



## ***VIRTUAL DATA INTERNSHIP***

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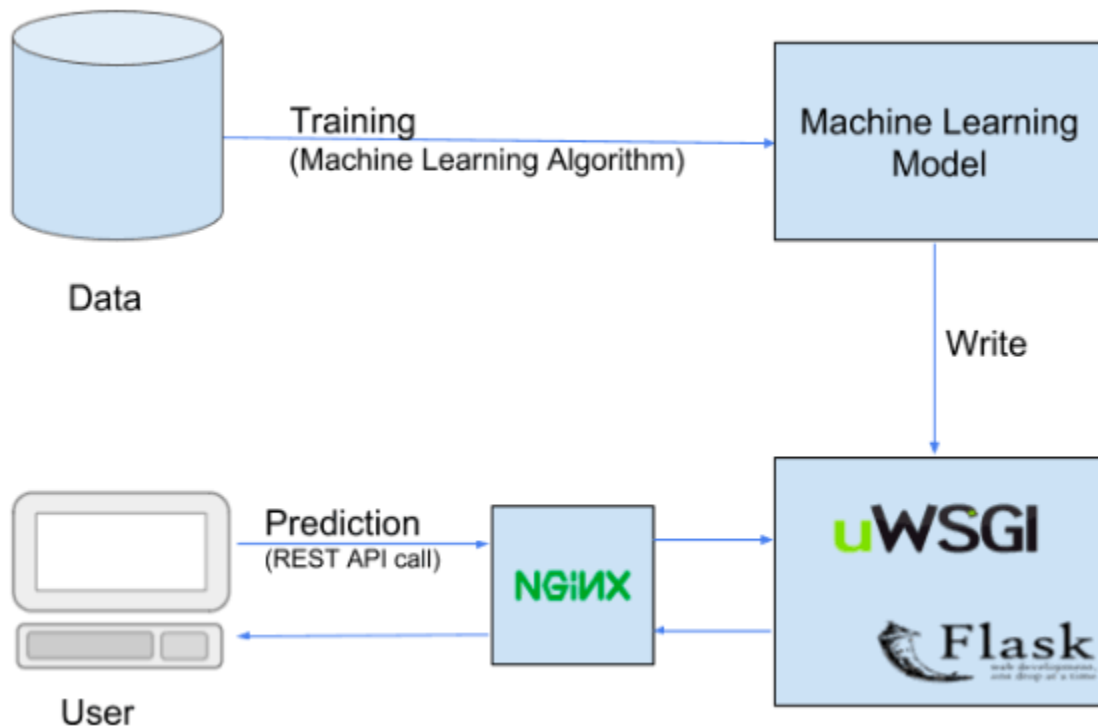
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SUBMITTED TO: DATA GLACIER

## Introduction

This project aims at the deployment of a machine learning model for data that expresses the quality of wine using a Flask framework. The proposed workflow is shown in diagram 1.1 while the data information is showcased in table 1.1



**Diagram 1.1 Application Workflow**

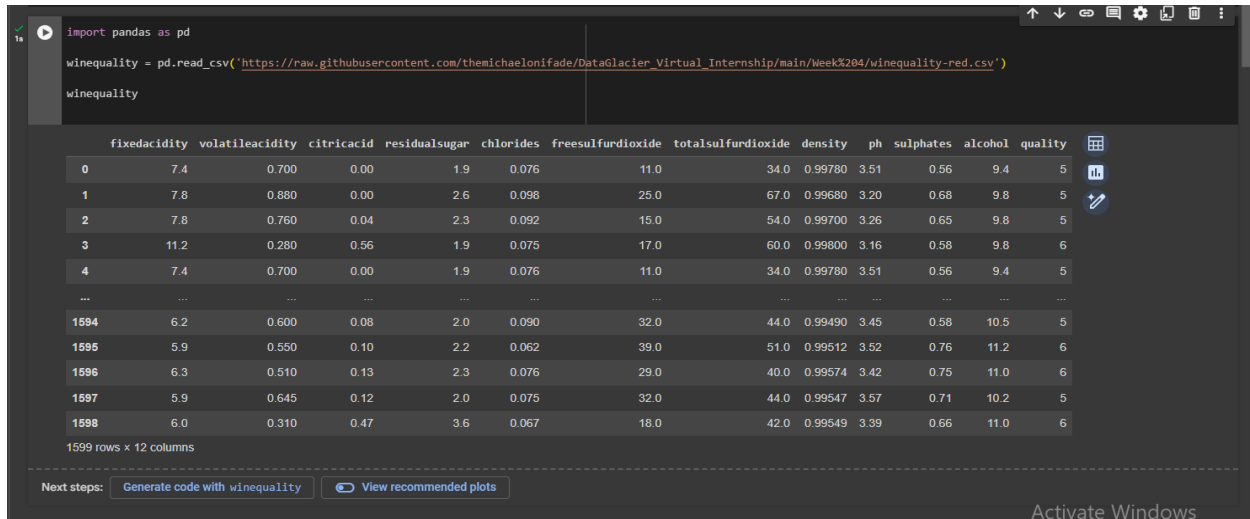
### **Table Data Details**

Total number of observations	1599
Total number of files	1
Total number of features	12
Base format of the file	CSV
Size of the data	84KB

