Architecture Document

Mushroom Type Classifier

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Abstract

By using the pre-trained of Mushroom Classifier user can understand the type of mushroom he is handling by this we can reduce the risk involved in the intake of the same.

1 Introduction

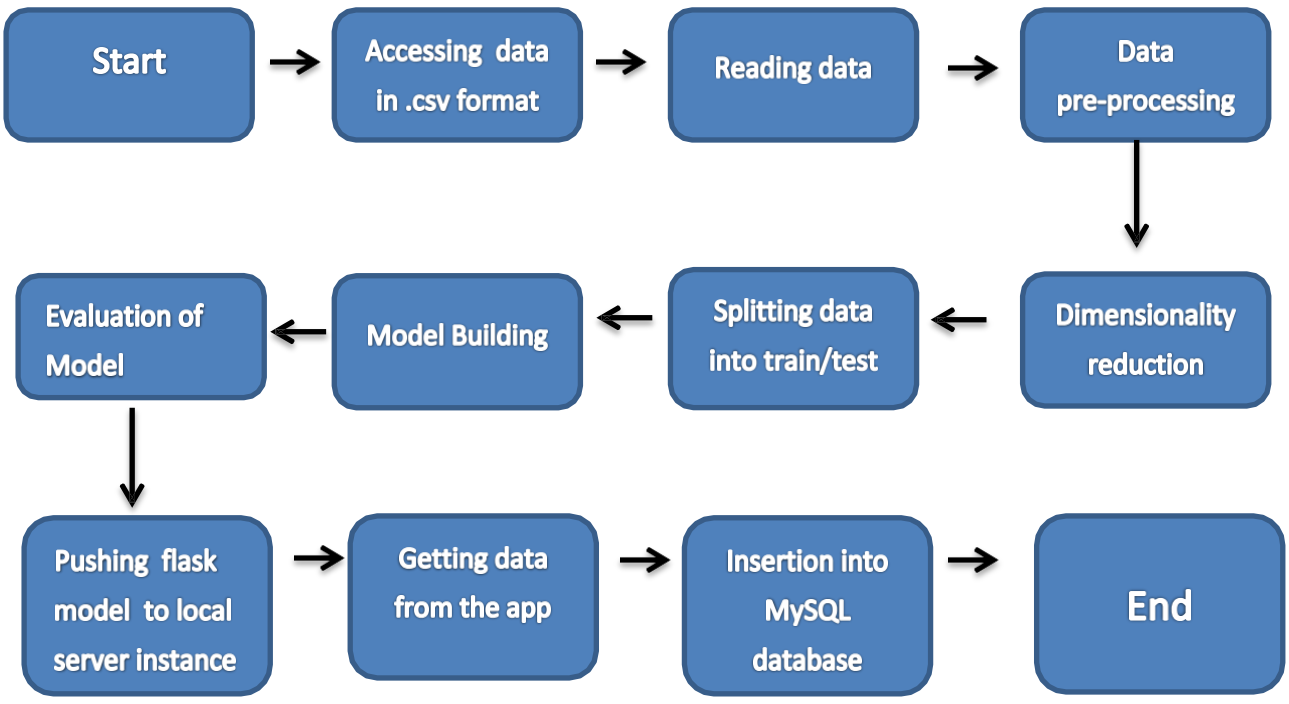
1.1. What is document required?

The goal of LLD or a low-level design document (LLDD) is to give the internal logical design of the actual programmed code for Mushroom classifier. LLD describes the class relations with predictors .It describes the modules so that the programmer can directly code the program from the document.

1.2. Scope

Low-level design (LLD) is a component-level design process that follows a step-by-step r process. This process can be used for designing data structures, required software architecture, source code and ultimately, performance algorithms. Overall, the data organization may be defined during requirement analysis and then refined during data design work.

2 Architecture



3 Architecture Description

3.1 Data Accessing

We can access the data in the from the download link as available in the project.

We load the data to the framework using the pandas read function.

Attribute Information: (classes: edible=e, poisonous=p)

a. cap-shape: bell=b, conical=c, convex=x, flat=f, knobbed=k, sunken=s

b. cap-surface: fibrous=f, grooves=g, scaly=y, smooth=s

c. cap-color: brown=n, buff=b, cinnamon=c, gray =g, green=r, pink=p, purple=u, red=e, white=w, yellow=y

d. bruises: bruises=t, no=f

e. odor: almond=a, anise=l, creosote=c, fishy=y, foul=f, musty=m, none=n, pungent=p, spicy=s

f. gill-attachment: attached=a, descending=d, free=f, notched=n

g. gill-spacing: close=c, crowded=w, distant=d

h. gill-size: broad=b, narrow=n

i. gill-color: black=k, brown=n, buff=b, chocolate=h, gray=g, green=r, orange=o, pink=p, purple=u, red=e, white=w, yellow=y

j. stalk-shape: enlarging=e, tapering=t

k. Stalk-root: bulbous=b, club=c, cup=u, equal=e, rhizomorphs=z, rooted=r, missing=?

