PROJECT REPORT

Date	18 May 2023
Team ID	NM2023TMID08977
Project Name	Uncovering The Hidden Mushroom Kingdom:A Classification Analysis
Team Members	Sudherson R (Team Leader) Naveen Kumar A (Team Member) Samsudeen Mohammed Riyaz (Team Member) Rahul S (Team Member)

INTRODUCTION

1.1 Project Overview

In this project we are classifying various types of Mushrooms that are found on various regions of our planet. These Mushrooms are majorly classified into 3 categories namely Boletus, Lactarius & Russula. Deep-learning (DL) methods in artificial intelligence (AI) play a dominant role as high-performance classifiers in the detection of the Mushrooms using images. Transfer learning has become one of the most common techniques that has achieved better performance in many areas, especially in image analysis and classification. We used Transfer Learning techniques like Inception V3,Resnet50V2, Xception that are more widely used as a transfer learning method in image analysis and they are highly effective. Mushrooms are a type of fungi that grow in a variety of habitats, from forests to fields to decomposing logs. They come in many different shapes, sizes, and colors, and are used for food, medicine, and other purposes. A mushroom is a fruitful body of fungus which is usually produced above the ground on soil or other nutrients

1.2 Purpose

The purpose of the project "Uncovering The Hidden Mushroom Kingdom: A Classification Analysis" is to apply classification analysis techniques to uncover hidden patterns and relationships within the Mushroom Kingdom.

The Mushroom Kingdom is a fictional world in the popular Nintendo franchise, Super Mario. It is inhabited by various creatures, including mushrooms, turtles, and other unique characters. This project aims to analyze and classify these characters based on their characteristics, attributes, and behaviors. Classify the different characters in the Mushroom Kingdom into meaningful categories or classes based on their shared characteristics. This can involve identifying different species, roles, or power-ups possessed by the characters.Overall, the purpose of this project is to utilize classification analysis techniques to delve into the Mushroom Kingdom, reveal its hidden secrets, and provide a comprehensive understanding of the characters and their relationships within this fictional universe.

1.3 LITERATURE SURVEY

The advanced technology made a huge impact on human life. Different types of tools developed to make life better. Machine learning (ML) is the field of study that enable computers to learn from data[5]. ML used to extract information from data and make decisions. It has been used by all type of industries. There are many machine-learning approaches applied to find the optimal solution from huge data sets. Data classification includes two-step process. The first process is learning step representing by constructing the classification model. The second process is a classification (testing) step and in this step represents the constructed model, which used a given data to predict class labels for them. Decision tree is one of the common method that represents choices and their results in a tree. It has several implementation: ID3, J48, C4.5, Random Forest, Random Tree, ID3+, Oci and Clouds. It has been used to classify the mushrooms whether edible or poisonous based on its behavioral features[4]. They used J48 implementation and the running time on both training and test set is the same with 100% accuracy. A comparative study between most used classification methods[6] shows that the best result obtained by KNN. The KNN used with

naïve Bayes to get more accurate and efficient result[7]. naïve Bayes is a classification techniques that based on base theory. Naïve base count the frequencies of data and their values to calculate probabilities. It assumes that a feature in a class is independent of other features[8]. Researches have state that the performance of Bayesian classifier is better than to the performance of decision tree and selected neural network[9]. Image processing techniques with naïve Bayes and KNN algorithms used to classify mushroom[10], naive Bayes shows better accuracy than KNN.

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IDEATION & PROPOSED SOLUTION

2.1 Problem Statement Definition

Customer Problem Statement:

Fig 2.1.1 Customer Problem Statement

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makesme feel
PS-1	Security officer	efficiently monitor the people and vehicles enteringthe premises	manual counting method is time-consuming and prone to errors	It is challenging to accurately track and respond to potential security threats	frustrated and concerned about the overall security
PS-2	Maintenance staff member	Plan maintenanc eschedules and allocate resources effectively	lack of accurate data on thenumber ofoccupants and vehicles within the premises	struggle to plan maintenance activities efficiently and allocate resources appropriately	frustrated andresults in inefficient maintenance operations.
PS-3	Secretariat administrator	improve visitor manageme nt and enhance the overall visitor experience	manual process of counting and tracking visitors entering and exiting	there are errors in visitor records and delays in providing necessary assistance	overwhelmed and concerned about visitor satisfaction.
			the premises		
PS-4	Security personnel	Trying to efficiently manage	The problem is the manual	of this, there are delays in	concerned about the effectiveness

		access control and monitor entry points.	process of verifying visitor identity and counting their entry.	granting access and a risk of unauthorized entry.	of the security measures.

Table 2.1.1 Customer Problem Statement

2.2 Empathy Map Canvas

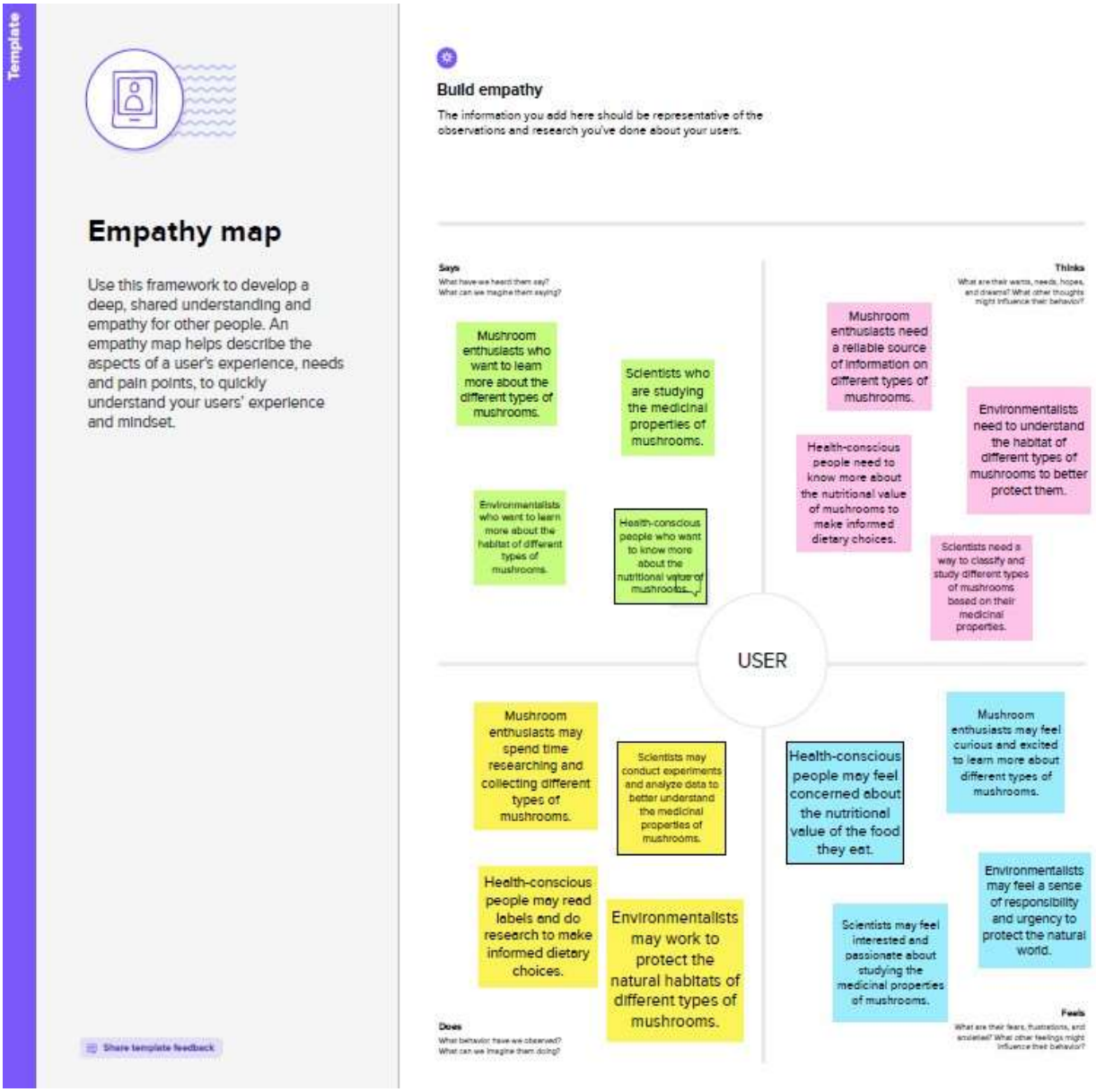


Fig 2.2.1 Empathy Map Canvas

2.3 Ideation & Brainstorming

Team Gathering, Collaboration and Select the Problem Statement

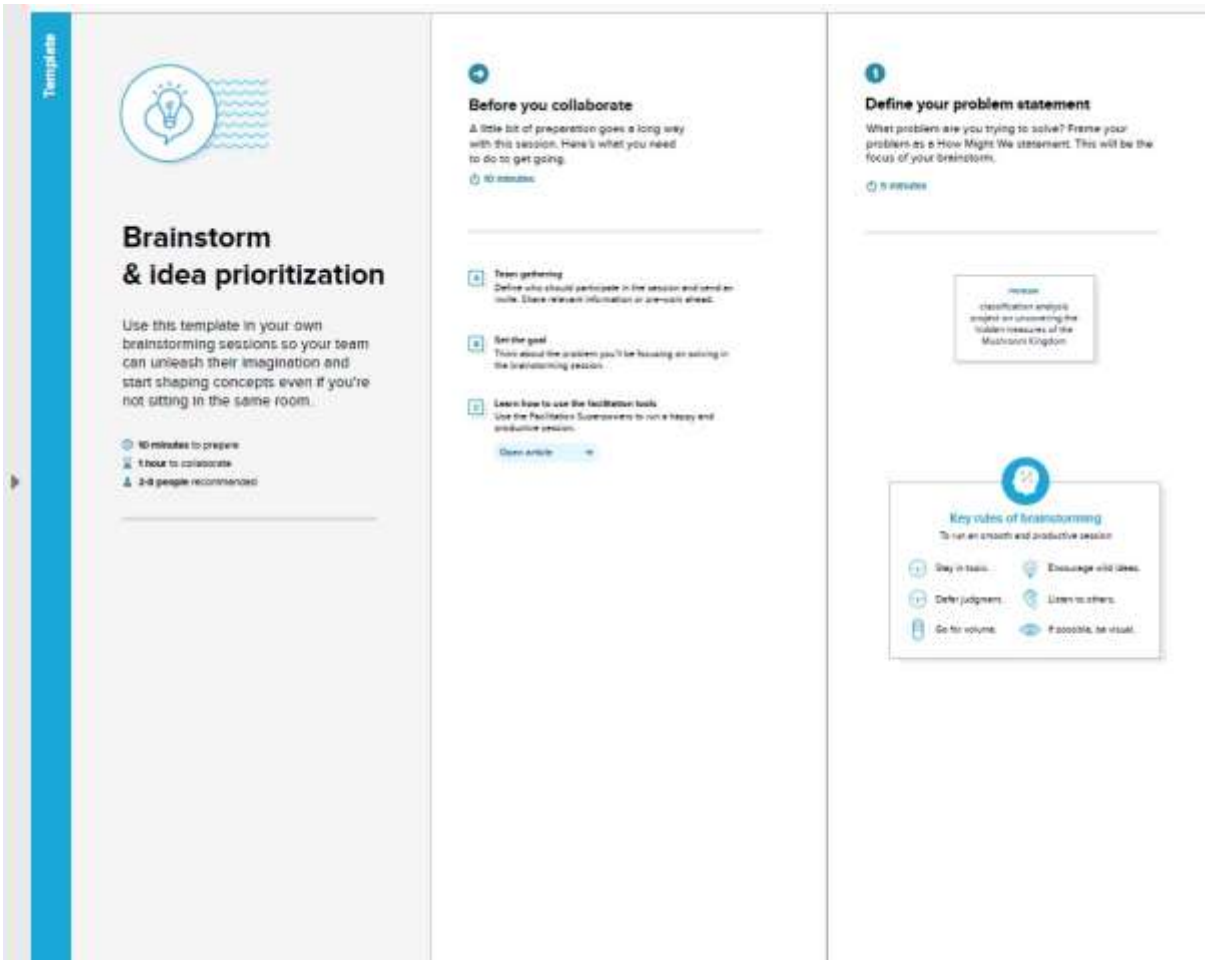
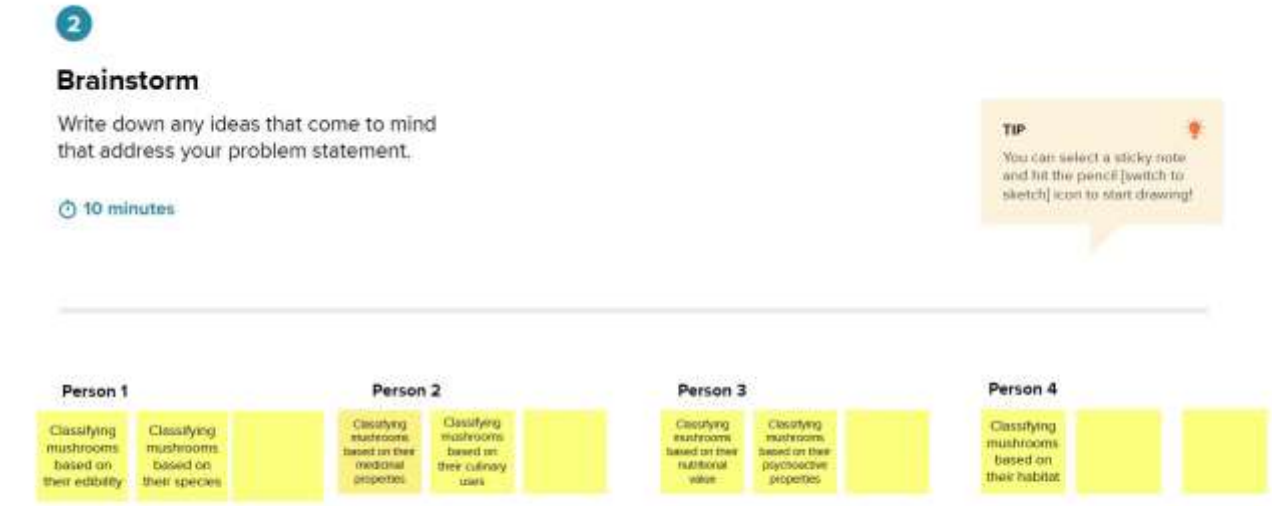
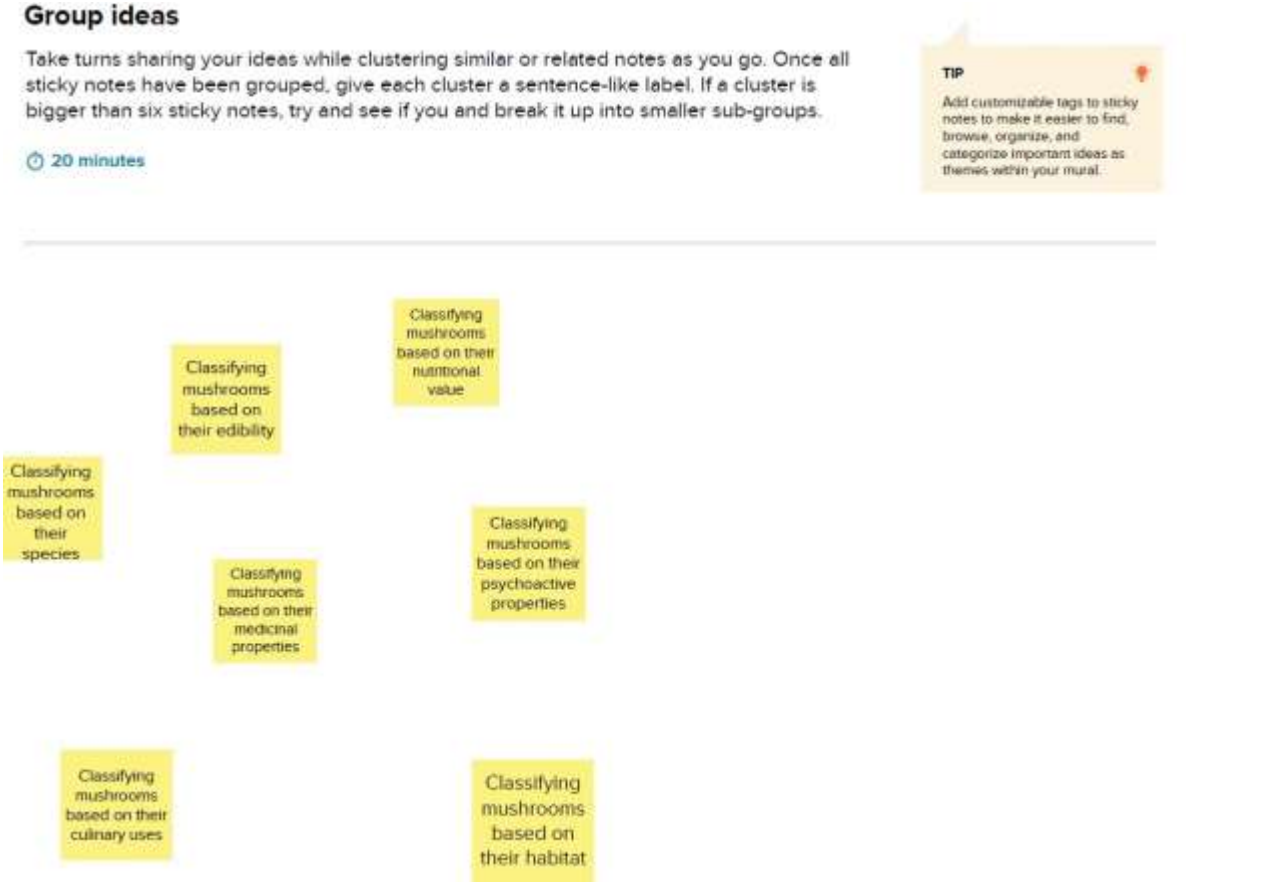


Fig 2.3.1 Brainstorm

Brainstorm, Idea Listing and Grouping:





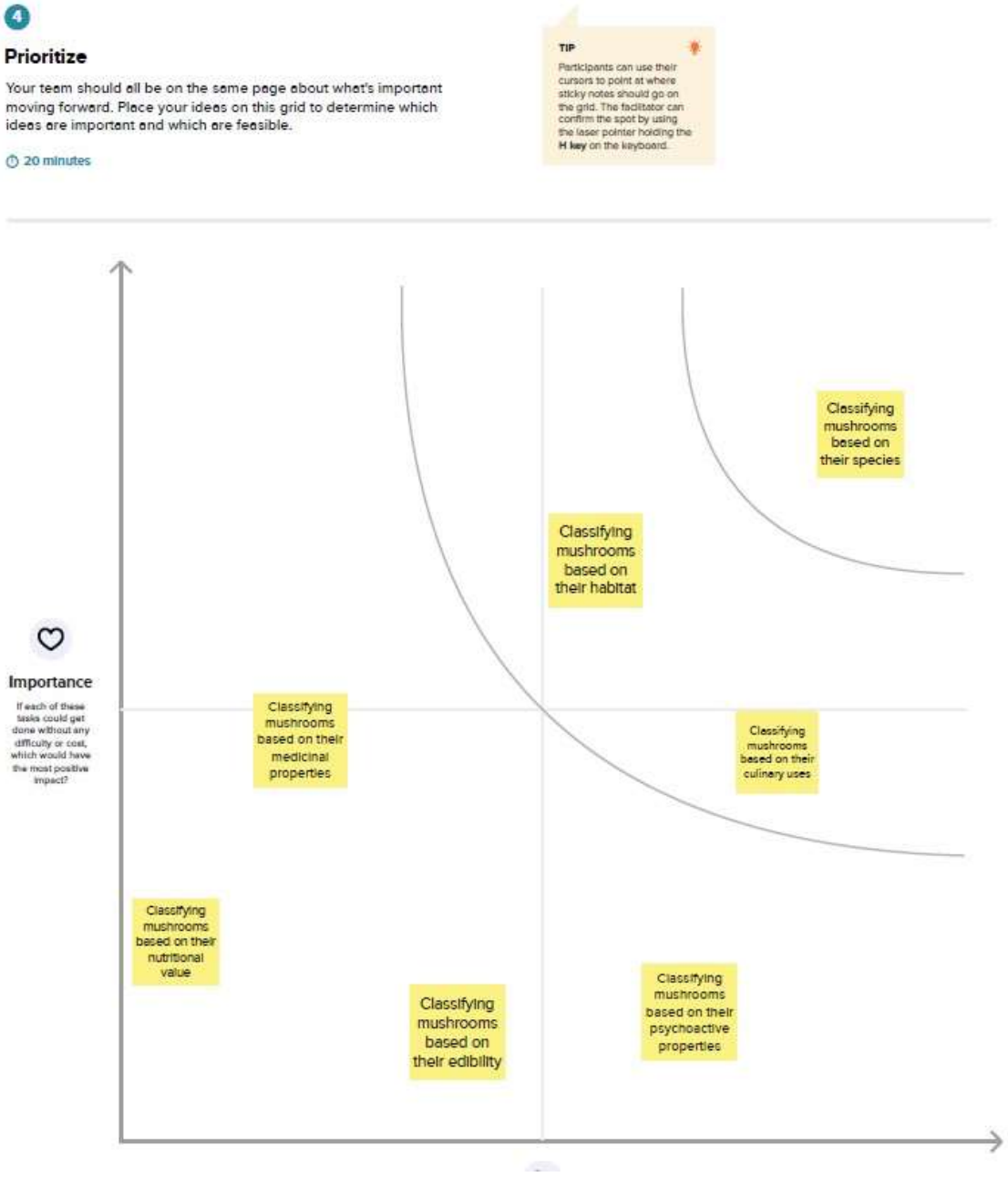


Fig 2.3.1 Idea Prioritization

2.4 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Classification analysis project on uncovering the hidden treasures of the Mushroom Kingdom
2.	Idea / Solution description	Applying the machine language to the classification analysis project on uncovering the hidden treasures of the Mushroom kingdom
3.	Novelty / Uniqueness	To solve the problems of classification analysis in this project, we can use various techniques of machine learning such as decision trees, random forests, support vector machines, and neural networks. These algorithms can be trained on a dataset of mushroom samples, each labelled with its corresponding species and various physical characteristics
4.	Social Impact / Customer Satisfaction	First and foremost, this type of technologycan lead to advancements in the field of mycology, as the analysis of

		different mushroom species can reveal previously unknown properties and uses.
5.	Business Model (Revenue Model)	In order to achieve this goal, a comprehensive business modelwill need to be developed that incorporates classification analysis. The business model will outline the key activities and processes necessary to effectively identify and extract the hidden treasures in the Mushroom Kingdom.
6.	Scalability of the Solution	The objective of the classification analysis project is to uncover hidden treasures or patterns in the Mushroom Kingdom dataset. The dataset contains information about various

REQUIREMENT ANALYSIS

3.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	To participate in Uncovering The Hidden Treasures of the Mushroom Kingdom: A Classification Analysis, users will need to complete the registration process. The registration processwill require users to provide their personal information, such as their full name, email address, and country of residence. Once the registration form has been completed and submitted, users will receive a confirmation email containing instructions on how to access the platform.
FR-2	User Confirmation	The aims to providean in-depth analysis of the different types of mushrooms found in the Mushroom Kingdom, including their properties and potential uses. Through classification techniques, we have organized the wide variety of mushroom species into distinct groups based on physical characteristics and chemical properties. We believe

3.2 Non-Functional requirement

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	In this classification analysis, we will be looking at the different aspects of usability that are relevant for uncovering hidden treasures in the mushroom kingdom. Discoverability: This refers to how easily users can find important features or information within the application. The application should have clear navigation and menu options that help users to quickly access the different features of the application related to treasure hunting, such as maps.
NFR-2	**Security**	This analysis can help identify the different types ofmushrooms and their potential benefits or dangers, which can enhance the safety and security of mushroom foragers and consumers. Here are some security measures that can be employed to ensure the safety and well-being of those involved in mushroom foraging and consumption.
NFR-3	**Reliability**	In order to assess the reliability of the classification analysis in uncovering the hidden treasures of the mushroom kingdom, it is important to

		consider the accuracy and consistencyof the results. Accuracy refers to how well the model correctly classifies the different types of mushrooms in the kingdom. This can be measured by comparing the model predictions with the actual characteristics of the mushrooms. In order to ensure accuracy.
NFR-4	**Performance**	In this project we are classifying various types of Mushrooms that are found on various regions of our planet. These Mushrooms are majorly classified into 3 categories namely Boletus, Lactarius & Russula. Deep-learning (DL) methods in artificial intelligence (AI) play a dominant role as high-performance classifiers in the detection of the Mushrooms using images. Transfer learning has become one of the most common techniques that has achieved better performance in many areas, especially in image analysis and classification. We used Transfer Learning techniques like Inception V3,Resnet50V2, Xception that are more widely used as a transfer learning method in image analysis and they are highly effective.

NFR-5	**Availability**	These Mushrooms are majorly classified into 3 categories namely Boletus, Lactarius & Russula. Deep-learning (DL) methods in artificial intelligence (AI) play a dominant role as high-performance classifiers in the detection of the Mushrooms using images. Transfer learning has become one of the most common techniques that has achieved better
		performance in many areas, especially in image analysis and classification. We used Transfer Learning techniques like Inception V3,Resnet50V2, Xception that are more widely used as a transfer learning method in image analysis and they are highly effective.
NFR-6	**Scalability**	In the proposed approach, we used different algorithms to get best results of mushroom classification, we implement each of neural network (NN), SVM, Decision Tree, and KNN on different scenarios, with background and without background. We extract different features from mushroom images like Eigen features, histogram features and parametric features. In order to improve the results, we remove images background but unfortunately this step failed to improve the result. Finally, the experiment results show advantage for background images.

PROJECT DESIGN

4.1 Data Flow Diagram

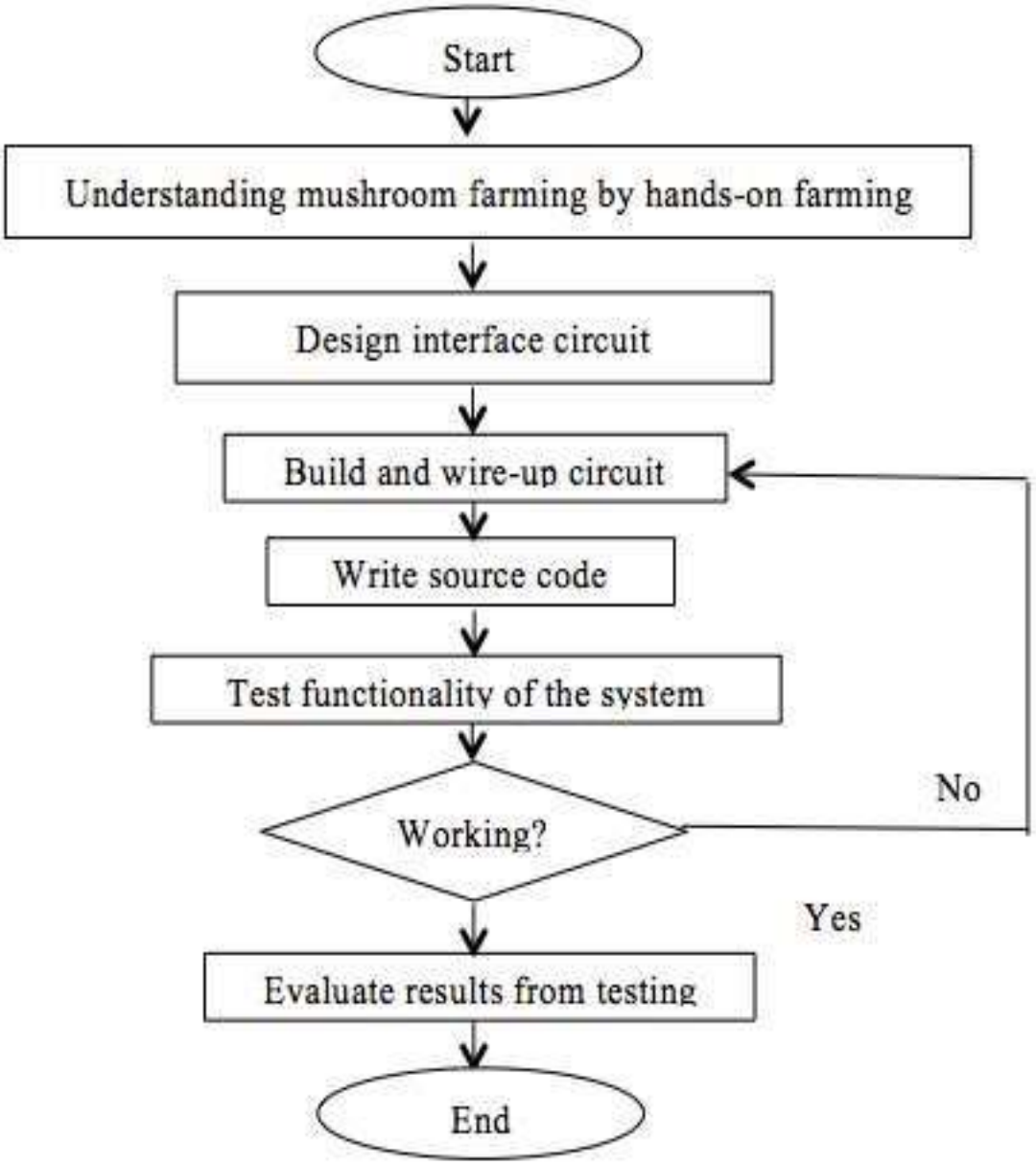


Fig 4.1.2 Data flow diagram

4.2 Solution & Technical Architecture

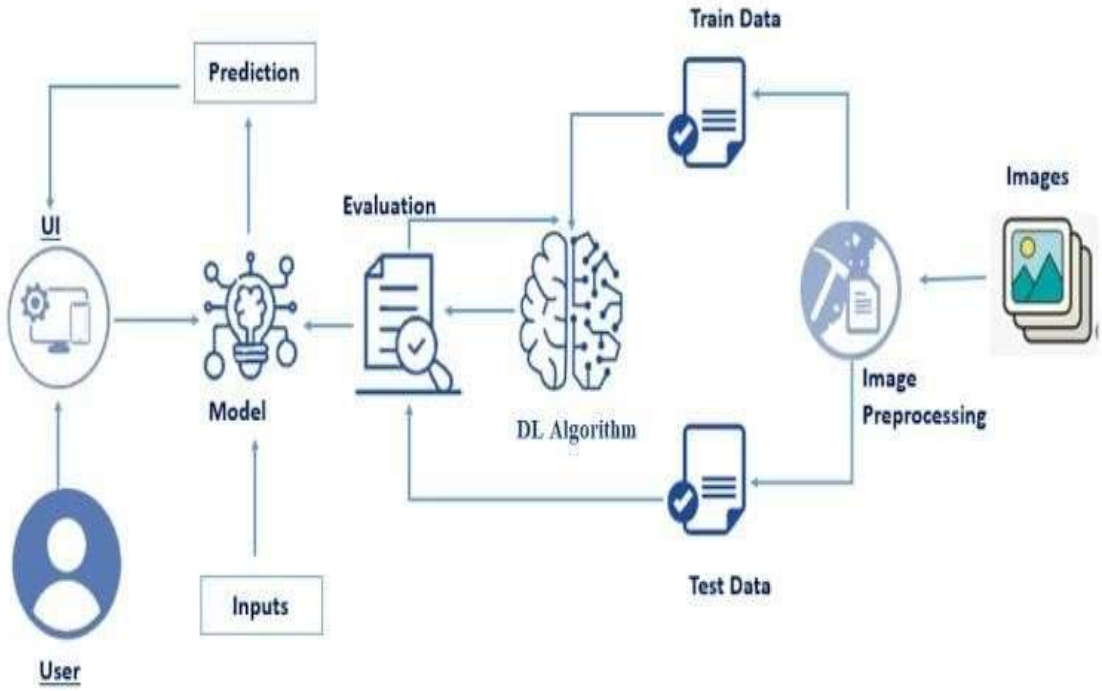


Fig 4.2.1 solution and technical architecture

4.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	T M
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	R
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	S
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	R
		USN-4	As a user, I can register for the application through Gmail	I can receive the application through Gmail	Medium	N
	Login	USN-5	As a user, I can log into the application by entering email & password	I can access the application by email via.	High	s
	Dashboard					
Customer (Web user)	Uncovering The Hidden Treasures of the mushroom kingdom	User 1	As an educator, I want to access the classification analysis tool to teach my students about the diverse mushroom species found in the Mushroom Kingdom, fostering their curiosity and understanding of the natural world.	Reasearch and identify	High	
Customer Care Executive	Give an proper response		As a Customer Care executive, I'm here to assist you with any questions or concerns you may have regarding the classification analysis of uncovering the hidden treasures of the mushroom kingdom. Please feel free to ask me	Understanding purpose via	High	

			anything, and I'll do my best to help you.		
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority
Administrator			Power-ups: Super Mushroom: An iconic power-up that increases Mario's size and grants an additional hit point. Fire Flower: Grants Mario the ability to throw fireballs at enemies. Super Star: Provides temporary invincibility and increased speed to Mario. Tanooki Suit: Allows Mario to transform into a statue, fly, and attack with a tail. Cape Feather: Enables Mario to fly and perform a spinning attack. Collectible Coins: Gold Coins: The standard currency in the Mushroom Kingdom. Red Coins: Usually found in groups, collecting them often rewards special items or Power Stars. Blue Coins: Sometimes hidden or earned through specific challenges, they can be exchanged for unique rewards. Power Moons: Power Moons: Scattered throughout the kingdom, these serve as the primary objective in Super Mario Odyssey, unlocking new areas and progression. Warp Pipes: Green Warp Pipes: Used for transportation between different parts of the Mushroom Kingdom. Warp Whistles: Rare items that allow Mario to warp to new worlds or levels. Special Items: 1-Up Mushrooms: Extra lives that grant Mario an additional chance if he loses all his hit points. Yoshi Eggs: Hatching these eggs grants Mario the ability to ride Yoshi, who has unique abilities. Hidden Blocks: Question Blocks: Contain various items, including power-ups and coins. Invisible Blocks: Often placed strategically, these blocks can provide hidden paths or rewards. Treasures and Artifacts: Star Coins: Found in some games, these are used to unlock secret levels or areas.	Implemented the phase to solve the eye problems	High

			Royal Crowns: Valuable artifacts that may hold special powers or abilities.		

CODING & SOLUTIONING

RESULTS

6.1 Performance Metrics

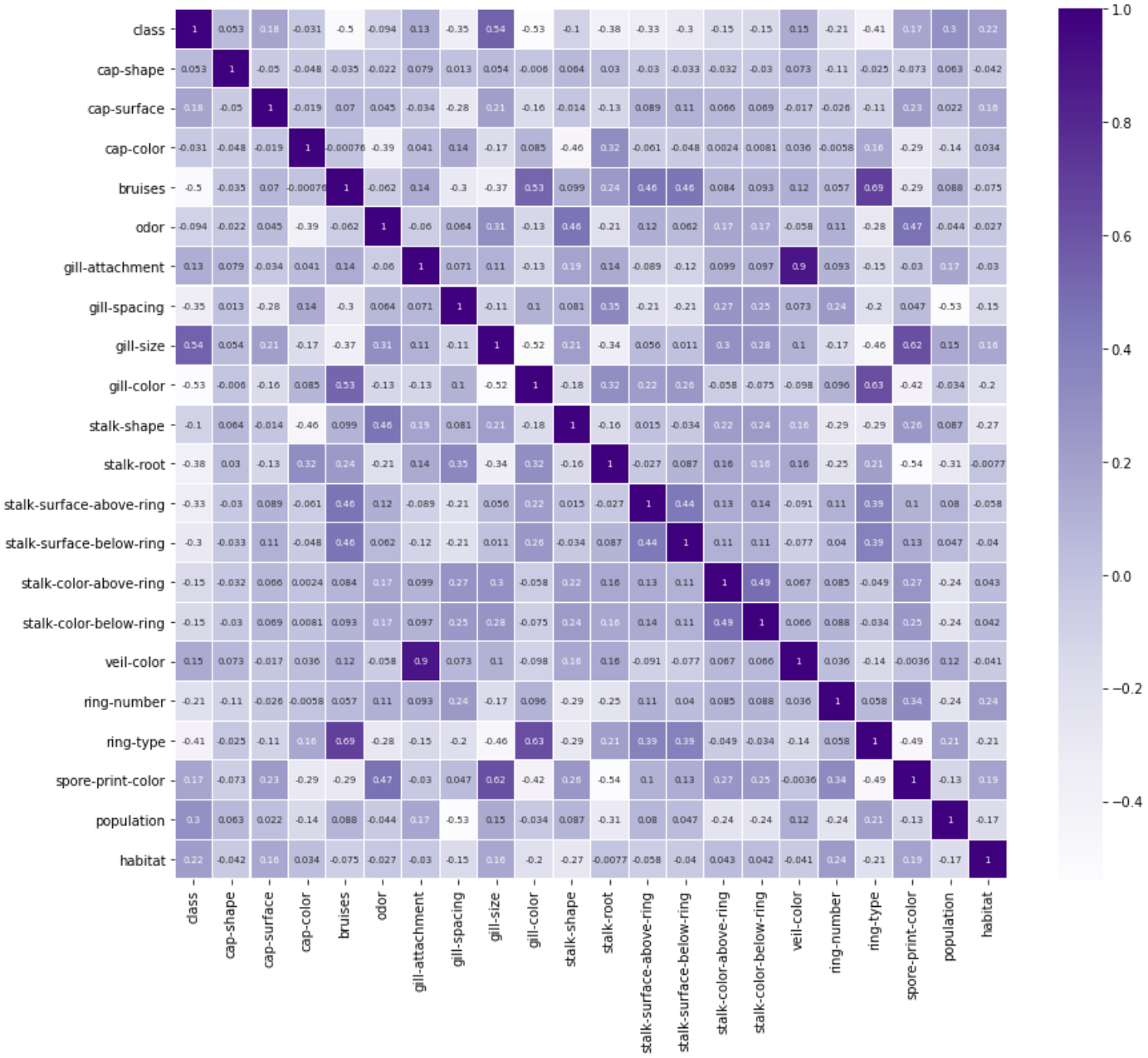


Fig 6.1.1 Running Simulation

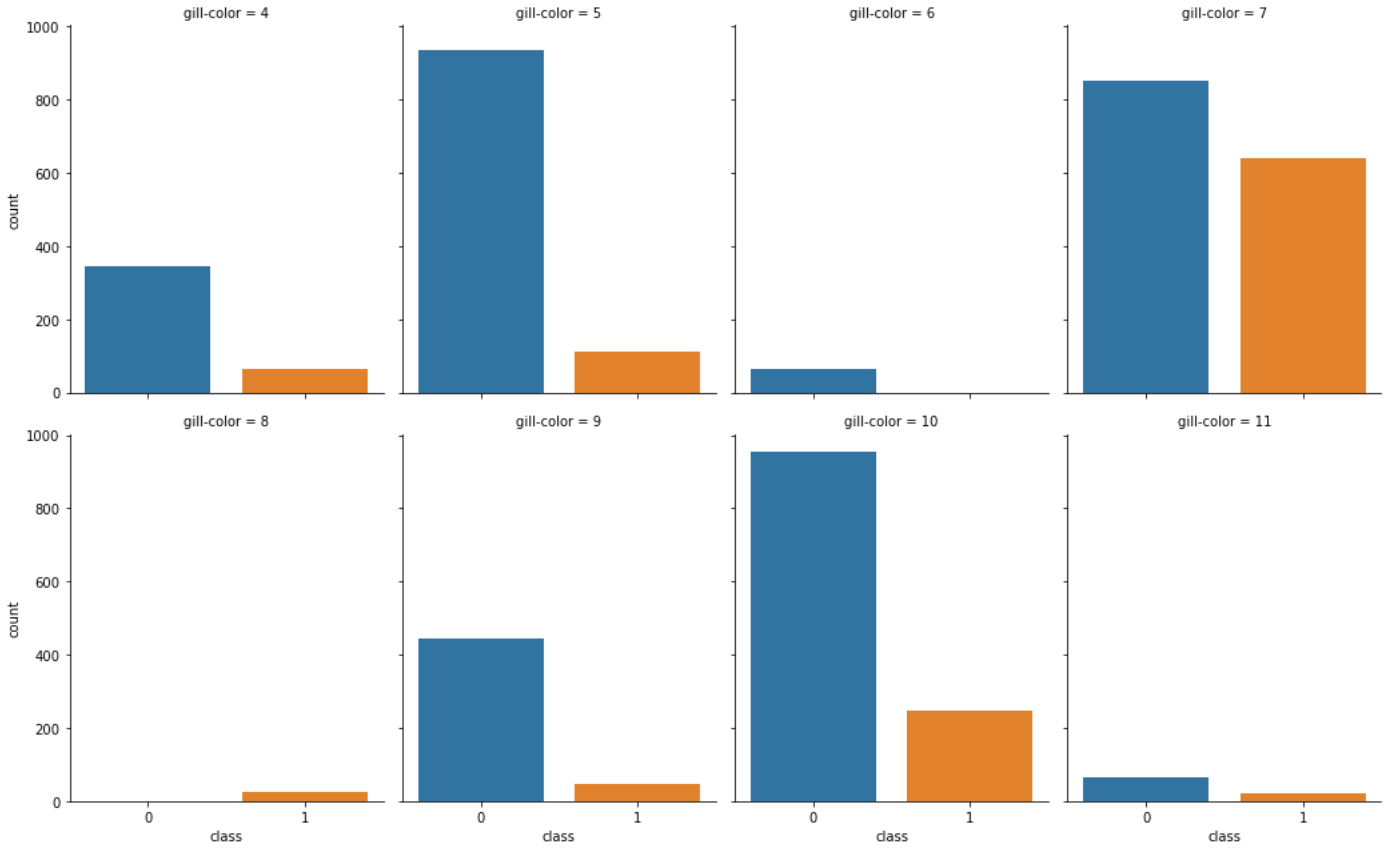


Fig 6.1.2 Iot Watson Platform

Node-red flow and Dashboard:

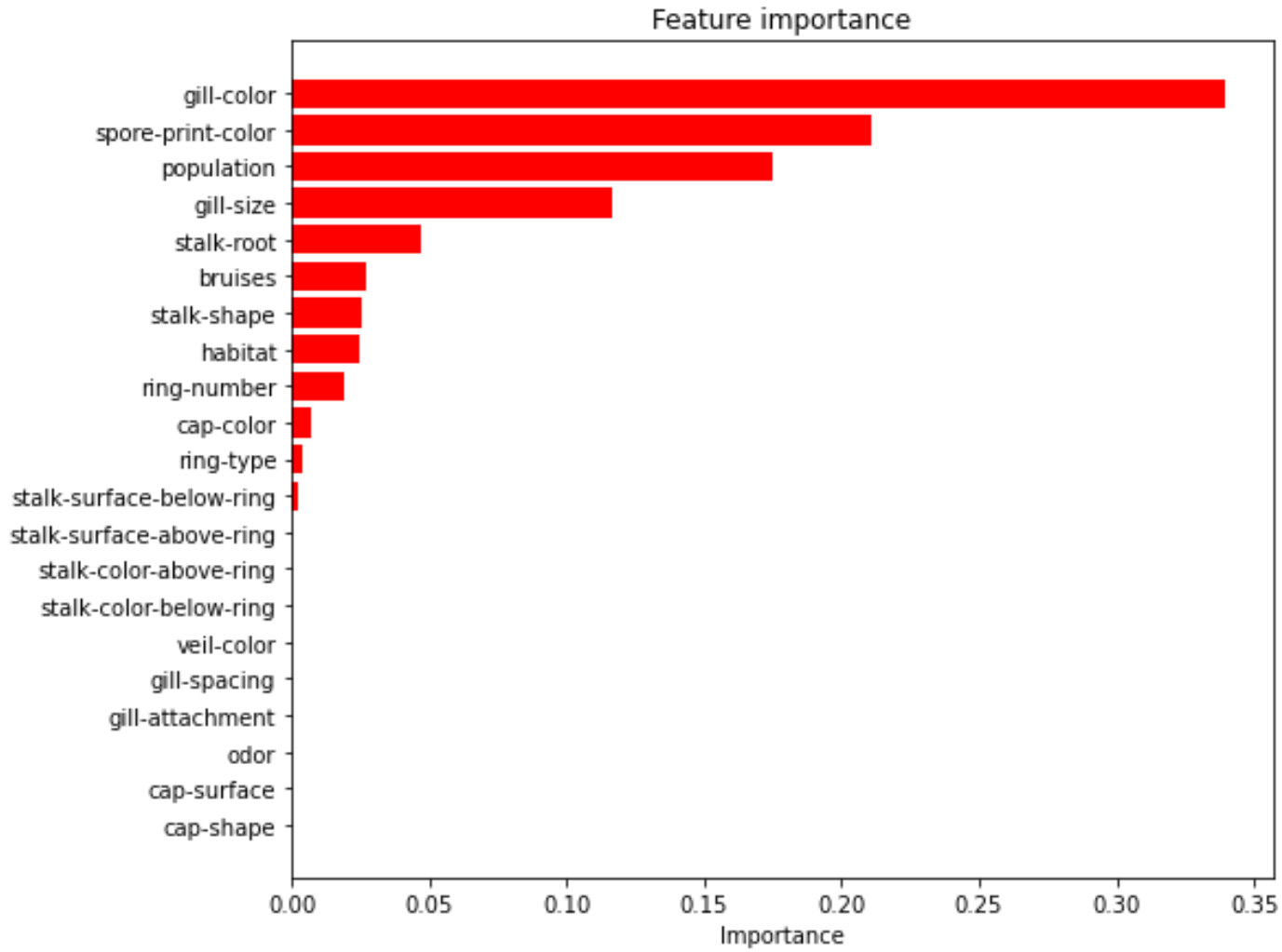


Fig 6.1.3 Node-red flow

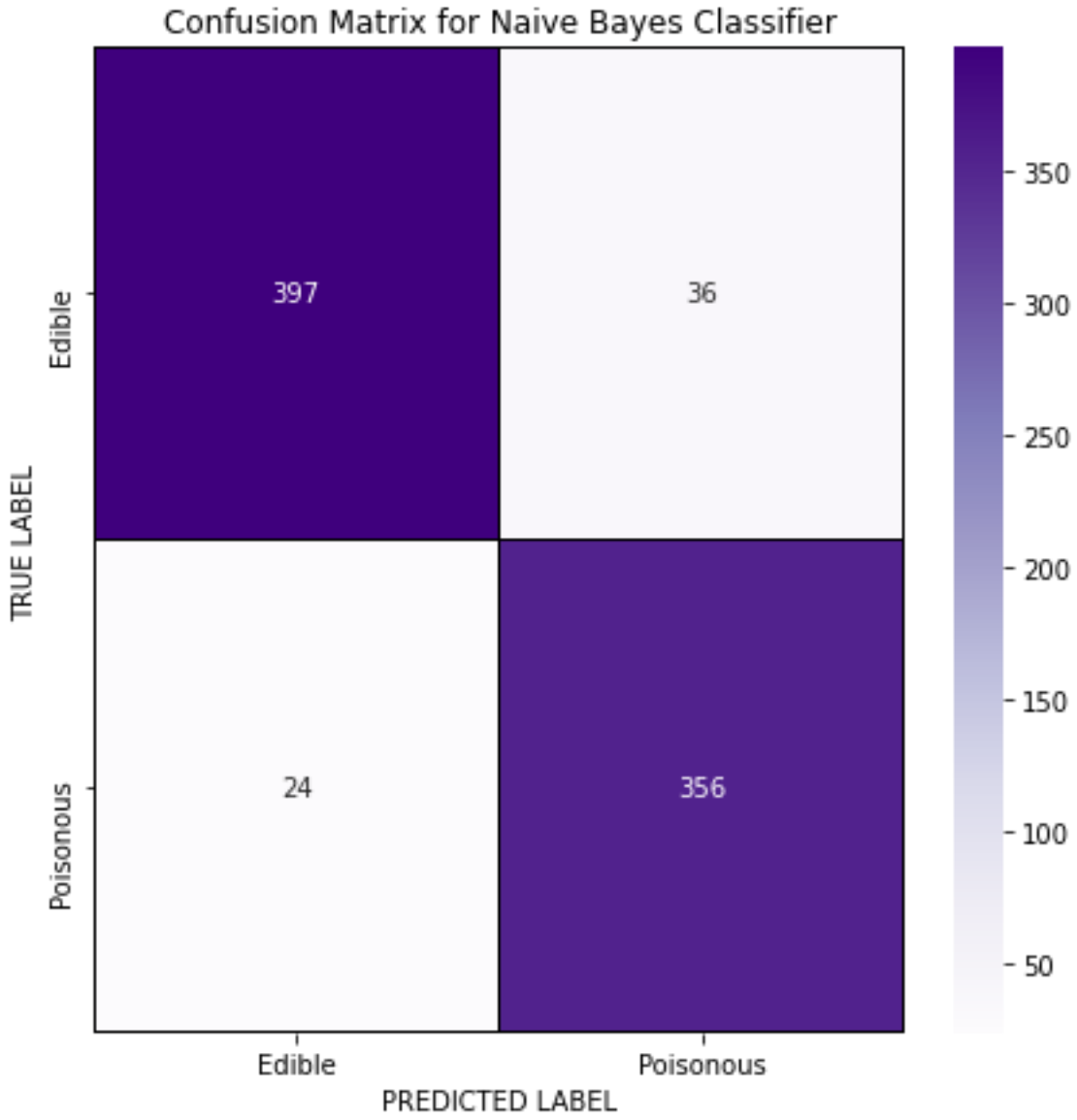


Fig 6.1.4 Node-red Dashboard

ADVANTAGES

Medicinal Potential: Mushrooms possess a wide array of bioactive compounds that exhibit medicinal properties. These compounds have shown promise in the treatment and prevention of various diseases, including cancer, cardiovascular conditions, and immune disorders. Exploring the medicinal potential of mushrooms opens up new avenues for drug discovery and alternative therapies.

Nutritional Value: Mushrooms are low in calories and fat while being rich in essential nutrients, including vitamins (such as vitamin D and B vitamins), minerals (such as potassium and selenium), and dietary fiber. Incorporating mushrooms into diets can enhance nutritional intake, promote overall health, and contribute to a balanced diet.

Culinary Versatility: Mushrooms offer a unique flavor profile, texture, and culinary versatility. They can be cooked in numerous ways, from sautéing and grilling to incorporating them into soups, stews, and sauces. Their umami-rich taste adds depth and complexity to dishes, making them a valuable ingredient for chefs and home cooks.

Environmental Benefits: Mushrooms play a vital role in ecological systems as decomposers and symbiotic partners with plants. They help break down organic matter, contribute to nutrient cycling, and promote healthy soil ecosystems. Cultivating mushrooms can be a sustainable agricultural practice that utilizes waste materials and reduces environmental impact.

Economic Opportunities: The mushroom industry offers economic opportunities, including commercial cultivation, gourmet mushroom production, and the development of value-added mushroom products. These ventures can stimulate local economies, create jobs, and provide avenues for entrepreneurship and innovation.

DISADVANTAGES

1. Limited generalization: Mushroom classification models are often trained on specific datasets that may not cover the full diversity of mushrooms. Consequently, the model's ability to generalize to unseen or rare mushroom species may be limited. This can lead to misclassifications or inaccurate predictions when encountering mushrooms outside the training dataset.
2. Safety concerns: Although mushroom classification models can assist in identifying edible and poisonous mushrooms, there is always a risk of misclassification or false negatives. Relying solely on a machine learning model for mushroom identification without expert verification can be dangerous, as misidentifying a poisonous mushroom as safe to consume could have severe health consequences.
3. Lack of interpretability: Some machine learning algorithms, such as deep neural networks, can be complex and lack interpretability. It may be challenging to

understand the underlying reasons or features driving the model's predictions. This can limit the ability to explain and justify the classification results, which may be crucial in certain contexts, such as scientific research or legal proceedings.

4. Dataset biases: The accuracy and reliability of a mushroom classification model heavily depend on the quality and representativeness of the training dataset. Biases or errors in the dataset, such as mislabeled samples or imbalanced class distributions, can lead to biased or skewed predictions. It is essential to ensure the dataset used for training is carefully curated and balanced to minimize these biases.
5. Ethical considerations: Deploying a mushroom classification model without considering ethical implications can lead to unintended consequences. For example, if the model is used to guide foraging or commercial mushroom harvesting, it may contribute to overharvesting or ecological damage if not used responsibly. Additionally, if the model's predictions are used in a regulatory or legal context, it is crucial to consider the potential impact on individuals or communities affected by the model's decisions.

CONCLUSION

In conclusion, the journey to uncover the hidden treasures of the Mushroom Kingdom has revealed a world full of marvels and potential. Through the exploration of medicinal properties, nutritional composition, culinary delights, ecological significance, cultural relevance, cultivation techniques, and mycological research, we have gained valuable insights into the diverse and fascinating world of mushrooms.

Mushrooms have demonstrated their immense potential as sources of medicinal compounds, offering new possibilities for drug development and natural remedies. Their nutritional value has highlighted their significance in maintaining a healthy diet and preventing nutrient deficiencies. From traditional recipes to innovative culinary creations, mushrooms have proven to be versatile and delicious ingredients that inspire chefs and culinary enthusiasts alike.

The ecological importance of mushrooms cannot be understated, as they play crucial roles in nutrient cycling, soil health, and biodiversity. Understanding their contributions to the environment opens up avenues for sustainable practices and environmental conservation.

Additionally, our exploration of the cultural and historical significance of mushrooms has provided a deeper understanding of the human-mushroom relationship and its influence on cultural practices and traditions across the globe. This cultural appreciation enriches our understanding of the interconnectedness between nature and human society.

Looking to the future, there are numerous opportunities for further research and development in the realm of mushrooms. Advanced medicinal research, functional food development, biotechnology applications, and genomic studies hold great promise for harnessing the potential of mushrooms in various field

FUTURE SCOPE

- To explore the medicinal properties of mushrooms: Investigate the bioactive compounds present in mushrooms and their potential therapeutic benefits, aiming to contribute to the field of natural medicine and the development of new treatments.
- To analyze the nutritional composition of mushrooms: Investigate the nutrient content of various mushroom species, including vitamins, minerals, and dietary fiber, to promote their inclusion in a healthy and balanced diet.
- To delve into the culinary potential of mushrooms: Explore different culinary uses of mushrooms, including traditional recipes and innovative cooking techniques, to inspire culinary enthusiasts and chefs to experiment with mushrooms in their culinary creations.
- To understand the ecological significance of mushrooms: Investigate the role of mushrooms as decomposers and symbiotic partners with plants, examining their impact on nutrient cycling, soil health, and biodiversity, with the aim of promoting environmental conservation and sustainable practices.
- To explore the cultural and historical significance of mushrooms: Investigate the cultural uses, beliefs, and folklore associated with mushrooms in different societies and regions, aiming to gain insights into the human-mushroom relationship and its influence on cultural practices and traditions.

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APPENDIX

Source Code

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import os
   from sklearn.model_selection import
   train_test_split
from sklearn.preprocessing import
  LabelEncoder
from sklearn.metrics import
  classification_report, confusion_matrix
from sklearn.tree import export_graphviz
import graphviz
print(os.listdir("C:/Users/Kanchi/Pycharm
  Projects/Mushroom-Classification"))
df = pd.read_csv("mushrooms.csv")
df.head()
df.info()
df.describe()
print("Dataset shape:", df.shape)
df['class'].value_counts()
df["class"].unique()
count = df['class'].value_counts()
plt.figure(figsize=(8,7))
sns.barplot(count.index, count.values,
  alpha=0.8, palette="prism")
plt.ylabel('Count', fontsize=12)
plt.xlabel('Class', fontsize=12)
plt.title('Number of poisonous/edible
  mushrooms')
#plt.savefig("mushrooms1.png",
  format='png', dpi=900)
plt.show()
df = df.astype('category')
df.dtypes
labelencoder=LabelEncoder()
for column in df.columns:
    df[column] =
  labelencoder.fit_transform(df[column])
df.head()
df['veil-type']
df=df.drop(["veil-type"],axis=1)
df_div = pd.melt(df, "class",
  var_name="Characteristics")
fig, ax = plt.subplots(figsize=(16,6))
```

```
p = sns.violinplot(ax = ax,
  x="Characteristics", y="value",
  hue="class", split = True, data=df_div,
  inner = 'quartile', palette = 'Set1')
df_no_class = df.drop(["class"],axis = 1)
p.set_xticklabels(rotation = 90, labels =
  list(df_no_class.columns));
#plt.savefig("violinplot.png", format='png',
  dpi=900, bbox_inches='tight')
plt.figure(figsize=(14,12))
sns.heatmap(df.corr(),linewidths=.1,cmap=
  "Purples", annot=True,
  annot_kws={"size": 7})
plt.yticks(rotation=0);
#plt.savefig("corr.png", format='png',
  dpi=900, bbox_inches='tight')
df[['class', 'gill-color']].groupby(['gill-
  color'],
  as_index=False).mean().sort_values
new_var = df[['class', 'gill-color']]
new_var = new_var[new_var['gill-
  color']<=3.5]
sns.factorplot('class', col='gill-color',
  data=new_var, kind='count', size=4.5,
  aspect=.8, col_wrap=4);
#plt.savefig("gillcolor1.png", format='png',
  dpi=900, bbox_inches='tight')
new_var=df[['class', 'gill-color']]
new_var=new_var[new_var['gill-
  color']>3.5]
sns.factorplot('class', col='gill-color',
  data=new_var, kind='count', size=4.5,
  aspect=.8, col_wrap=4);
#plt.savefig("gillcolor2.png", format='png',
  dpi=900, bbox_inches='tight')
X = df.drop(['class'], axis=1)
y = df["class"]
X_train, X_test, y_train, y_test =
  train_test_split(X, y, random_state=42,
  test_size=0.1)
from sklearn.tree import
  DecisionTreeClassifier
dt = DecisionTreeClassifier()
dt.fit(X_train, y_train)
os.environ["PATH"] += os.pathsep +
  'C:/Program Files
  (x86)/Graphviz2.38/bin/'
dot_data = export_graphviz(dt,
  out_file=None,
                      feature_names=X.columns,
```

```
                    filled=True, rounded=True,
                    special_characters=True)
graph = graphviz.Source(dot_data)
#graph.render(filename='DecisionTree')
graph
features_list = X.columns.values
feature_importance =
 dt.feature_importances_
sorted_idx =
 np.argsort(feature_importance)
plt.figure(figsize=(8,7))
plt.barh(range(len(sorted_idx)),
 feature_importance[sorted_idx],
 align='center', color ="red")
plt.yticks(range(len(sorted_idx)),
 features_list[sorted_idx])
plt.xlabel('Importance')
plt.title('Feature importance')
plt.draw()
#plt.savefig("featureimp.png",
 format='png', dpi=900,
 bbox_inches='tight')
plt.show()
y_pred_dt = dt.predict(X_test)
print("Decision Tree Classifier report:
 \n\n", classification_report(y_test,
 y_pred_dt))
print("Test Accuracy:
 {}%".format(round(dt.score(X_test,
 y_test)*100, 2)))
y_pred_svm = svm.predict(X_test)
print("SVM Classifier report: \n\n",
 classification_report(y_test,
 y_pred_svm))
cm = confusion_matrix(y_test,
 y_pred_svm)

x_axis_labels = ["Edible", "Poisonous"]
y_axis_labels = ["Edible", "Poisonous"]

f, ax = plt.subplots(figsize =(7,7))
sns.heatmap(cm, annot = True,
 linewidths=0.2, linecolor="black", fmt =
 ".0f", ax=ax, cmap="Purples",
 xticklabels=x_axis_labels,
 yticklabels=y_axis_labels)
plt.xlabel("PREDICTED LABEL")
plt.ylabel("TRUE LABEL")
plt.title('Confusion Matrix for SVM
 Classifier')
```

```
#plt.savefig("svmcm.png", format='png',
  dpi=900, bbox_inches='tight')
plt.show()
from sklearn.naive_bayes import
  GaussianNB
nb = GaussianNB()
nb.fit(X_train, y_train)
print("Test Accuracy:
  {}%".format(round(nb.score(X_test,
  y_test)*100, 2)))

y_pred_nb = nb.predict(X_test)
print("Naive Bayes Classifier report: \n\n",
  classification_report(y_test, y_pred_nb))
cm = confusion_matrix(y_test, y_pred_nb)

x_axis_labels = ["Edible", "Poisonous"]
y_axis_labels = ["Edible", "Poisonous"]

f, ax = plt.subplots(figsize =(7,7))
sns.heatmap(cm, annot = True,
  linewidths=0.2, linecolor="black", fmt =
  ".0f", ax=ax, cmap="Purples",
  xticklabels=x_axis_labels,
  yticklabels=y_axis_labels)
plt.xlabel("PREDICTED LABEL")
plt.ylabel("TRUE LABEL")
plt.title('Confusion Matrix for Naive Bayes
  Classifier')
#plt.savefig("nbcm.png", format='png',
  dpi=900, bbox_inches='tight')
plt.show()

from sklearn.ensemble import
  RandomForestClassifier

rf =
  RandomForestClassifier(n_estimators=10
  0, random_state=42)
rf.fit(X_train, y_train)

print("Test Accuracy:
  {}%".format(round(rf.score(X_test,
  y_test)*100, 2)))

y_pred_rf = rf.predict(X_test)
print("Random Forest Classifier report:
  \n\n", classification_report(y_test,
  y_pred_rf))
cm = confusion_matrix(y_test, y_pred_rf)
```

```
x_axis_labels = ["Edible", "Poisonous"]
y_axis_labels = ["Edible", "Poisonous"]

f, ax = plt.subplots(figsize =(7,7))
sns.heatmap(cm, annot = True,
  linewidths=0.2, linecolor="black", fmt =
  ".0f", ax=ax, cmap="Purples",
  xticklabels=x_axis_labels,
  yticklabels=y_axis_labels)
plt.xlabel("PREDICTED LABEL")
plt.ylabel("TRUE LABEL")
plt.title('Confusion Matrix for Random
  Forest Classifier');
#plt.savefig("rfcm.png", format='png',
  dpi=900, bbox_inches='tight')
plt.show()
preds = dt.predict(X_test)

print(preds[:36])
print(y_test[:36].values)

# 0 - Edible
# 1 - Poisonous
```