**Table 1.1 Dataset Information**

The process for the deployment is summarized as follows

## 1) Data import



The screenshot shows a Jupyter Notebook interface. The code cell contains the following Python code:

```
import pandas as pd

winequality = pd.read_csv('https://raw.githubusercontent.com/themichaelonifade/DataGlacier_Virtual_Internship/main/Week%204/winequality-red.csv')

winequality
```

The output of the code is a preview of the 'winequality' DataFrame. It shows the first few rows and the last few rows of the dataset. The columns are: fixedacidity, volatileacidity, citricacid, residualsegar, chlorides, freesulfurdioxide, totalsulfurdioxide, density, ph, sulphates, alcohol, and quality. The quality column has values ranging from 4 to 8.

	fixedacidity	volatileacidity	citricacid	residualsegar	chlorides	freesulfurdioxide	totalsulfurdioxide	density	ph	sulphates	alcohol	quality
0	7.4	0.700	0.00	1.9	0.076	11.0	34.0	0.99780	3.51	0.56	9.4	5
1	7.8	0.880	0.00	2.6	0.098	25.0	67.0	0.99680	3.20	0.68	9.8	5
2	7.8	0.760	0.04	2.3	0.092	15.0	54.0	0.99700	3.26	0.65	9.8	5
3	11.2	0.280	0.56	1.9	0.075	17.0	60.0	0.99800	3.16	0.58	9.8	6
4	7.4	0.700	0.00	1.9	0.076	11.0	34.0	0.99780	3.51	0.56	9.4	5
...	...	...	...	...	...	...	...	...	...	...	...	...
1594	6.2	0.600	0.08	2.0	0.090	32.0	44.0	0.99490	3.45	0.58	10.5	5
1595	5.9	0.550	0.10	2.2	0.062	39.0	51.0	0.99512	3.52	0.76	11.2	6
1596	6.3	0.510	0.13	2.3	0.076	29.0	40.0	0.99574	3.42	0.75	11.0	6
1597	5.9	0.645	0.12	2.0	0.075	32.0	44.0	0.99547	3.57	0.71	10.2	5
1598	6.0	0.310	0.47	3.6	0.067	18.0	42.0	0.99549	3.39	0.66	11.0	6

1599 rows x 12 columns

Next steps: [Generate code with winequality](#) [View recommended plots](#)

## 2) Model Building



The screenshot shows a Jupyter Notebook interface with the title 'Build model'. The code cell contains the following Python code:

```
from sklearn.model_selection import train_test_split
#splitting data into train and test sets

x = winequality.drop(['quality'], axis=1)
y = winequality['quality']

X_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=100)
print(X_train.shape, x_test.shape)
```

The output of the code is:

```
(1279, 11) (320, 11)
```



The screenshot shows a Jupyter Notebook interface with the title 'Linear Regression'. The code cell contains the following Python code:

```
from sklearn.linear_model import LinearRegression

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

The output of the code is:

```
LinearRegression
LinearRegression()
```

The code cell also contains the following Python code:

```
from sklearn.metrics import mean_squared_error

predictions = lr.predict(x_test)
print("Mean Squared Error:", mean_squared_error(y_test, predictions))
```

The output of the code is:

```
Mean Squared Error: 0.42823367373739396
```

### 3) Turning Model into web application using flask

#### App.py file

