

Milestone 1: Project Initialization and Planning Phase

The "Project Initialization and Planning Phase" marks the project's outset, defining goals, scope, and stakeholders. This crucial phase establishes project parameters, identifies key team members, allocates resources, and outlines a realistic timeline. It also involves risk assessment and mitigation planning.

Activity 1: Define Problem Statement

Problem Statement: The current method of classifying rice types based on physical appearance alone is troublesome because it often leads to errors and inconsistencies. This can result in mislabeled products, customer dissatisfaction, and challenges in meeting market demands effectively. Our solution involves developing a model that accurately classify different rice types such as Basmati, Jasmine, Arborio, Karacadag, and Ipsala. This approach ensures precise labelling, better quality control, and enhanced customer satisfaction. Ultimately, our solution aims to streamline the classification process, reduce errors, and provide farmers, distributors, and consumers with reliable information about the rice they are dealing with, thereby improving overall efficiency and market competitiveness in the rice industry.

File link: <https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/1.%20Project%20Initialization%20and%20Planning%20Phase/Define%20Problem%20Statements%20Template.pdf>

Activity 2: Project Proposal (Proposed Solution)

This project aims to develop a Convolutional Neural Network (CNN) model for accurately classifying various rice types based on their physical and chemical properties. By leveraging deep learning techniques, the proposed solution seeks to improve labeling precision, enhance quality control measures, and streamline operational workflows within the rice industry. The project will focus on data collection, model development, rigorous evaluation, and deployment of the CNN model to provide a robust tool for efficient rice type classification.

File link: [https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/1.%20Project%20Initialization%20and%20Planning%20Phase/Project%20Proposal%20\(Proposed%20Solution\)%20template.pdf](https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/1.%20Project%20Initialization%20and%20Planning%20Phase/Project%20Proposal%20(Proposed%20Solution)%20template.pdf)

Activity 3: Initial Project Planning

The project will begin with a kickoff meeting to define goals, scope, and assign team roles. Following this, we will collect and preprocess a diverse dataset of rice grain images. Next, we will experiment with different CNN architectures and select the best-performing model. After training and fine-tuning the model, we will rigorously evaluate its performance. Finally, we will deploy the model and integrate it into existing workflows for efficient rice type classification.

File link: <https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/1.%20Project%20Initialization%20and%20Planning%20Phase/Project%20Planning%20Template.pdf>

Milestone 2: Data Collection and Preprocessing Phase

The Data Collection and Preprocessing Phase involves executing a plan to gather relevant data from Kaggle, ensuring data quality through verification and addressing missing values. Preprocessing tasks include resizing, normalizing, augmenting, denoising, adjusting contrast, detecting edges, converting color space, cropping, batch normalizing, and whitening data.

Activity 1: Data Collection Plan, Raw Data Sources Identified, Data Quality Report

Elevate your data strategy with the Data Collection plan and the Raw Data Sources report, ensuring meticulous data curation and integrity for informed decision-making in every analysis and decision-making endeavour.

File link: <https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/2.%20Data%20Collection%20and%20Preprocessing%20Phase/Raw%20Data%20Sources%20And%20Data%20Quality%20Report%20template.pdf>

Activity 2: Data Quality Report

The dataset for "Rice Type Classification using CNN" is sourced from Kaggle. Data quality is ensured through thorough verification, addressing missing values, and maintaining adherence to ethical guidelines establishing a reliable foundation for predictive modeling. The Data Quality Report will summarize data quality issues from the selected source, including severity levels and resolution plans. It will aid in systematically identifying and rectifying data discrepancies.

File link: <https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/2.%20Data%20Collection%20and%20Preprocessing%20Phase/Data%20Quality%20Report%20template.pdf>

Activity 3: Data Exploration and Preprocessing

The images will be preprocessed by resizing, normalizing, augmenting, denoising, adjusting contrast, detecting edges, converting colour space, cropping, batch normalizing, and whitening data. These steps will enhance data quality, promote model generalization, and improve convergence during neural network training, ensuring robust and efficient performance across various computer vision tasks.

File link: <https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/2.%20Data%20Collection%20and%20Preprocessing%20Phase/Data%20Preprocessing%20template.pdf>

Milestone 3: Model Development Phase

In the Model Development Phase for loan approval, we strategically select relevant features and evaluate models such as Random Forest, Decision Tree, KNN. We initiate model training with code implementation and rigorously validate performance metrics like accuracy and recall. This phase aims to deliver a robust predictive model that enhances decision-making efficiency in the lending process.

Activity 1: Model Selection Report

In the model selection report for future deep learning and computer vision projects, various architectures, such as CNNs or RNNs, will be evaluated. Factors such as performance, complexity, and computational requirements will be considered to determine the most suitable model for the task at hand.

File link: <https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/3.%20Model%20Development%20Phase/Model%20Selection%20Report.pdf>

Activity 2: Initial Model Training Code, Model Validation and Evaluation Report

The Initial Model Training Code employs selected algorithms on the dataset. The initial model training code will be showcased in the future through a screenshot. The model validation and evaluation report will include a summary and training and validation performance metrics for multiple models, presented through respective screenshots.

File link: <https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/3.%20Model%20Development%20Phase/Initial%20Model%20Training%20Code%2C%20Model%20Validation%20and%20Evaluation.pdf>

Milestone 4: Model Optimization and Tuning Phase

The Model Optimization and Tuning Phase involves refining neural network models for peak performance. It includes optimized model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

Activity 1: Hyperparameter Tuning Documentation

We selected Convolutional Neural Networks (CNNs) for our rice varieties classification project due to their proven ability to handle complex image data and capture intricate visual patterns. During hyperparameter tuning, we optimized parameters like convolutional layers, filter sizes, and dropout rates to enhance model accuracy and mitigate overfitting. This process aimed to ensure robust classification of rice varieties based on image data, aligning perfectly with our project goals.

Activity 2: Performance Metrics Comparison Report

Our Performance Metrics Comparison Report highlights the significant improvements achieved through hyperparameter tuning of the CNN model. By comparing baseline and optimized metrics such as accuracy, precision, recall, and F1-score, we demonstrate the CNN's enhanced ability to accurately classify rice varieties from images. This analysis underscores the effectiveness of parameter adjustments in refining our model's predictive capabilities.

Activity 3: Final Model Selection Justification

We chose the CNN as our final model for rice variety classification based on its exceptional performance after hyperparameter tuning. Its robustness in analyzing image features and its alignment with project objectives of accurate classification make it the optimal choice. The CNN's capability to learn complex visual patterns ensures reliable predictions crucial for applications in agricultural analysis and crop management.

File link: <https://github.com/SamP231004/Rice-Type-Classification-CNN/blob/main/4.%20Model%20Optimization%20and%20Tuning%20Phase/Model%20Optimization%20and%20Tuning%20Phase.pdf>

Milestone 5: Project Files Submission and Documentation

File link: <https://github.com/SamP231004/Rice-Type-Classification-CNN/tree/main/5.%20Project%20Executable%20Files>

Milestone 6: Project Demonstration

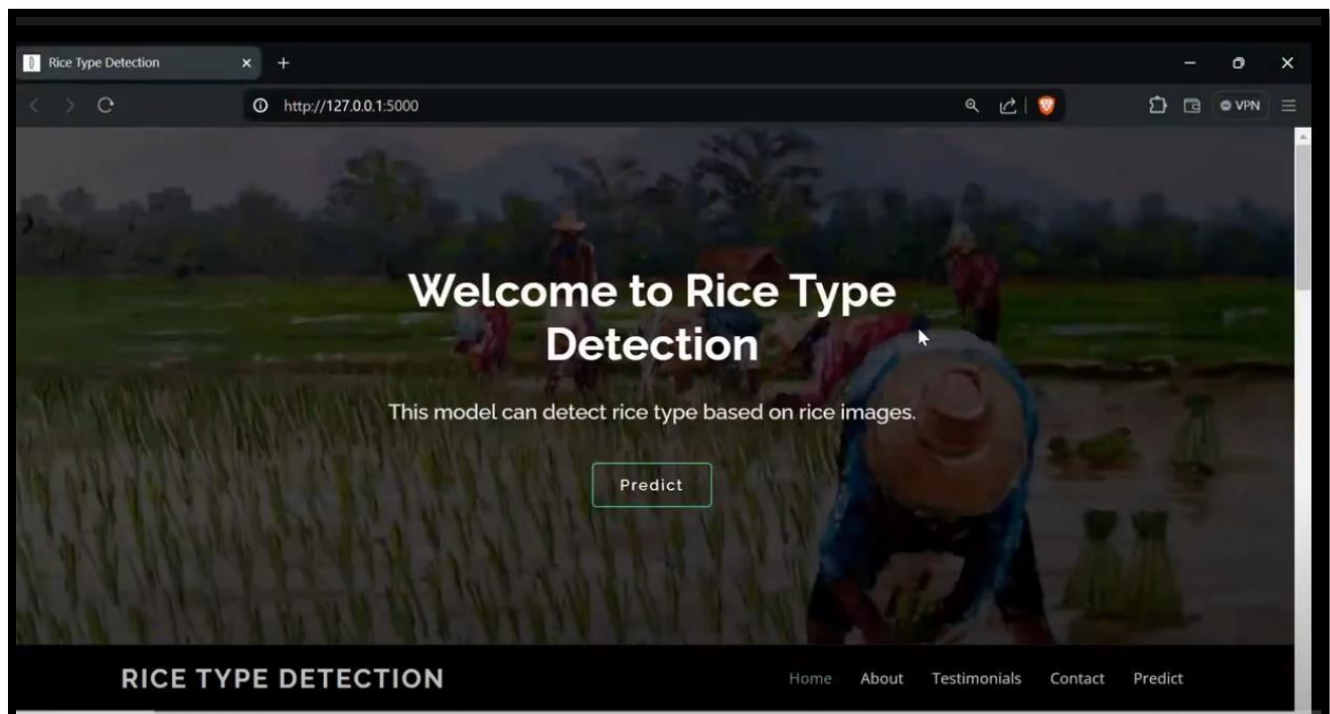
Video Presentation-

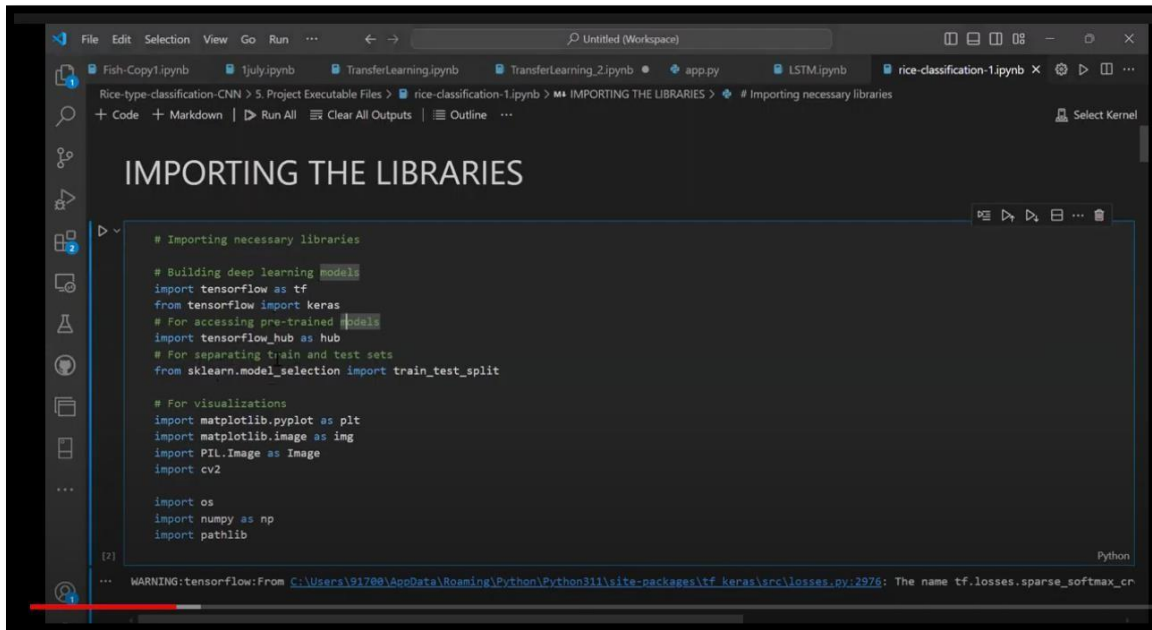
Video link:

<https://drive.google.com/file/d/1xQxmVYpFZwvtBsvjf2NWgKwMcsm9XOc5/view?usp=drivesdk>

RESULTS: -

OUTPUT SCREENSHOTS: -





The screenshot shows a Jupyter Notebook titled "IMPORTING THE LIBRARIES". The code imports various libraries for deep learning and data handling. A warning message is displayed at the bottom regarding the TensorFlow backend.

```

# Importing necessary libraries

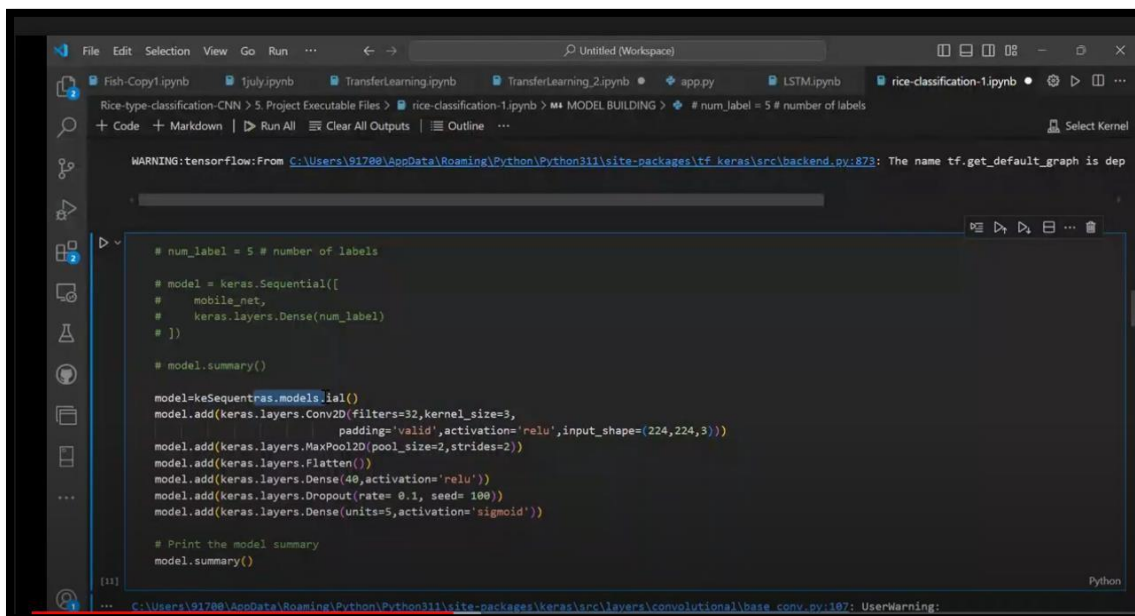
# Building deep learning models
import tensorflow as tf
from tensorflow import keras
# For accessing pre-trained models
import tensorflow_hub as hub
# For separating train and test sets
from sklearn.model_selection import train_test_split

# For visualizations
import matplotlib.pyplot as plt
import matplotlib.image as img
import PIL.Image as Image
import cv2

import os
import numpy as np
import pathlib

WARNING:tensorflow:From C:\Users\91708\AppData\Roaming\Python\Python311\site-packages\tf_keras\src\losses.py:2976: The name tf.losses.sparse_softmax_cross_entropy is deprecated for APIs with >= 2.12.0. Please use tf.nn.sparse_softmax_cross_entropy_with_logits instead.

```



The screenshot shows a Jupyter Notebook titled "MODEL BUILDING". The code defines a Keras model architecture with a MobileNet backbone and a custom dense layer. A warning message is displayed at the bottom regarding the TensorFlow backend.

```

# num_label = 5 # number of labels

# model = keras.Sequential([
#     mobile_net,
#     keras.layers.Dense(num_label)
# ])

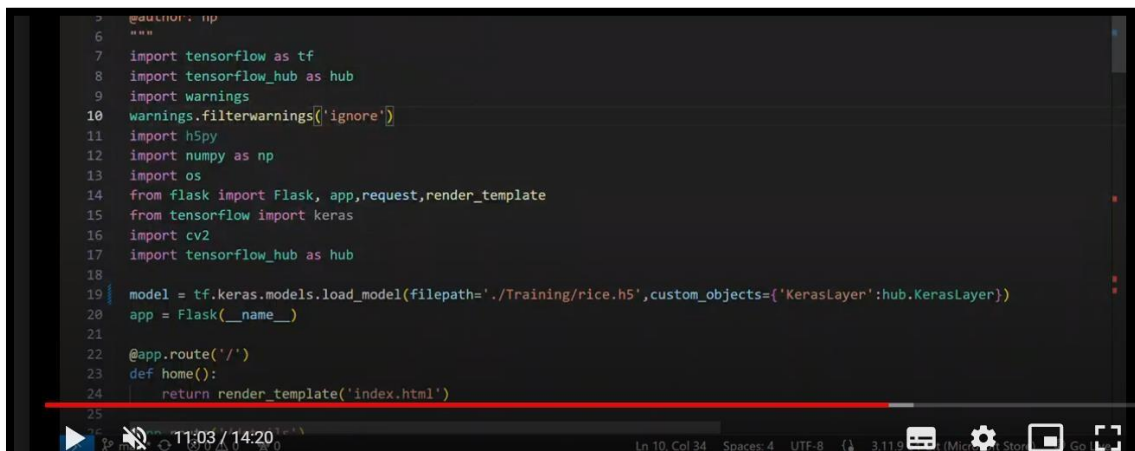
# model.summary()

model=keras.models.Sequential()
model.add(keras.layers.Conv2D(filters=32, kernel_size=3,
                             padding='valid', activation='relu', input_shape=(224, 224, 3)))
model.add(keras.layers.MaxPool2D(pool_size=2, strides=2))
model.add(keras.layers.Flatten())
model.add(keras.layers.Dense(40, activation='relu'))
model.add(keras.layers.Dropout(rate=0.1, seed=100))
model.add(keras.layers.Dense(units=5, activation='sigmoid'))

# Print the model summary
model.summary()

WARNING:tensorflow:From C:\Users\91708\AppData\Roaming\Python\Python311\site-packages\tf_keras\src\backend.py:873: The name tf.get_default_graph is deprecated for APIs with >= 2.12.0. Please use tf.compat.v1.get_default_graph instead.

```



The screenshot shows a Python script for a Flask application. It imports necessary libraries, sets up the Flask app, and defines a home route that renders an index.html template.

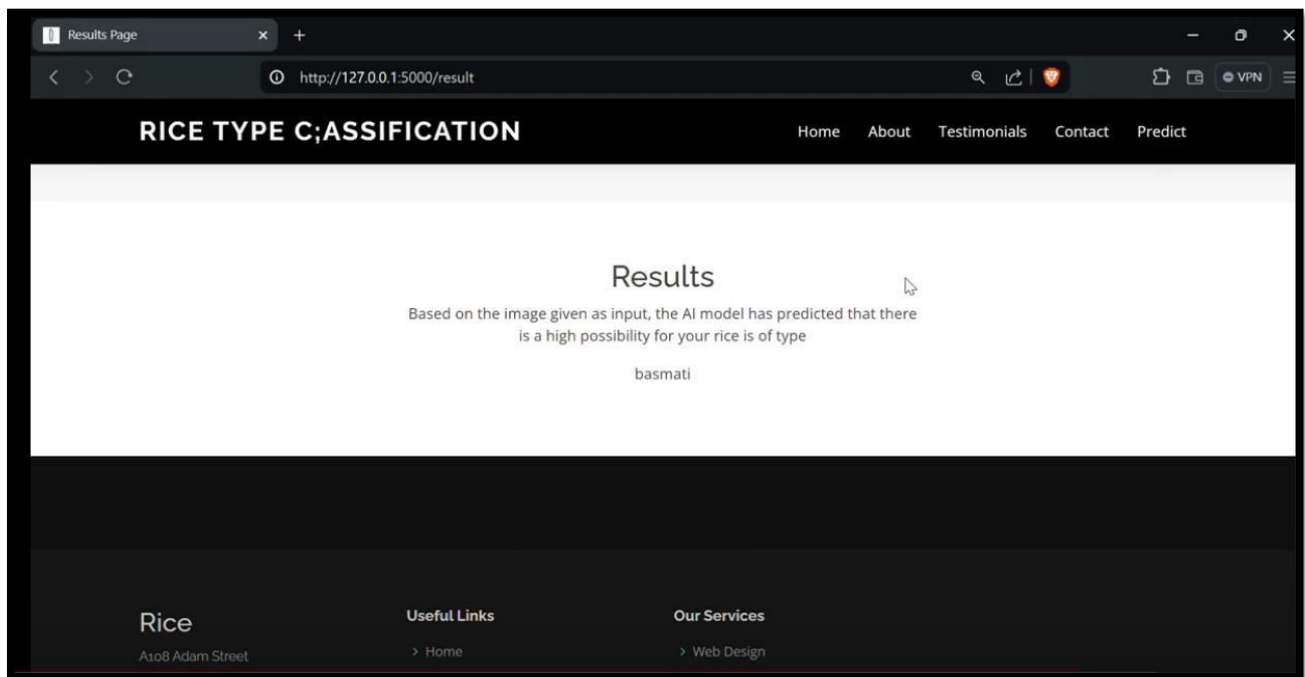
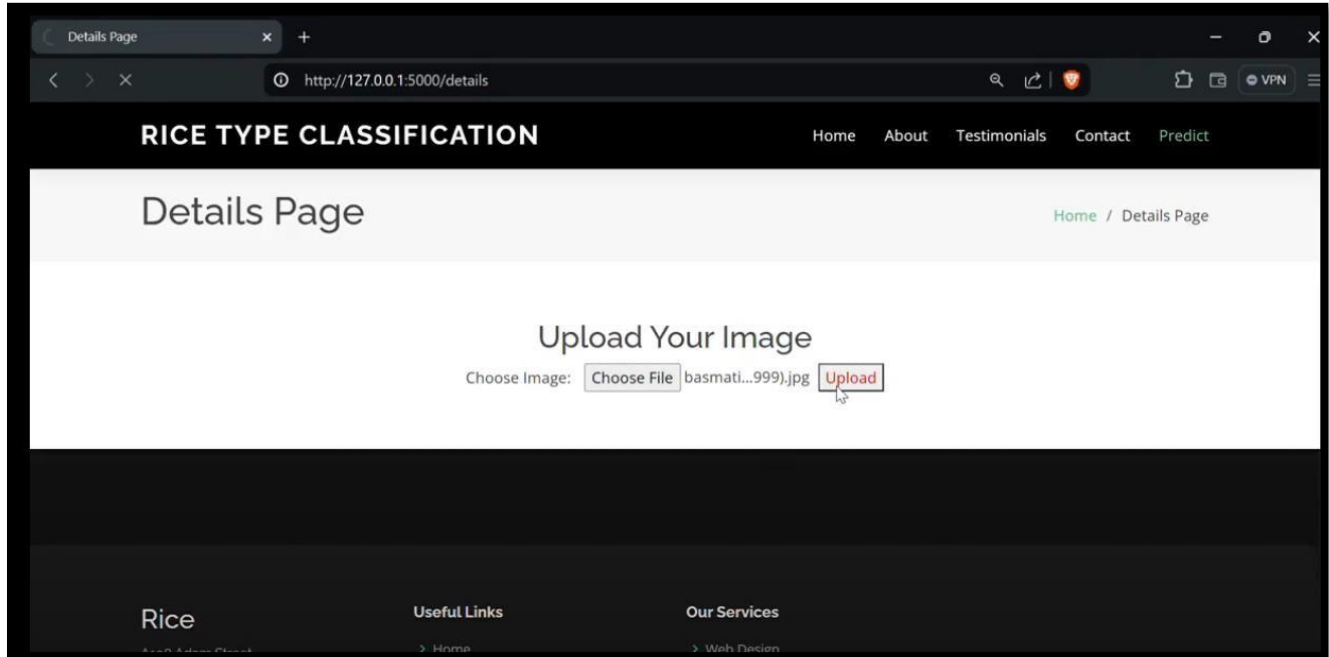
```

import numpy as np
import tensorflow as tf
import tensorflow_hub as hub
import warnings
import h5py
import numpy as np
import os
from flask import Flask, app, request, render_template
from tensorflow import keras
import cv2
import tensorflow_hub as hub

model = tf.keras.models.load_model(filepath='./Training/rice.h5', custom_objects={'KerasLayer': hub.KerasLayer})
app = Flask(__name__)

@app.route('/')
def home():
    return render_template('index.html')

```

ADVANTAGES: -

➤ High Accuracy and Efficiency:

CNNs can achieve high classification accuracy due to their ability to automatically learn and extract relevant features from images, reducing the reliance on manual feature engineering.

➤ Scalability and Automation:

Once trained, CNN models can quickly and automatically classify large volumes of rice samples, significantly speeding up processes in agricultural industries and reducing human labor.

➤ Consistency and Reliability:

Automated classification using CNNs ensures consistent and objective results, minimizing human error and variability that can occur with manual inspection and classification.

DISADVANTAGES: -

• Requirement for Large Datasets:

Training CNNs effectively requires large amounts of labeled data, which can be time-consuming and expensive to collect and annotate, especially for less common rice types.

• Computationally Intensive:

CNN training and inference can be computationally intensive, requiring significant hardware resources such as high-performance GPUs, which might not be accessible for all users or organizations.

• Potential for Overfitting:

Without proper regularization techniques and sufficient diverse data, CNNs can overfit to the training dataset, leading to poor generalization and reduced performance on unseen data.

CONCLUSION: -

In conclusion, the development and implementation of this CNN-based rice type classification model represent a significant advancement in the rice industry. By addressing the shortcomings of traditional classification methods, this model promises to enhance accuracy, efficiency, and consistency in identifying different rice varieties. The benefits extend across the supply chain, from farmers to consumers, ensuring better product labeling, improved quality control, and higher customer satisfaction. Ultimately, this project aims to set a new standard in rice classification, driving the industry towards greater precision and reliability.

FUTURE SCOPE: -

The future scope of rice type classification using CNNs is promising, with potential advancements poised to enhance accuracy, efficiency, and applicability. With the integration of more extensive and diverse datasets, models can be trained to recognize even subtle variations among a wider range of rice types, including hybrids and regional varieties. The incorporation of advanced techniques such as transfer learning and federated learning can further improve model performance and adaptability to different environments. Additionally, the development of lightweight, mobile-friendly models can enable on-site classification using smartphones, benefiting farmers and quality control inspectors in remote areas. The system could also expand to encompass other grain types, contributing to a comprehensive agricultural management tool that leverages AI for improved crop monitoring, inventory management, and supply chain optimization.

SOURCE CODE FILES LINK(IN GITHUB): -

<https://github.com/SamP231004/Rice-Type-Classification-CNN/tree/main/5.%20Project%20Executable%20Files>

GITHUB LINK:

<https://github.com/SamP231004/Rice-Type-Classification-CNN>

PROJECT DEMO LINK(RUN IN GOOGLE BROWSER): -

<https://drive.google.com/file/d/1xQxmVYpFZwvtBsvjf2NWgKwMcsm9XOc5/view?usp=drivesdk>