A general idea of what happens in Flask deployment.



System requirements and versions I used for Flask deployment:

- Python IDE version 3.9.13
- Libraries like
- Pandas
- Numpy
- Sklearn/Sci-kit Learn
- pickle
- Request
- Render_template
- Jsonify

Then

- Html/css
- Flask
- Visual studio code version 1.76.2

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Deployment

A general Flask deployment requires the following to enable a smooth web application deployment.

- **Mode.py** : This is the model file generated using python IDE (spyder) which consists of our Logistics Regression model, and at the end the model is saved as a pickle file, to be used later in the application.
- **app.py**: This is the main application file which contains the flask API's that receive the iris details through API calls, computes the predicted value based on the model and returns it. It's also the file where the codes resides and binds all the files together.
- **Model.pkl**: This is the Logistics Regression model.pkl which will be used to predict real-time values
- **Templates** :This contains the html files (index.html,predict.html) that are used to give basic structure and styling to our web application usually used on the app.py file to generate the front end of the application.
- **iris.csv**: The data set that is used for the project.

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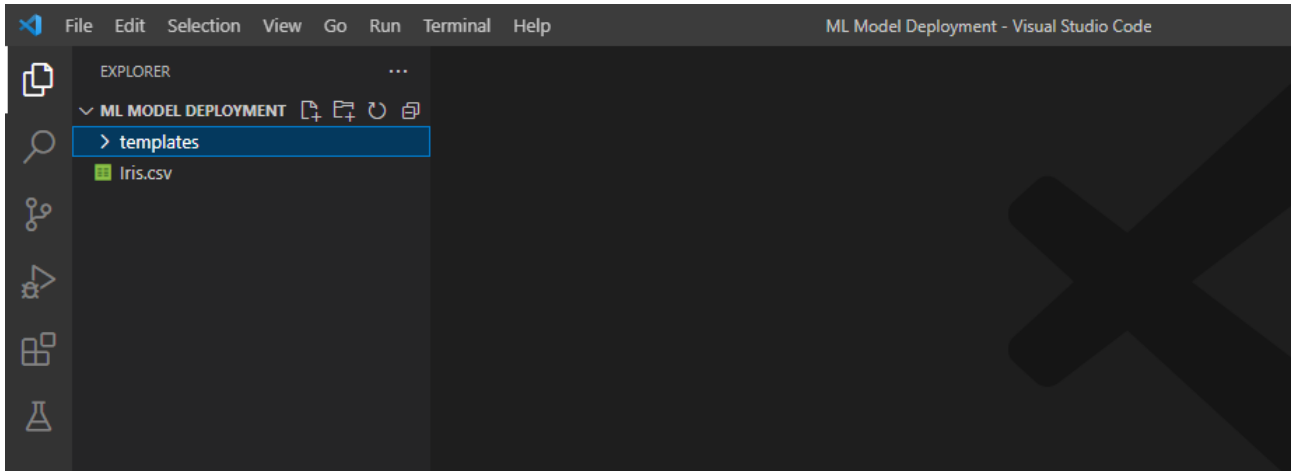
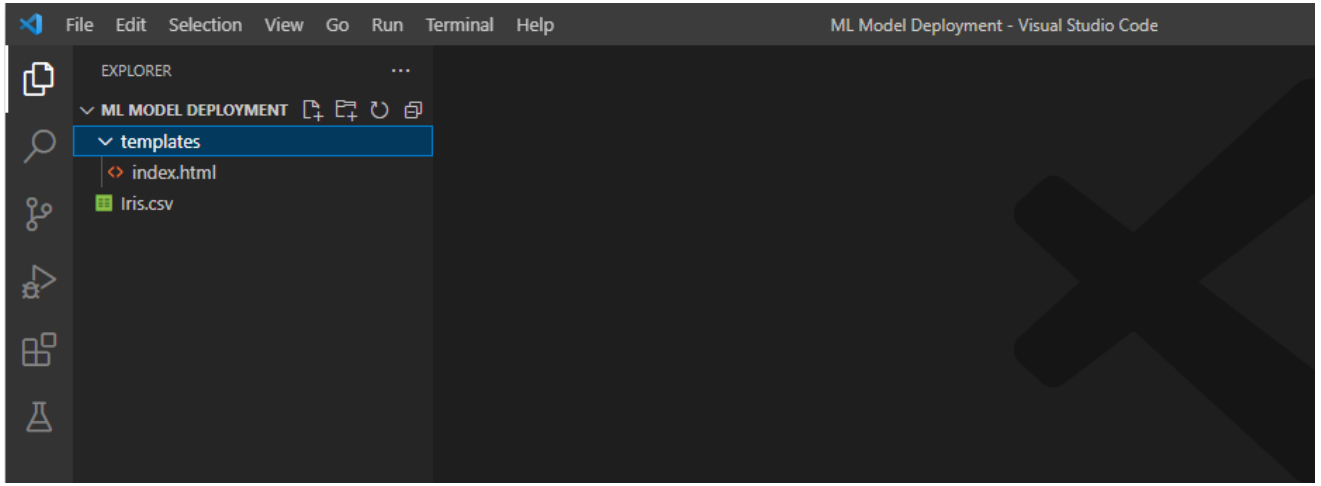
Deployment



A folder was created called ML Model Deployment and in it has the following files

- Templates
- Iris data set

The whole deployment is performed using Visual studio code.



Inside the templates folder is the html file called index which is responsible for the web application structure and outline.

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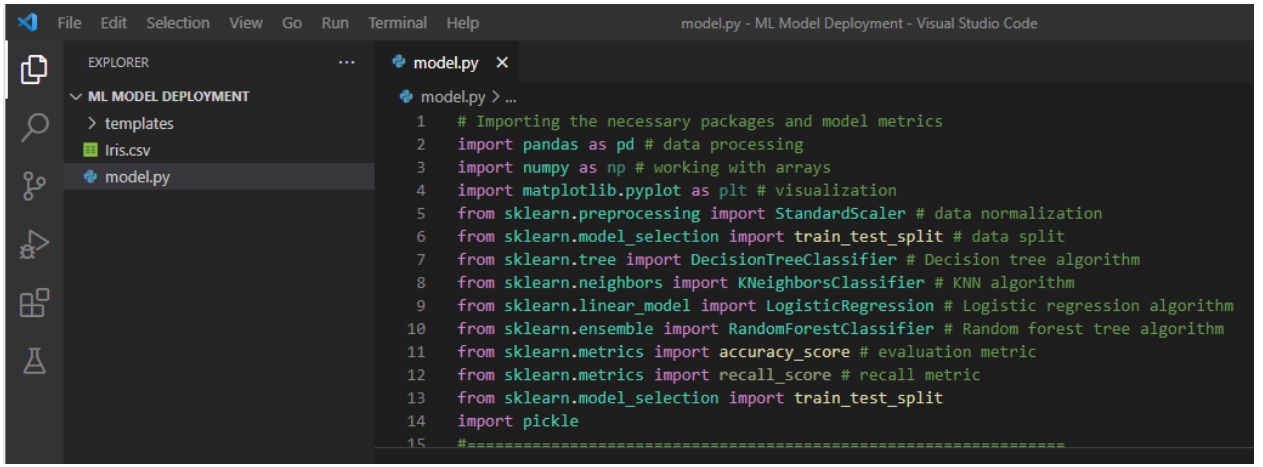
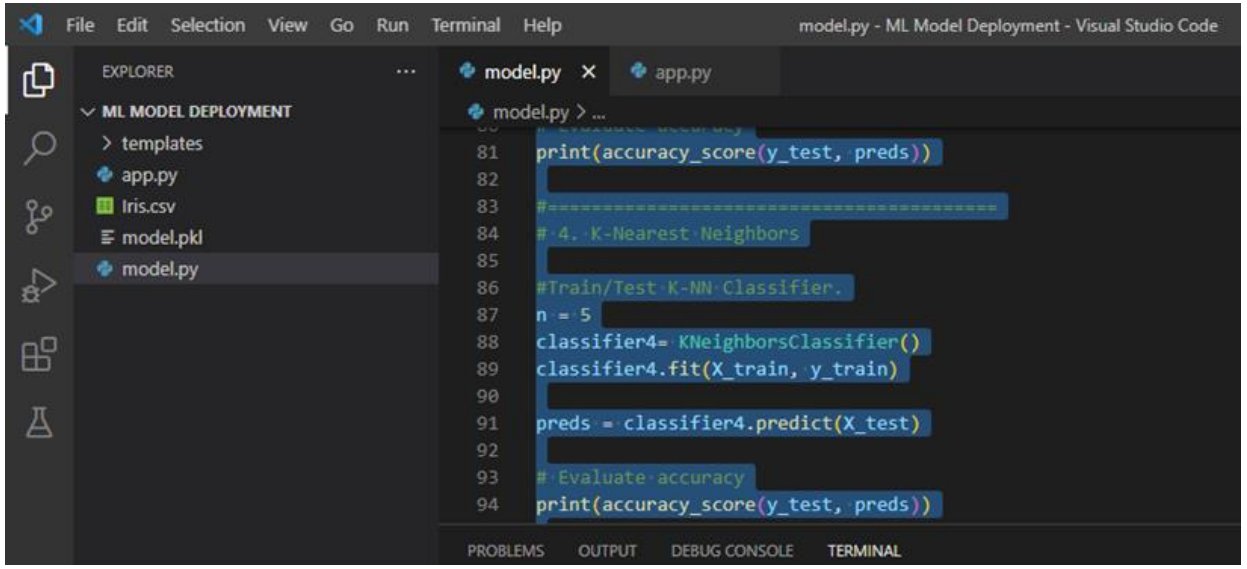
Deployment



The model.py file which contains the entire code of the iris data set is run/initiated in the visual studio environment.



This then produces the model.pkl file where the best performing classifier is stored that will be used for the prediction in the web interface application.

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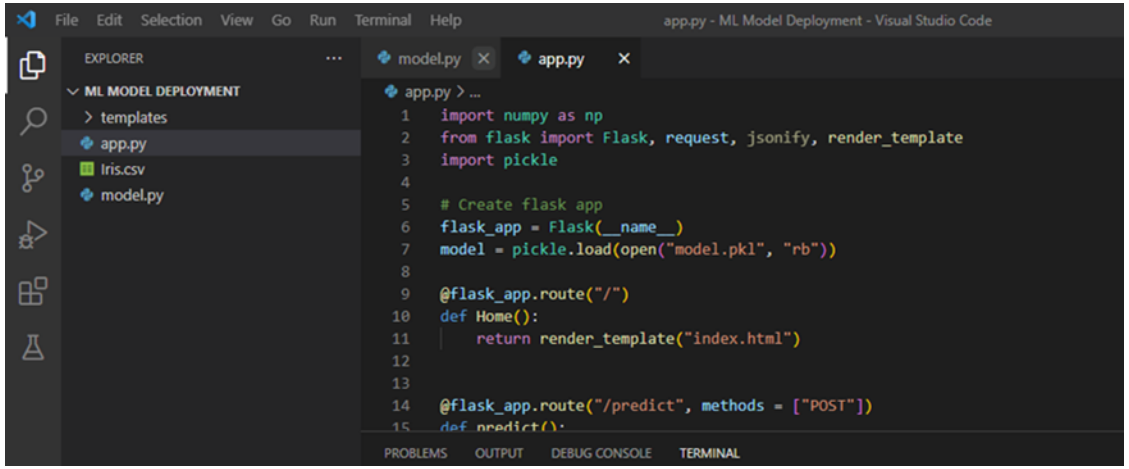
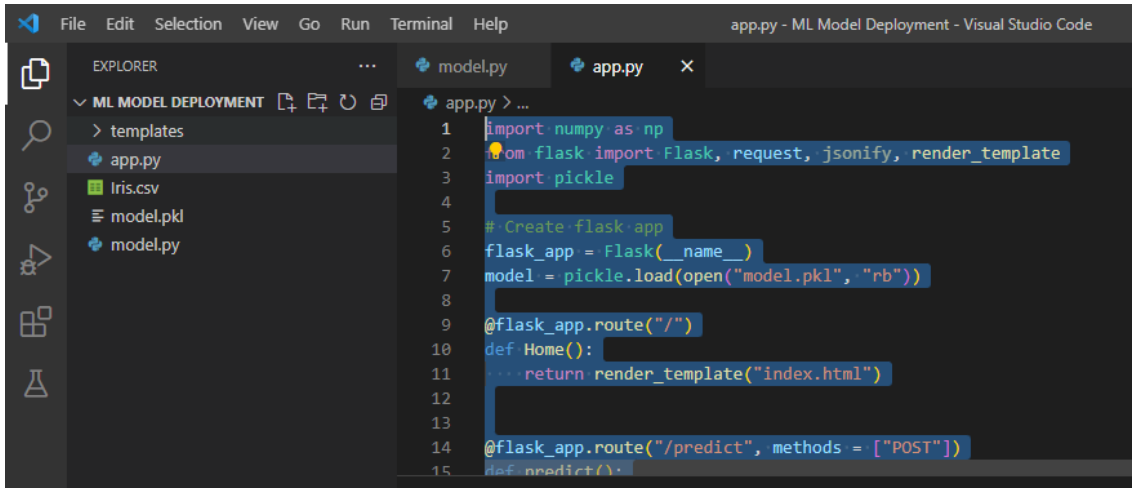
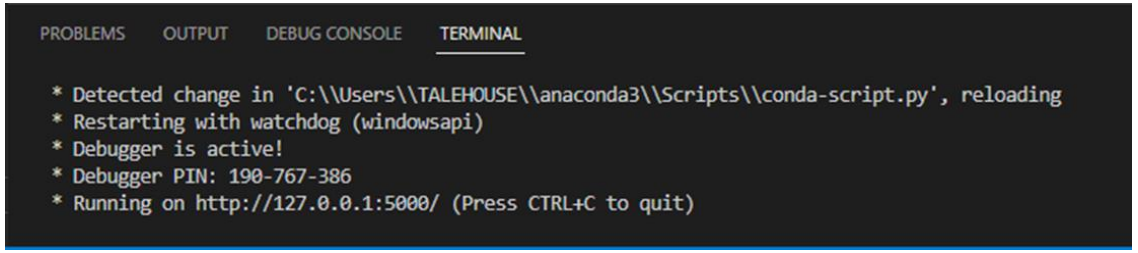
Deployment



Also a file called app.py is created in the visual studio code environment which brings and harmonises all files together for a smooth deployment.



This app.py file is then run with the help of the html index file, this produces a web application interface as shown below.



Upon execution, this web application interface runs on the local host with IP: http://127.0.0.1:5000 and port number 5000.

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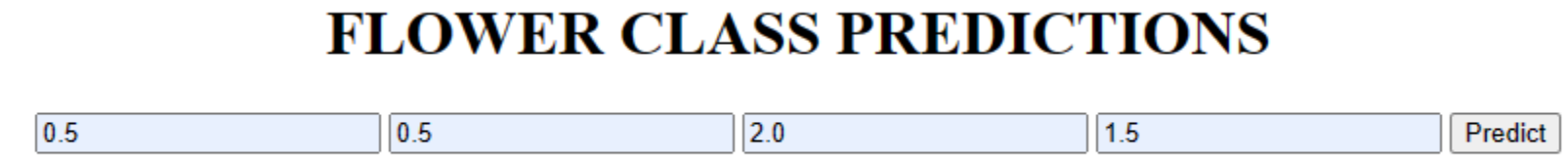
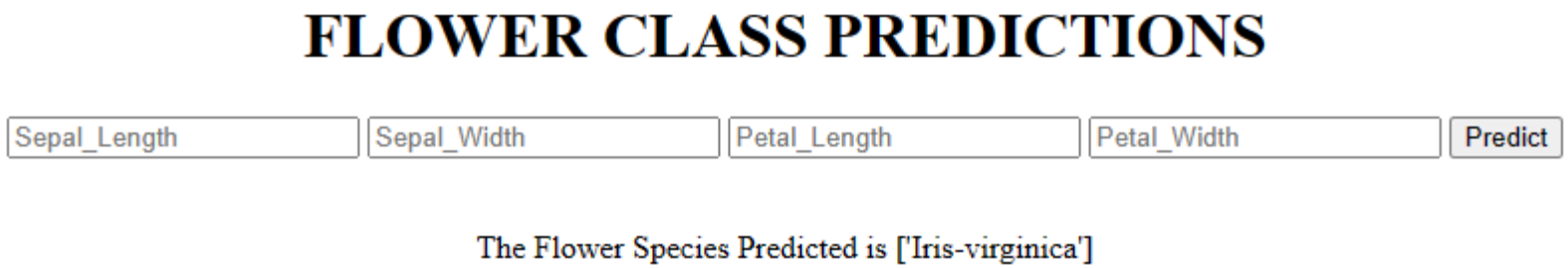
Deployment

The ML Model Deployment API

Data is inputted into the prediction model



The results of the data inputted is shown to predict the plant type



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Conclusion

Finally we have successfully developed a model app that could be run on the web browser. Once we input the values and click on predict button, the screen will show the class type of the iris plant based on the length and width of sepals and petals.

The machine learning model could be viewed on any web browser by copying and pasting the IP address of the **URL:http://127.0.0.1:5000**.
In conclusion, we have successfully dealt with how machine learning models are built, how to connect them onto a web interface application, and deploying it on the local host using Flask.

These and other technological innovations are the bench mark of today's smart agriculture solution market which is growing rapidly by using data science offerings, big data analytics to help farmers make informed decisions thereby optimising their operations.

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Thank You