l. stalk-surface-above-ring: fibrous=f, scaly=y, silky=k, smooth=s

m. stalk-surface-below-ring: fibrous=f, scaly=y, silky=k, smooth=s

n. stalk-color-above-ring: brown=n, buff=b, cinnamon=c, gray=g, orange=o, pink=p, red=e, white=w, yellow=y

o. stalk-color-below-ring: brown=n, buff=b, cinnamon=c, gray=g, orange=o, pink=p, red=e, white=w, yellow=y

p. veil-type: partial=p, universal=u

q. veil-color: brown=n, orange=o, white=w, yellow=y

r. ring-number: none=n, one=o, two=t

s. ring-type: cobwebby=c, evanescent=e, flaring=f, large=l, none=n, pendant=p, sheathing=s, zone=z

t. spore-print-color: black=k, brown=n, buff=b, chocolate=h, green=r, orange=o, purple=u, white=w, yellow=y

u. population: abundant=a, clustered=c, numerous=n, scattered=s, several=v, solitary=y

v. habitat: grasses=g, leaves=l, meadows=m, paths=p, urban=u, waste=w, woods=d

class	cap-shape	cap-surface	cap-color	bruises	odor	gill-attach...
e	x	y	y	t	l	f
e	x	y	y	t	a	f
e	b	s	y	t	a	f
p	x	y	w	t	p	f
e	x	f	n	f	n	f
e	s	f	g	f	n	f
e	f	f	w	f	n	f
p	x	s	n	t	p	f
p	x	y	w	t	p	f
p	x	s	n	t	p	f
e	b	s	y	t	a	f
p	x	y	n	t	p	f
e	b	y	y	t	l	f
e	b	y	w	t	a	f

3.2 Data Pre-Processing

By the usage of the different data manipulation techniques we will remove unwanted features

Also we use the dimensionality reduction and make all the features in numerical data type

```
In [ ]: df.drop('veil-type',axis =1, inplace=True)

In [ ]: df.drop('stalk-root',axis =1, inplace=True)

In [ ]: df.columns

Out[8]: Index(['class', 'cap-shape', 'cap-surface', 'cap-color', 'bruises', 'odor',
               'gill-attachment', 'gill-spacing', 'gill-size', 'gill-color',
               'stalk-shape', 'stalk-surface-above-ring', 'stalk-surface-below-ring',
               'stalk-color-above-ring', 'stalk-color-below-ring', 'veil-color',
               'ring number', 'ring type', 'spore print color', 'population',
               'habitat'],
              dtype='object')

In [ ]: df['class'].replace({'p':0,'e':1},inplace = True)

In [ ]: y = df['class']

In [ ]: x = df.drop('class',axis =1)

In [ ]: type(x)

Out[16]: pandas.core.frame.DataFrame
```

2	b	s	w	t	l	f	c	b	n	e	s	s	w	w	w	o	p	n
3	x	y	w	t	p	f	c	n	n	e	s	s	w	w	w	o	p	k
4	x	s	g	f	n	f	w	b	k	t	s	s	w	w	w	o	e	n

```
In [ ]: x_dummed = pd.get_dummies(x,drop_first=True)

In [ ]: x_dummed.head()
```

Out[14]:

	cap-shape_c	cap-shape_f	cap-shape_k	cap-shape_s	cap-shape_x	cap-surface_g	cap-surface_s	cap-surface_y	cap-color_c	cap-color_e	...	population_n	population_s	population_v	popula
0	0	0	0	0	1	0	1	0	0	0	...	0	1	0	
1	0	0	0	0	1	0	1	0	0	0	...	1	0	0	
2	0	0	0	0	0	0	1	0	0	0	...	1	0	0	
3	0	0	0	0	1	0	0	1	0	0	...	0	1	0	

```
Out[15]: list
```

```
In [ ]: corr_columns = []
        for i in range(0,90):
          for j in range(i,90):

            corr_value = x_dummed[columns[i]].corr(x_dummed[columns[j+1]])

            if corr_value>=0.80:
              corr_columns.append(columns[j+1])
        corr_columns = set(corr_columns)
```

```
In [ ]: corr_columns
```

```
[ ]: from sklearn.linear_model import Lasso
     from sklearn.feature_selection import SelectFromModel
```

```
[ ]: features = SelectFromModel(Lasso(alpha = 0.001))
     features.fit(x_dummed,y)
```

```
[30]: SelectFromModel(estimator=Lasso(alpha=0.001))
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

```
[ ]: features.get_support()
     #len(features.get_support())
```

```
In [ ]: features.get_support()
        #len(features.get_support())
```

```
Out[46]: array([False, False, False, False, False, False, False, False, False,
                False, False,  True, False, False, False, False, False, False,
                 True,  True,  True,  True,  True,  True,  True,  True, False,
                 True,  True, False, False, False, False,  True, False, False,
                False, False,  True, False,  True,  True,  True, False, False,
                 True,  True, False, False, False,  True, False, False, False,
                False, False, False, False,  True,  True, False, False,  True,
                 True,  True,  True,  True,  True, False,  True, False, False,
                False, False,  True, False,  True, False, False, False, False,
                 True,  True,  True])
```

```
In [ ]: x_dummed.columns[features.get_support()]
        x_new = x_dummed[x_dummed.columns[features.get_support()]]
```

```
In [ ]: print(x_dummed.shape),
        print(x_new.shape)
```

3.3 Splitting the Data

We use train test split Sklearn function to split the data for training and validation

```
In [ ]: from sklearn.model_selection import train_test_split,GridSearchCV
        from sklearn.linear_model import LogisticRegression
        from sklearn.metrics import accuracy_score,classification_report,confusion_matrix

In [ ]: x_train,x_test,y_train,y_test = train_test_split(x_new,y,test_size = 0.2,random_state =123,stratify =y)
```

3.4 Model Building

We will deploy as many models as possible and fine tune them using GridsearchCV select the model which are performing with highest accuracy and select those models and ensemble them using voting classifier for the best model. Perform the model evaluation.

```
In [ ]: from sklearn.ensemble import VotingClassifier

In [ ]: estimators_all = [('RF', model_rfc),
                         ('LG', model_lg),
                         ('SGD', model_sgd),
                         ('SVC', model_svc),
                         ('GBC',model_gbc),
                         ('XGBC',model_xgb),
                         ('DTC',model_dc),
                         ('ABC',model_abc),
                         ('BNB',model_bnb),
                         ('KNN',model_knn)]

In [ ]: model_final = VotingClassifier(estimators = estimators_all,
                                       voting = 'hard')

In [ ]: model_final.fit(x_train,y_train)
```

3.5 Create Front End User Module using flask

Once the model is created download and save the model and now we create GUI for front end user using the flask incorporated with HTML, CSS. Align and map the user data to the data base created. From user data create the data frame and load it to the model for the prediction the same prediction is send back to the user GUI and well saved in the data base (MySQL).

```python
from flask import Flask, redirect, url_for,render_template,request
import numpy as np
import joblib
from joblib import dump, load
import pandas as pd
import logging


logging.basicConfig(filename= 'logs.log',
                    filemode = 'a',
                    format = '%(asctime)s %(levelname)s-%(message)s',
                    datefmt= '%Y-%m-%d %H:%M:%S',
                    level = logging.DEBUG)

logging.info('libraries loaded...')

app = Flask(__name__)
```

```python
@app.route('/submit', methods = ['POST','GET'])
def submit():
    features = ['cap-color_n', 'odor_c', 'odor_f', 'odor_l', 'odor_m', 'odor_n',
     'odor_p', 'odor_s', 'odor_y', 'gill-spacing_w', 'gill-size_n',
     'gill-color_n', 'gill-color_w', 'stalk-shape_t',
     'stalk-surface-above-ring_k', 'stalk-surface-above-ring_s',
     'stalk-surface-below-ring_s', 'stalk-surface-below-ring_y',
     'stalk-color-above-ring_o', 'stalk-color-below-ring_w',
     'stalk-color-below-ring_y', 'ring-number_t', 'ring-type_f',
     'ring-type_l', 'ring-type_p', 'spore-print-color_k',
     'spore-print-color_n', 'spore-print-color_r', 'population_n',
     'population_v', 'habitat_p', 'habitat_u', 'habitat_w']

    data = np.array([0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0])
    logging.info('Empty numpy array created')

    if request.method == 'POST':
        cap_color  = request.form['cap-color']
        if cap_color == 'n':
            data[0]=
                (variable) request: Request

        odor       = request.form['odor']
        if odor == 'c':
            data[1]=1
```

```
<form action="/submit" method = 'post'>
    <label for="cap-color">cap-color:</label><tr>
    <select id="cap-color" name ='cap-color'><tr>
      <option value="n">brown</option>
      <option value="">others</option>
      </select>   

    <label for="odor">odor:</label><tr>
    <select id="odor" name ='odor'><tr>
      <option value="c">creosote</option>
      <option value="f">foul</option>
      <option value="l">anise</option>
      <option value="m">musty</option>
      <option value="n">none</option>
      <option value="p">pungent</option>
      <option value="s">spicy</option>
      <option value="y">fishy</option>
    </select>   

    <label for="gill-spacing">gill-spacing:</label><tr>
    <select id="gill-spacing" name ='gill-spacing'>
      <option value="w">crowded</option>
      <option value="">others</option>
```

result.html

templates > result.html > ...

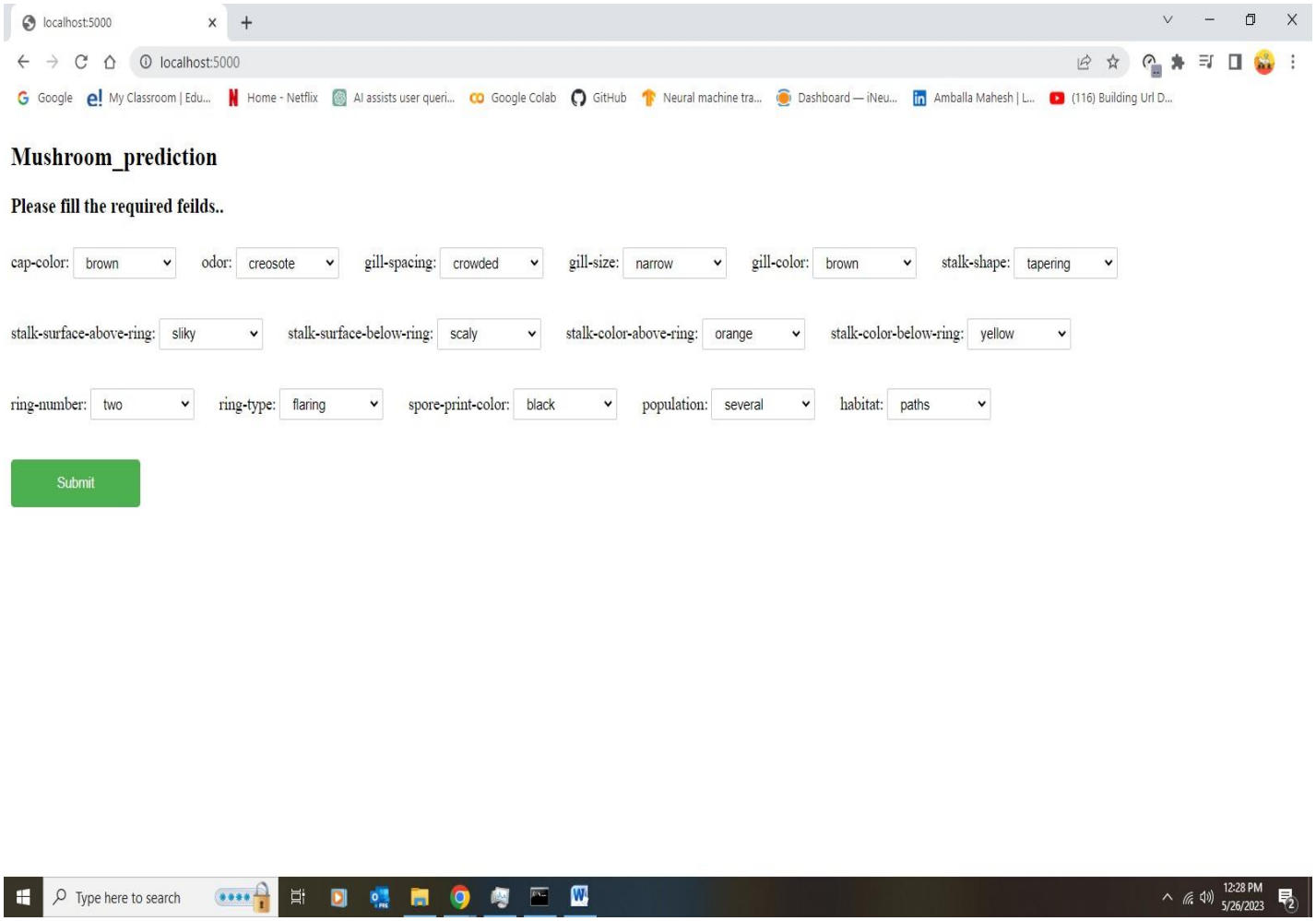
```
1   <!DOCTYPE html>
2   <html>
3       <h2 style = color:blue;>Final Result...</h2>
4   <body>
5
6    {% if result == 0 %}
7    <h3 style = color:red;>Classification of Mushroom is - Posionous Mushroom!</h3>
8   </div>
9    {% else %}
10   <h3 style = color:green;>Classification of Mushroom is - Edible Mushroom!</h3>
11
12   {% endif %}
13
14  <a href="http://127.0.0.1:5000/">click here for the test again..</a><br>
15
16  </body>
17  </html>
18
```

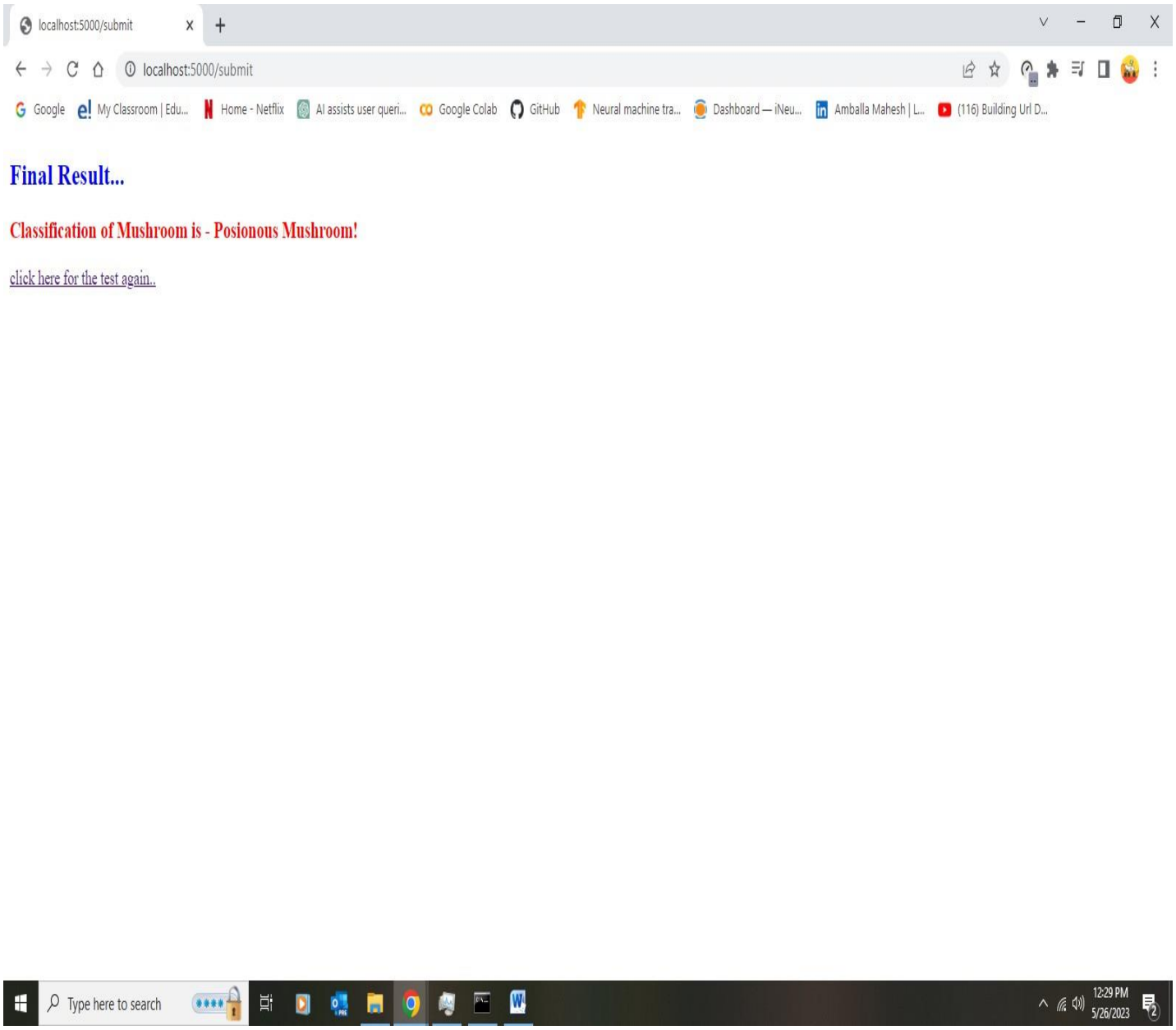
3.6 Testing the Model

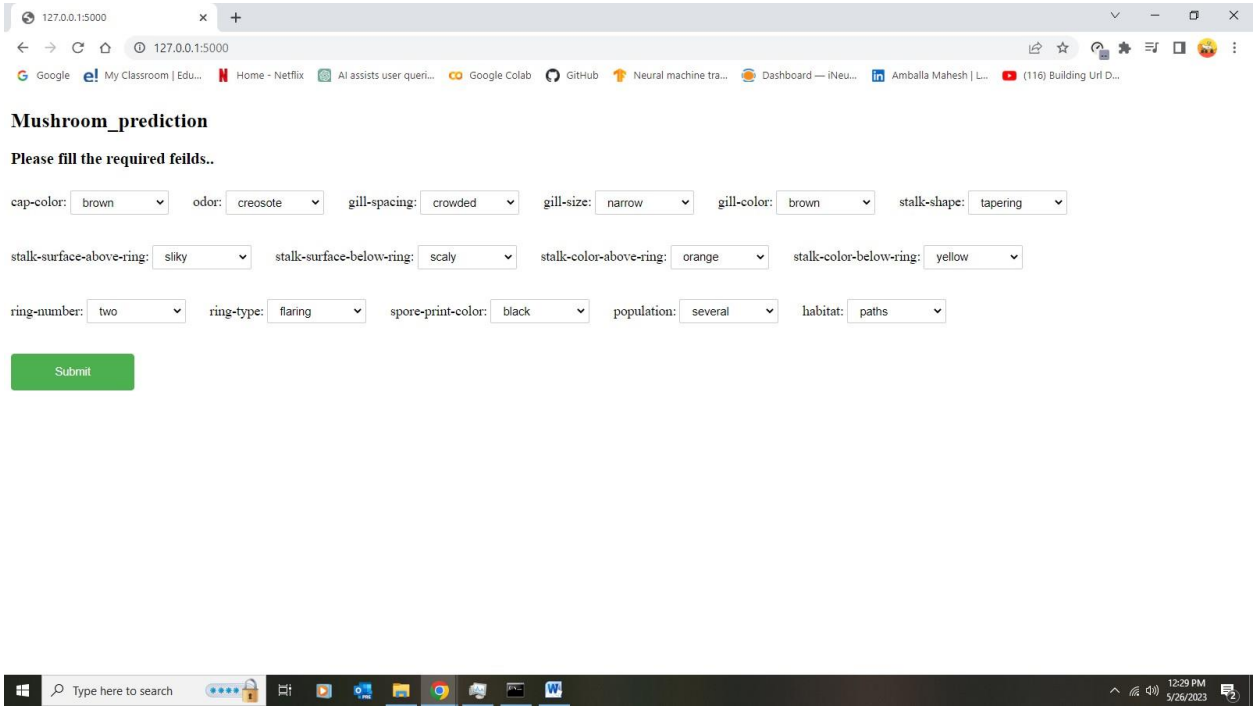
- ✓ Verify whether the application is the loading on the local server instance.
- ✓ Verify whether the user can access the application.
- ✓ Verify the user can access the different fields for selection and can be visible
- ✓ Once the user selection the fields and made the submit
- ✓ Check the user can get the result or prediction.
- ✓ Once he gets the prediction.
- ✓ Check the data form the user and prediction from the model is loaded into the local MySQL

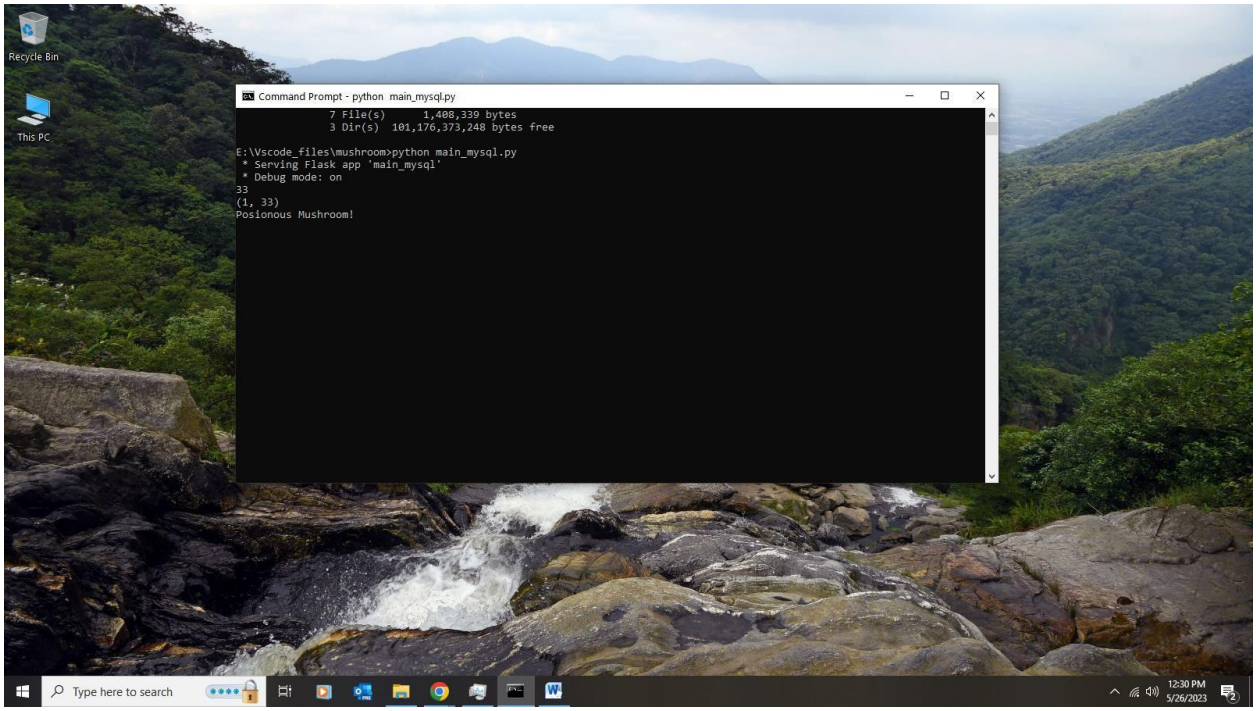
- ✓ Verify whether the application is the loading on the web service intance.

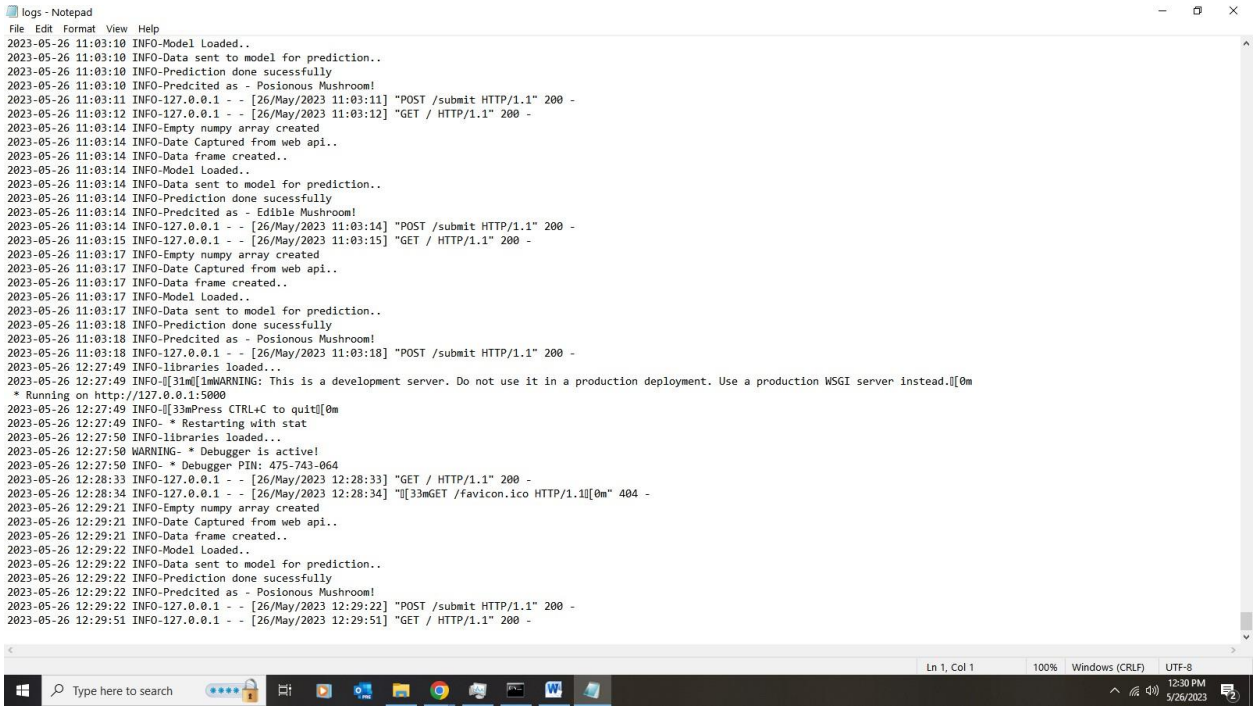
- ✓ Check the database and download the data…

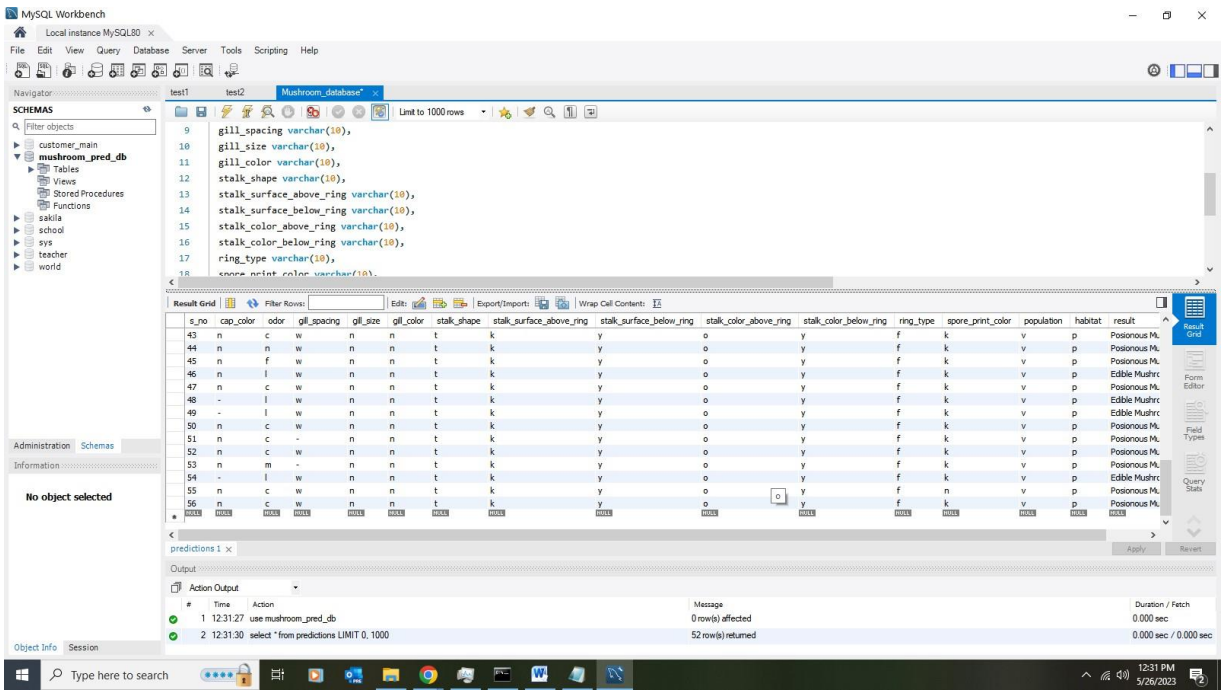


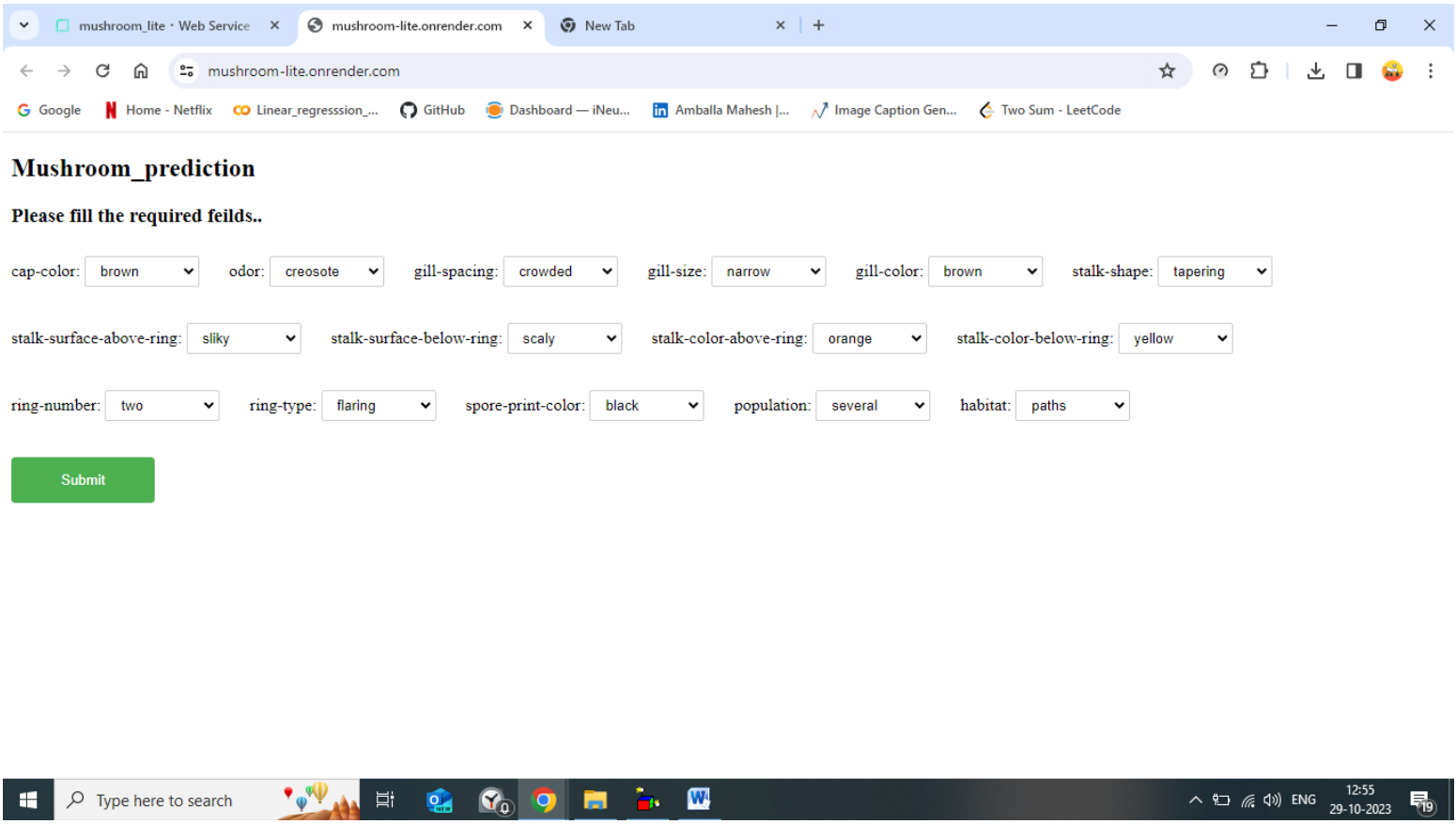

localhost:5000/submit
localhost:5000/submit
Google
My Classroom | Edu...
Home - Netflix
AI assists user queri...
Google Colab
GitHub
Neural machine tra...
Dashboard — iNeu...
Amballa Mahesh | L...
(116) Building Url D...
Final Result...
Classification of Mushroom is - Posionous Mushroom!
click here for the test again..
Type here to search
12:29 PM
5/26/2023


127.0.0.1:5000
Mushroom_prediction
Please fill the required feilds..
cap-color: brown
odor: creosote
gill-spacing: crowded
gill-size: narrow
gill-color: brown
stalk-shape: tapering
stalk-surface-above-ring: sliky
stalk-surface-below-ring: scaly
stalk-color-above-ring: orange
stalk-color-below-ring: yellow
ring-number: two
ring-type: flaring
spore-print-color: black
population: several
habitat: paths
Submit
Type here to search
12:29 PM
5/26/2023


Recycle Bin
This PC
Command Prompt - python main_mysql.py
7 File(s) 1,408,339 bytes
3 Dir(s) 101,176,373,248 bytes free
E:\Vscode_files\mushroom>python main_mysql.py
* Serving Flask app 'main_mysql'
* Debug mode: on
33
(1, 33)
Posionous Mushroom!
Type here to search
12:30 PM
5/26/2023


logs - Notepad
File Edit Format View Help
2023-05-26 11:03:10 INFO-Model Loaded..
2023-05-26 11:03:10 INFO-Data sent to model for prediction..
2023-05-26 11:03:10 INFO-Prediction done sucessfully
2023-05-26 11:03:10 INFO-Predcited as - Posionous Mushroom!
2023-05-26 11:03:11 INFO-127.0.0.1 - - [26/May/2023 11:03:11] "POST /submit HTTP/1.1" 200 -
2023-05-26 11:03:12 INFO-127.0.0.1 - - [26/May/2023 11:03:12] "GET / HTTP/1.1" 200 -
2023-05-26 11:03:14 INFO-Empty numpy array created
2023-05-26 11:03:14 INFO-Date Captured from web api..
2023-05-26 11:03:14 INFO-Data frame created..
2023-05-26 11:03:14 INFO-Model Loaded..
2023-05-26 11:03:14 INFO-Data sent to model for prediction..
2023-05-26 11:03:14 INFO-Prediction done sucessfully
2023-05-26 11:03:14 INFO-Predcited as - Edible Mushroom!
2023-05-26 11:03:14 INFO-127.0.0.1 - - [26/May/2023 11:03:14] "POST /submit HTTP/1.1" 200 -
2023-05-26 11:03:15 INFO-127.0.0.1 - - [26/May/2023 11:03:15] "GET / HTTP/1.1" 200 -
2023-05-26 11:03:17 INFO-Empty numpy array created
2023-05-26 11:03:17 INFO-Date Captured from web api..
2023-05-26 11:03:17 INFO-Data frame created..
2023-05-26 11:03:17 INFO-Model Loaded..
2023-05-26 11:03:17 INFO-Data sent to model for prediction..
2023-05-26 11:03:18 INFO-Prediction done sucessfully
2023-05-26 11:03:18 INFO-Predcited as - Posionous Mushroom!
2023-05-26 11:03:18 INFO-127.0.0.1 - - [26/May/2023 11:03:18] "POST /submit HTTP/1.1" 200 -
2023-05-26 12:27:49 INFO-libraries loaded...
2023-05-26 12:27:49 INFO-[31m[1mWARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.[0m
* Running on http://127.0.0.1:5000
2023-05-26 12:27:49 INFO-[33mPress CTRL+C to quit[0m
2023-05-26 12:27:49 INFO- * Restarting with stat
2023-05-26 12:27:50 INFO-libraries loaded...
2023-05-26 12:27:50 WARNING- * Debugger is active!
2023-05-26 12:27:50 INFO- * Debugger PIN: 475-743-064
2023-05-26 12:28:33 INFO-127.0.0.1 - - [26/May/2023 12:28:33] "GET / HTTP/1.1" 200 -
2023-05-26 12:28:34 INFO-127.0.0.1 - - [26/May/2023 12:28:34] "[33mGET /favicon.ico HTTP/1.1[0m" 404 -
2023-05-26 12:29:21 INFO-Empty numpy array created
2023-05-26 12:29:21 INFO-Date Captured from web api..
2023-05-26 12:29:21 INFO-Data frame created..
2023-05-26 12:29:22 INFO-Model Loaded..
2023-05-26 12:29:22 INFO-Data sent to model for prediction..
2023-05-26 12:29:22 INFO-Prediction done sucessfully
2023-05-26 12:29:22 INFO-Predcited as - Posionous Mushroom!
2023-05-26 12:29:22 INFO-127.0.0.1 - - [26/May/2023 12:29:22] "POST /submit HTTP/1.1" 200 -
2023-05-26 12:29:51 INFO-127.0.0.1 - - [26/May/2023 12:29:51] "GET / HTTP/1.1" 200 -
Ln 1, Col 1
100%
Windows (CRLF)
UTF-8
Type here to search
12:30 PM
5/26/2023


MySQL Workbench
Local instance MySQL80
File Edit View Query Database Server Tools Scripting Help
Navigator
SCHEMAS
customer_main
mushroom_pred_db
Tables
Views
Stored Procedures
Functions
sakila
school
sys
teacher
world
Administration Schemas
Information
No object selected
Object Info Session
test1
test2
Mushroom_database*
Limit to 1000 rows
gill_spacing varchar(10),
gill_size varchar(10),
gill_color varchar(10),
stalk_shape varchar(10),
stalk_surface_above_ring varchar(10),
stalk_surface_below_ring varchar(10),
stalk_color_above_ring varchar(10),
stalk_color_below_ring varchar(10),
ring_type varchar(10),
Result Grid
Filter Rows:
Edit:
Export/Import:
Wrap Cell Content:
s_no cap_color odor gill_spacing gill_size gill_color stalk_shape stalk_surface_above_ring stalk_surface_below_ring stalk_color_above_ring stalk_color_below_ring ring_type spore_print_color population habitat result
predictions 1
Output
Action Output
Time Action Message Duration / Fetch
1 12:31:27 use mushroom_pred_db 0 row(s) affected 0.000 sec
2 12:31:30 select * from predictions LIMIT 0, 1000 52 row(s) returned 0.000 sec / 0.000 sec
Type here to search
12:31 PM
5/26/2023



LIVE HOST WEB ADDRESS: https://mushroom-lite.onrender.com/

4. Key performance indicators (KPI)

- Time and work load reduction by using the flask model.
- Compare the accuracy of model using prediction and actual results.
- Check for the wrong predictions
- If found any wrong predictions again train the model with the new data along with previous data
- Retest the model unless the productions attain the good results.