```
app.py > home
1 from flask import Flask, request, render_template
2 import numpy as np
3 import pickle
4
5 # Load the trained model
6 model = pickle.load(open('model.pkl', 'rb'))
7
8 app = Flask(__name__)
9
10 @app.route('/')
11 def home():
12     return render_template('index.html')
13
14 @app.route('/predict', methods=['POST'])
15 def predict():
16     if request.method == 'POST':
17         fixedacidity = request.form.get('fixedacidity'),
18         volatileacidity = request.form.get('volatileacidity'),
19         citricacid = request.form.get('citricacid'),
20         residualsegar = request.form.get('residualsegar'),
21         chlorides = request.form.get('chlorides'),
22         freesulfurdioxide = request.form.get('freesulfurdioxide'),
23         totalsulfurdioxide = request.form.get('totalsulfurdioxide'),
24         density = request.form.get('density'),
25         ph = request.form.get('ph'),
26         sulphates = request.form.get('sulphates'),
27         alcohol = request.form.get('alcohol')
28
29         fixedacidity = float(fixedacidity[0]) if fixedacidity is not None and len(fixedacidity) > 0 else 0
30         volatileacidity = float(volatileacidity[0]) if volatileacidity is not None and len(volatileacidity) else 0
31         citricacid = float(citricacid[0]) if citricacid is not None and len(citricacid) else 0
32         residualsegar = float(residualsegar[0]) if residualsegar is not None and len(residualsegar) else 0
33         chlorides = float(chlorides[0]) if chlorides is not None and len(chlorides) else 0
34         freesulfurdioxide = int(freesulfurdioxide[0]) if freesulfurdioxide is not None and len(freesulfurdioxide) else 0
35         totalsulfurdioxide = int(totalsulfurdioxide[0]) if totalsulfurdioxide is not None and len(totalsulfurdioxide) else 0
36         density = float(density[0]) if density is not None and len(density) else 0
37         ph = float(ph[0]) if ph is not None and len(ph) else 0
38         sulphates = float(sulphates[0]) if sulphates is not None and len(sulphates) else 0
39         alcohol = float(alcohol[0]) if alcohol is not None and len(alcohol) else 0
40
41         features_arr = np.array([[fixedacidity, volatileacidity, citricacid, residualsegar, chlorides, freesulfurdioxide, totalsulfurdioxide, density, ph,
42         prediction = model.predict(features_arr)
43         output = round(prediction[0], 2)
44
45         return render_template('result.html', prediction_text=f'The predicted wine quality is: {output}')
46
47 if __name__ == '__main__':
48     app.debug=True
49     app.run()
```

Activate Windows

## Style.css

```
templates > # style.css > input
1 body {
2   font-family: Arial, sans-serif;
3   margin: 20px;
4 }
5
6 h1 {
7   text-align: center;
8 }
9
10 form {
11   max-width: 400px;
12   margin: 0 auto;
13 }
14
15 label {
16   display: block;
17   margin-bottom: 10px;
18 }
19
20 input {
21   width: 100%;
22   padding: 8px;
23   margin-bottom: 10px;
24   border: 1px solid #ccc;
25   border-radius: 4px;
26 }
27
28 input[type="submit"] {
29   background-color: #4CAF50;
30   color: white;
31   padding: 10px 15px;
32   border: none;
33   border-radius: 4px;
34   cursor: pointer;
35 }
```

## Index.html

```
templates > index.html > html > body
1 <!DOCTYPE html>
2 <html>
3 <head>
4   <title>Wine Quality Prediction</title>
5   <link rel="stylesheet" type="text/css" href="style.css">
6 </head>
7 <body>
8   <h1>Wine Quality Prediction</h1>
9   <form action="/predict" method="post">
10
11     <label>Fixed Acidity:
12     | <input type="number" step="any" name="fixedacidity">
13     </label>
14     <br><br>
15
16     <label>Volatile Acidity:
17     | <input type="number" step="any" name="volatileacidity">
18     </label>
19     <br><br>
20
21     <label>Citric Acid:
22     | <input type="number" step="any" name="citricacid">
23     </label>
24     <br><br>
25
26     <label>Residual Sugar:
27     | <input type="number" step="any" name="residualsugar">
28     </label>
29     <br><br>
30
```

```

31     <label>Chlorides:
32     |   <input type="number" step="any" name="chlorides">
33     </label>
34     <br><br>
35
36     <label>Free Sulfur Dioxide:
37     |   <input type="number" step="any" name="freesulfurdioxide">
38     </label>
39     <br><br>
40
41     <label>Total Sulfur Dioxide:
42     |   <input type="number" step="any" name="totalsulfurdioxide">
43     </label>
44     <br><br>
45
46     <label>Density:
47     |   <input type="number" step="any" name="density">
48     </label>
49     <br><br>
50
51     <label>pH:
52     |   <input type="number" step="any" name="ph">
53     </label>
54     <br><br>
55
56
57
58
59
60
61     <label>Alcohol:
62     |   <input type="number" step="any" name="alcohol">
63     </label>
64     <br><br>
65
66     <input type="submit" value="Predict">
67 </form>
68 </body>
69 </html>

```

## Result.html

```

templates > result.html > html
1 <!DOCTYPE html>
2 <html lang="en">
3 <head>
4   <meta charset="UTF-8">
5   <meta http-equiv="X-UA-Compatible" content="IE=edge">
6   <meta name="viewport" content="width=device-width, initial-scale=1.0">
7   <title>Wine Quality</title>
8 </head>
9 <body>
10  <h1>Wine Quality</h1>
11  <p>{{ prediction_text }}</p>
12 </body>
13 </html>

```

***Final output***

**Wine Quality Prediction**

Fixed Acidity:

Volatile Acidity:

Citric Acid:

Residual Sugar:

Chlorides:

Free Sulfur Dioxide:

Total Sulfur Dioxide:

Density:

pH:

Sulphates:

Alcohol: