

AI-Powered Nutrition Analyzer For Fitness Enthusiasts

TEAM ID :PNT2022TMID19478

Project Report

1. INTRODUCTION

1.1 Project Overview

Food is essential for human life and has been the concern of many healthcare conventions. Nowadays new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet. Nutritional analysis is the process of determining the nutritional content of food. It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.

1.2 Purpose

The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like color, shape, texture etc. Here the user can capture the images of different fruits and then the image will be sent to the trained model. The model analyses the image and detects the nutrition based on the fruits like (Sugar, Fiber, Protein, Calories, etc.).

2. LITERATURE SURVEY

2.1 Existing problem

Neutrino delivers nutrition-based data services and analytics to its users and wants to turn into a leading source of the nutrition-related platform. The platform employs NLP and mathematical models from the optimization theory as well as predictive analysis to enable individualized data compilation.

The application relies on Artificial Intelligence to produce custom data related to smart calorie counter powered by AI. Their artificial intelligence learns an individual's tastes, preferences, and body type. All of this is packaged in a comprehensive nutrition and activity tracker.

S.NO	PAPER	AUTHOR	YEAR	DESCRIPTION
1	Application of Motion Sensor Based on Neural Network in Basketball Technology and Physical Fitness Evaluation System	Bin Yuan, M. M.Kamruzzaman and Shaonan Shan	2021	Mobile sensors and intelligent systems to evaluate the physical fitness by 1000-meter running, 1-mile running, 20-meter round-trip running, and 12-minute long distance running
2	Relationship Between Health Status and Physical Fitness of College Students From South China: An Empirical Study by Data Mining Approach	Weihua Bai and Teng Zhou	2020	Armed with the trained model, we mine and highlight the relationship between the motor competence related physical fitness and the medical health status of the college students.
3	Physical Workout Classification Using Wrist Accelerometer Data by Deep Convolutional Neural Networks	Jaehyun Park and Jaeyong Chung	2019	The purpose of this study is to maximize accuracy by applying deep learning to the classification of body movements. The results of this experiment are applicable not only to the classification of fitness activities but also to the classification of different motions in numerous sporting events.
4	Fitness Monitoring System Based on Internet of Things and Big Data Analysis	Jing Lu	2021	Efficient physical fitness monitoring can effectively reduce the risks of disease and relieve the medical burden. This paper analyzes the shortcomings of traditional clustering routing protocols, and proposes a new Internet of Things (IoT) clustering routing algorithm using Particle Swarm Optimization (PSO).

2.3 Problem Statement Definition

The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like color, shape, texture etc. Here the user can capture the images of different fruits and then the image will be sent the trained model. The model analyses the image and detect the nutrition based on the fruits like (Sugar, Fiber, Protein, Calories, etc.).

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Proposed Solution

Proposed Solution :

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	A nutrition analyser with AI powered fruit classifier based on the features to provide nutritional values like fiber, vitamins, minerals etc to Fitness Enthusiasts.
2.	Idea / Solution description	Creating web interface application to monitor and track their health condition and helping the people to improve their health condition.
3.	Novelty / Uniqueness	CNN based fruit classifier that supports nutrition analyser that provides nutrition values of the fruit.
4.	Social Impact / Customer Satisfaction	By improving the health people can concentrate on their daily duties and works.
5.	Business Model (Revenue Model)	Offering monthly or yearly subscription for premium features.



6.	Scalability of the Solution	For now the nutrition analyser is limited to mostly fruits only, which can be scaled to other foods. Implementing in mobile app.
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3.4 ProblemSolutionfit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer’s problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns

Purpose:

- Solve complex problems in a way that fits the state of your customers.
- Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior.
- Sharpen your communication and marketing strategy with the right triggers and messaging.
- Increase touch-points with your company by finding the right problem-behavior fit and building trust by solving frequent annoyances, or urgent or costly problems.

Define CS, fit into CC	<div>1. CUSTOMER SEGMENT(S)<div>CS</div></div> <div>People who want to maintain their fitness and lead a healthy life.</div>	<div>6. CUSTOMER CONSTRAINTS<div>CC</div></div> <div>The constraints that prevent our customers toaccess out solution are network issues and network errors as there is no possible for anyother constraints since our solution is an application.</div>	<div>5. AVAILABLE SOLUTIONS<div>AS</div></div> <div>Existing Solution: Physical exercise, Yoga, Aerobic. Pros: The keys is to form workout habits that lead to long lasting changes to lifestyle and to long termimprovements in health and well being. Cons: Time consumption is more, no proper guidelines according to the health status of the user.</div>	Explore AS, differentiate
Focus on J&P, tap into BE, understand RC	<div>2. JOBS-TO-BE-DONE / PROBLEMS<div>J&P</div></div> <div>We provide the nutritional contents of the food they intake daily. There by providing the fitness to the people and helping them to stay healthy.</div>	<div>9. PROBLEM ROOT CAUSE<div>RC</div></div> <div>The root cause of this problem is lack of intake of nutrition. Improper diet and skipping the exercise daily leads to many disease which results in leading healthy life.</div>	<div>7. BEHAVIOUR<div>BE</div></div> <div>The customers who have issues of health care, nutrition, fitness will be stated in chatbox. At the time of logging in, the customers provide the details of their health status. After analysing the customer's status, solution will be given.</div>	Focus on J&P, tap into BE, understand RC
Identify strong TR & EM	<div>3. TRIGGERS<div>TR</div></div> <div>After continuous advertisements of our application, and hearing feedback from their friends, neighbours the customer will get motivated to use our application.</div> <div>4. EMOTIONS: BEFORE / AFTER<div>EM</div></div> <div>Before using our application, customer will face insecurity and bad health. After using our application, customer get good health and self motivated.</div>	<div>10. YOUR SOLUTION<div>SL</div></div> <div>Calories tracking is the key features in all fitness solutions which helps in preventing the diseases inadvance hence normal people can use this. Instructor demonstrates the particular fruits caloriesand provides guided assistance so that the users can perform them accurately.</div>	<div>8. CHANNELS of BEHAVIOUR<div>CH</div></div> <div>8.1 ONLINE User access the application by scanning the fruit andget the nutritional info. 8.2 OFFLINE Based on the nutritional info user will perform.</div>	Extract online & offline CH of BE

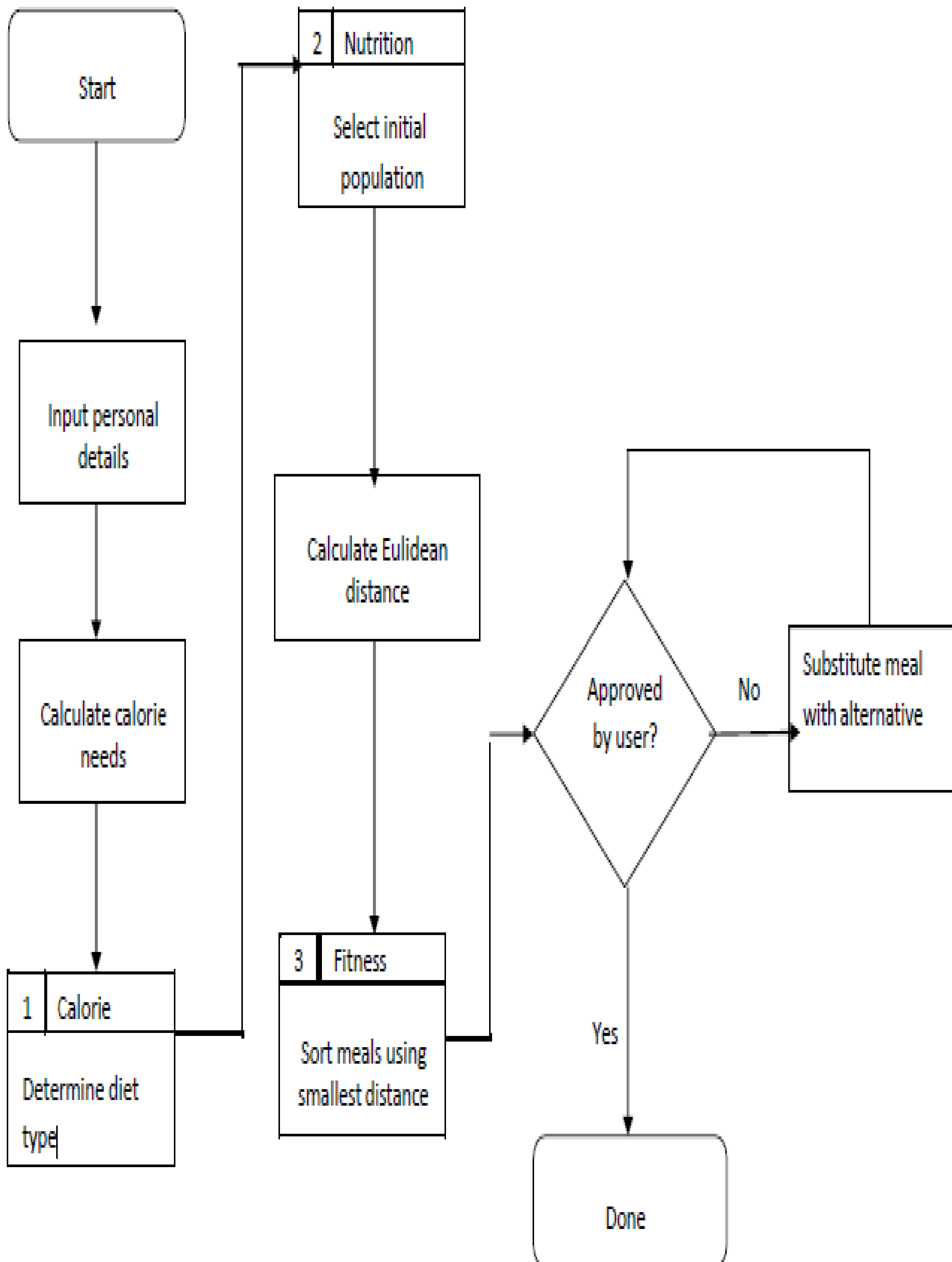
4.SOLUTION REQUIREMENTS

FR NO.	Functional Requirement (Epic)	Sub Requirement (Story/Sub-Task)
FR-1	Voice search option	It is useful for uneducated peoples to search the nutrition assistant for their use
FR-2	Language translator	Useful for users to understand the shown instructions in their own language
FR-3	Image Based UI	It is very useful for uneducated people to understand the nutrition package with the images
FR-4	Nutrition content	Users can check the nutrition content of their food they want to consume.

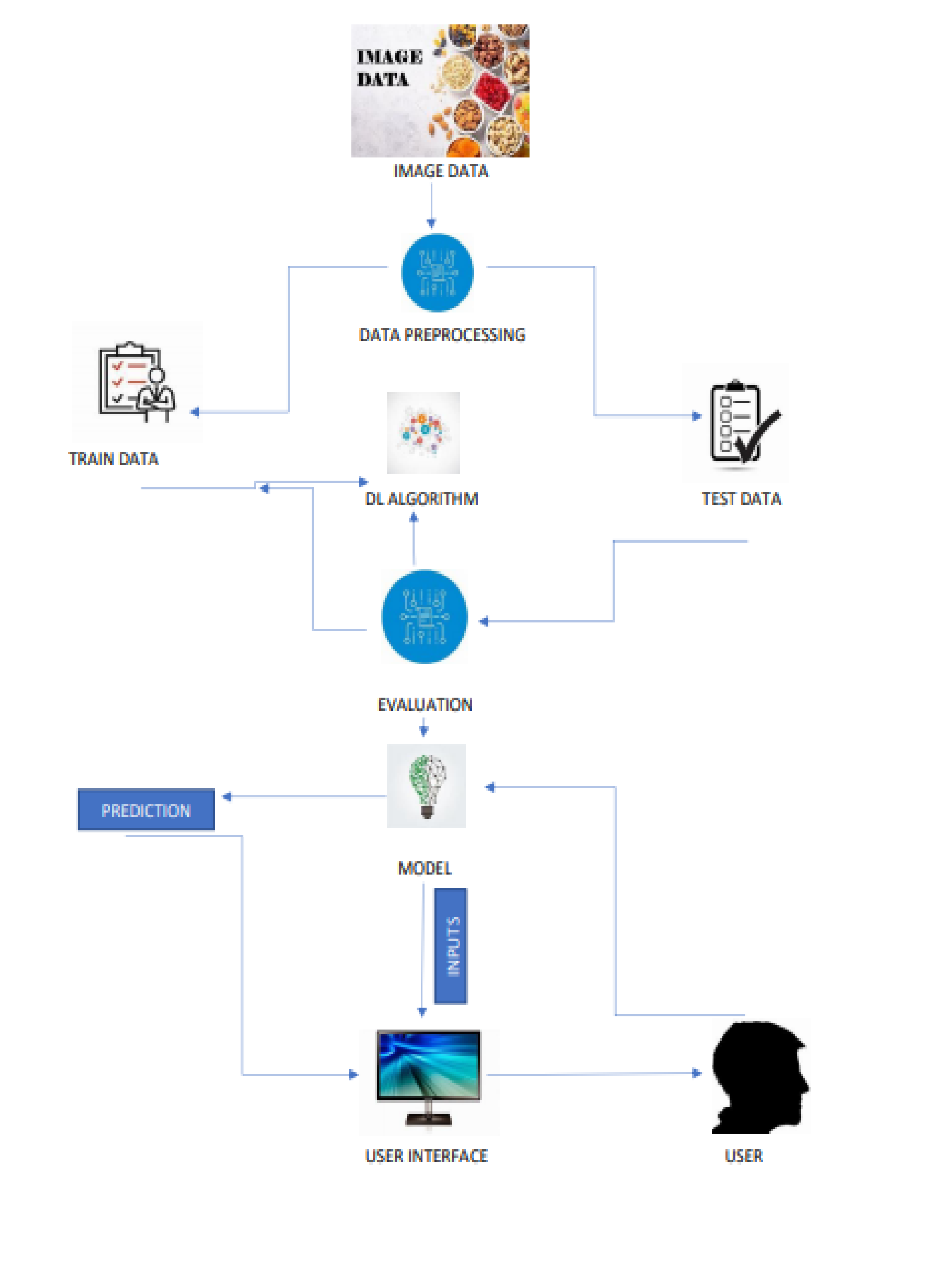
FR No.	Non-Functional Requirements	Description
NFR-1	Usability	Because of image based UI , language translator and voice search are makes it easy to the user to use the application and also for the uneducated peoples
NFR-2	Security	User information's are secured
NFR-3	Reliability	All the information's are maintain safe and private which cannot be access by others
NFR-4	Performance	User friendly even for the uneducated peoples
NFR-5	Availability	Most of the information needed for users are available without any subscription
NFR-6	Scalability	Since the applications is very user friendly it attracts many users

4. PROJECT DESIGN

4.1 Data Flow Diagrams

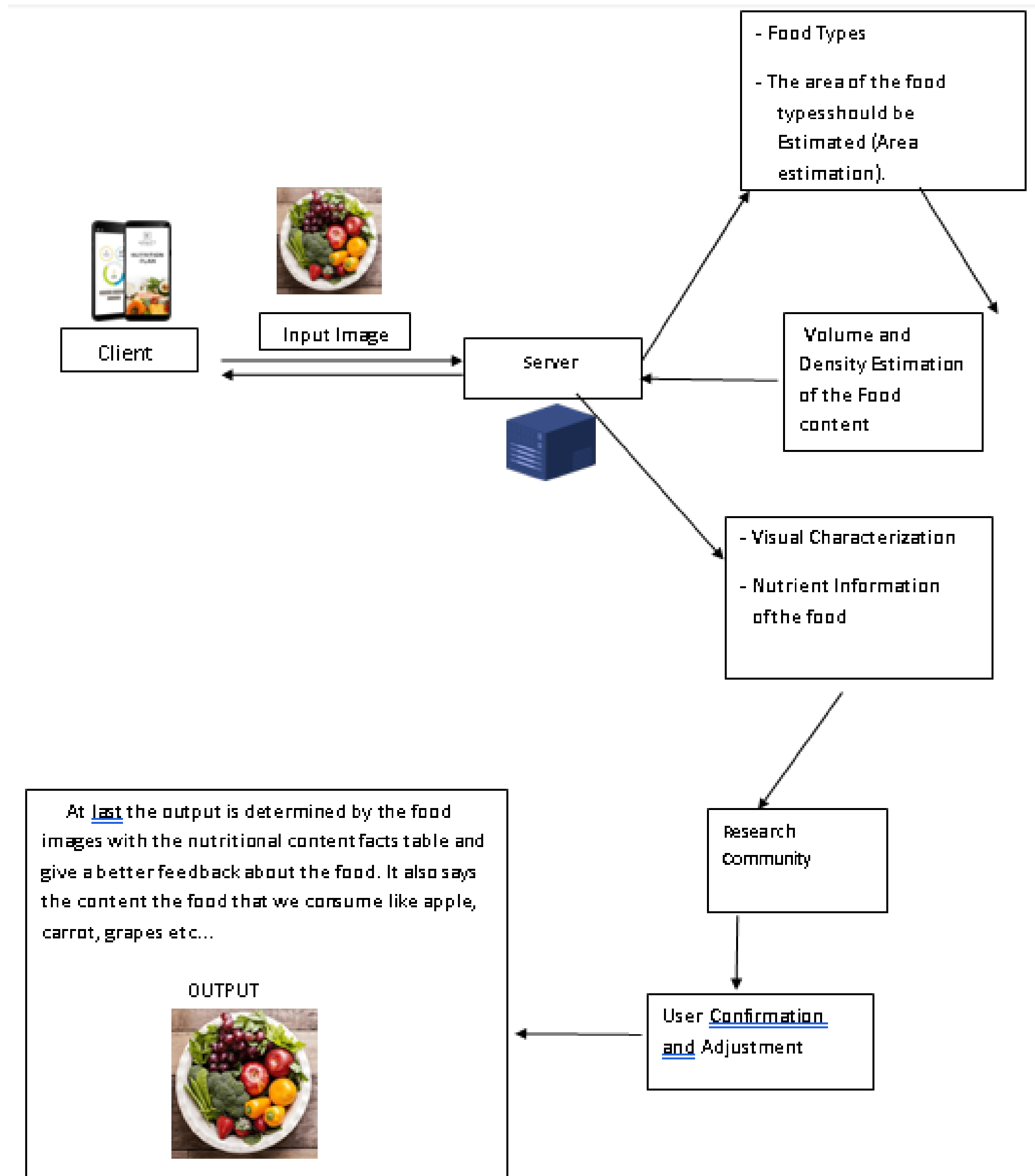


4.2 Solution & Technical Architecture



Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Open-source frameworks used	SendGrid, Python, J Query
2.	Security Implementations	Request authentication using encryption	Encryptions, SSL certs
3.	Scalable Architecture	The scalability of Architecture consists of 3tiers	Web Server – HTML, CSS ,Java script Application Server –Python Flask Database Server – IBM Cloud
4.	Availability	Availability is increased by loads balancers in cloud VPS	IBM Cloud hosting
5.	Performance	The application is expected to handle up to 4000 predications per second	IBM Load Balance



6. CODING & SOLUTIONING (Explain the features added in the project along with code)

6.1 Feature 1

Data Collection

Download the dataset [here](#)

```
[ ] from google.colab import drive
    drive.mount('/content/drive')
```

Mounted at /content/drive

```
[ ] cd/content/drive/MyDrive/Colab Notebooks
```

/content/drive/MyDrive/Colab Notebooks

```
[ ] # Unzipping the dataset
    !unzip 'Dataset.zip'
```

Image Preprocessing

```
[ ] from keras.preprocessing.image import ImageDataGenerator
```

Image Data Augmentation

```
[ ] train_datagen = ImageDataGenerator(rescale=1./255, shear_range=0.2, zoom_range=0.2, horizontal_flip=True)
    test_datagen = ImageDataGenerator(rescale=1./255)
```

Applying Image DataGenerator Functionality To Trainset And Testset

```
▶ x_train = train_datagen.flow_from_directory(
    r'/content/drive/MyDrive/Colab Notebooks/Dataset/TRAIN_SET',
    target_size=(64, 64), batch_size=5, color_mode='rgb', class_mode='sparse')
x_test = test_datagen.flow_from_directory(
    r'/content/drive/MyDrive/Colab Notebooks/Dataset/TEST_SET',
    target_size=(64, 64), batch_size=5, color_mode='rgb', class_mode='sparse')
```

Model Building

1. Importing The Model Building Libraries

```
[ ] import numpy as np
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras import layers
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Dropout
```

2. Initializing The Model

```
[ ] classifier = Sequential()
```

3. Adding CNN Layers

```
[ ] classifier = Sequential()
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))
classifier.add(Conv2D(32, (3, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))
classifier.add(Flatten())
```

4. Adding Dense Layers

```
[ ] classifier.add(Dense(units=128, activation='relu'))
classifier.add(Dense(units=5, activation='softmax'))
```



```
classifier.summary()
```

Model: "sequential_1"

Layer (type)	Output Shape	Param #
=====		
conv2d (Conv2D)	(None, 62, 62, 32)	896

5. Configure The Learning Process

```
[ ] classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])
```

6. Train The Model

```
[ ] classifier.fit_generator(generator=x_train,steps_per_epoch = len(x_train),epochs=20, validation_data=x_test,validation_steps = len(x_test))

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. P]

Epoch 1/20
494/824 [=====>.....] - ETA: 6:52 - loss: 0.7194 - accuracy: 0.7174
```



7. Saving The Model

```
[ ] classifier.save('nutrition.h5')
```

8. Testing The Model

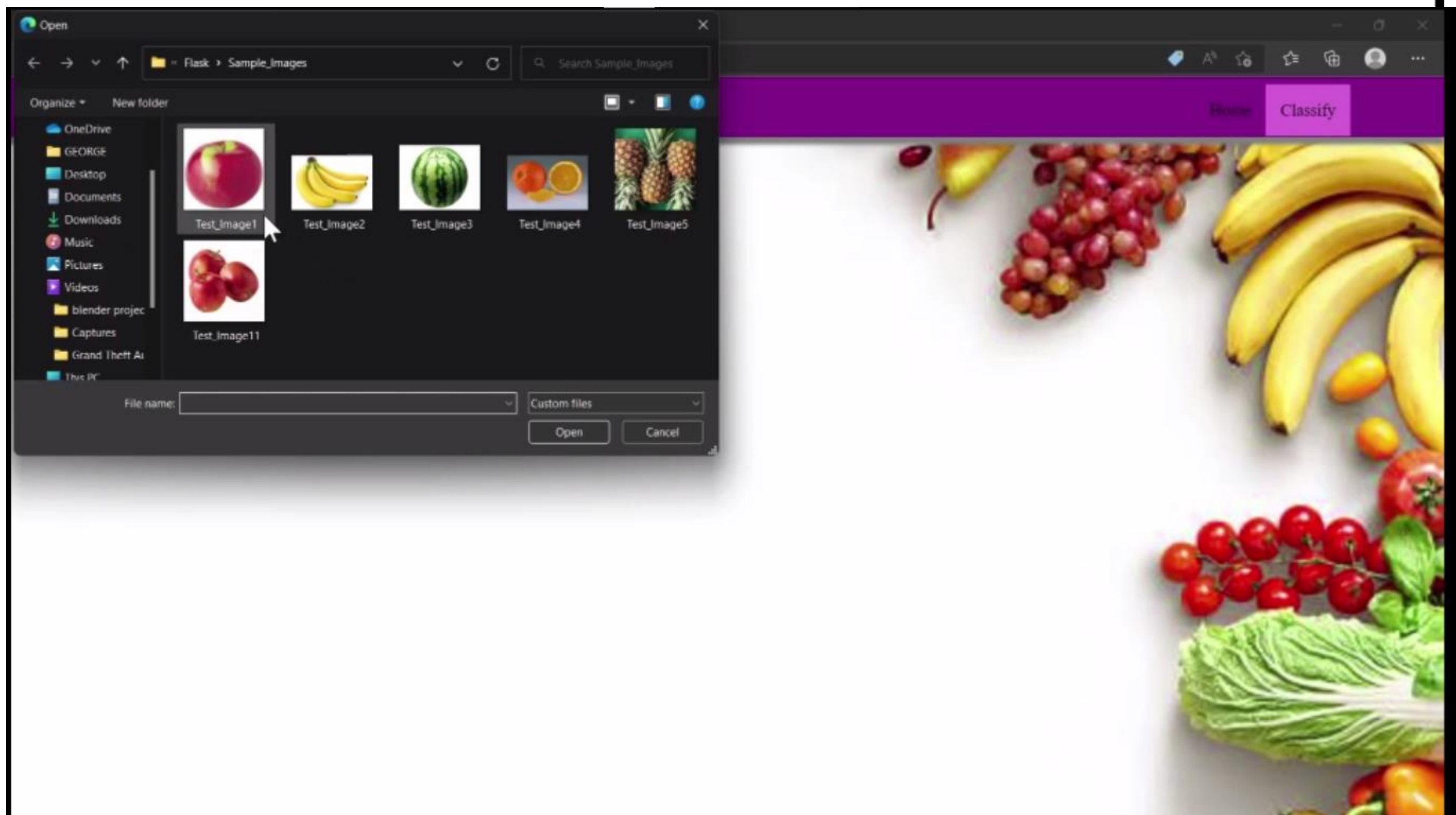
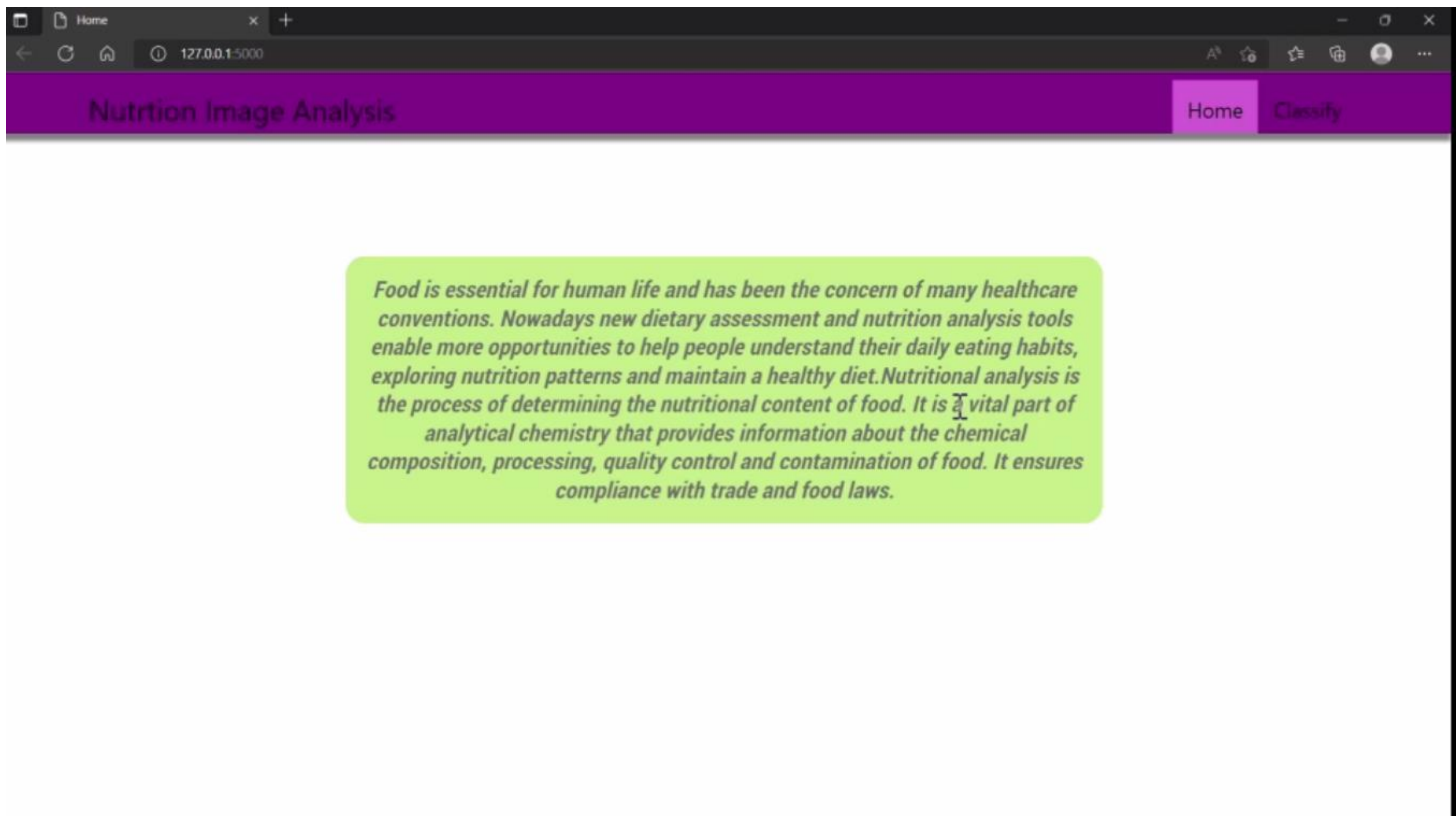
```
[ ] from tensorflow.keras.models import load_model
    from keras.preprocessing import image
    model = load_model("nutrition.h5")
```

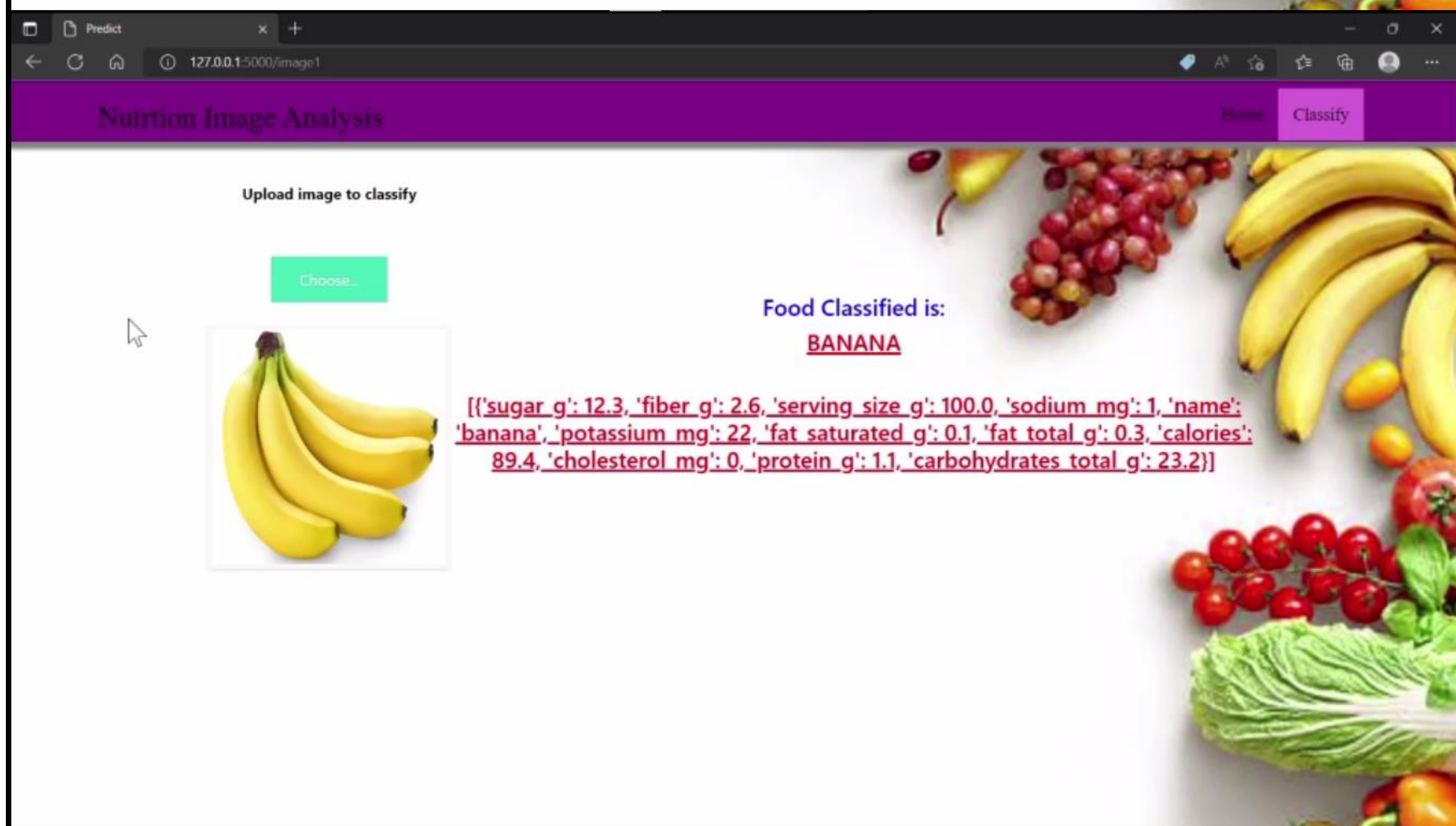
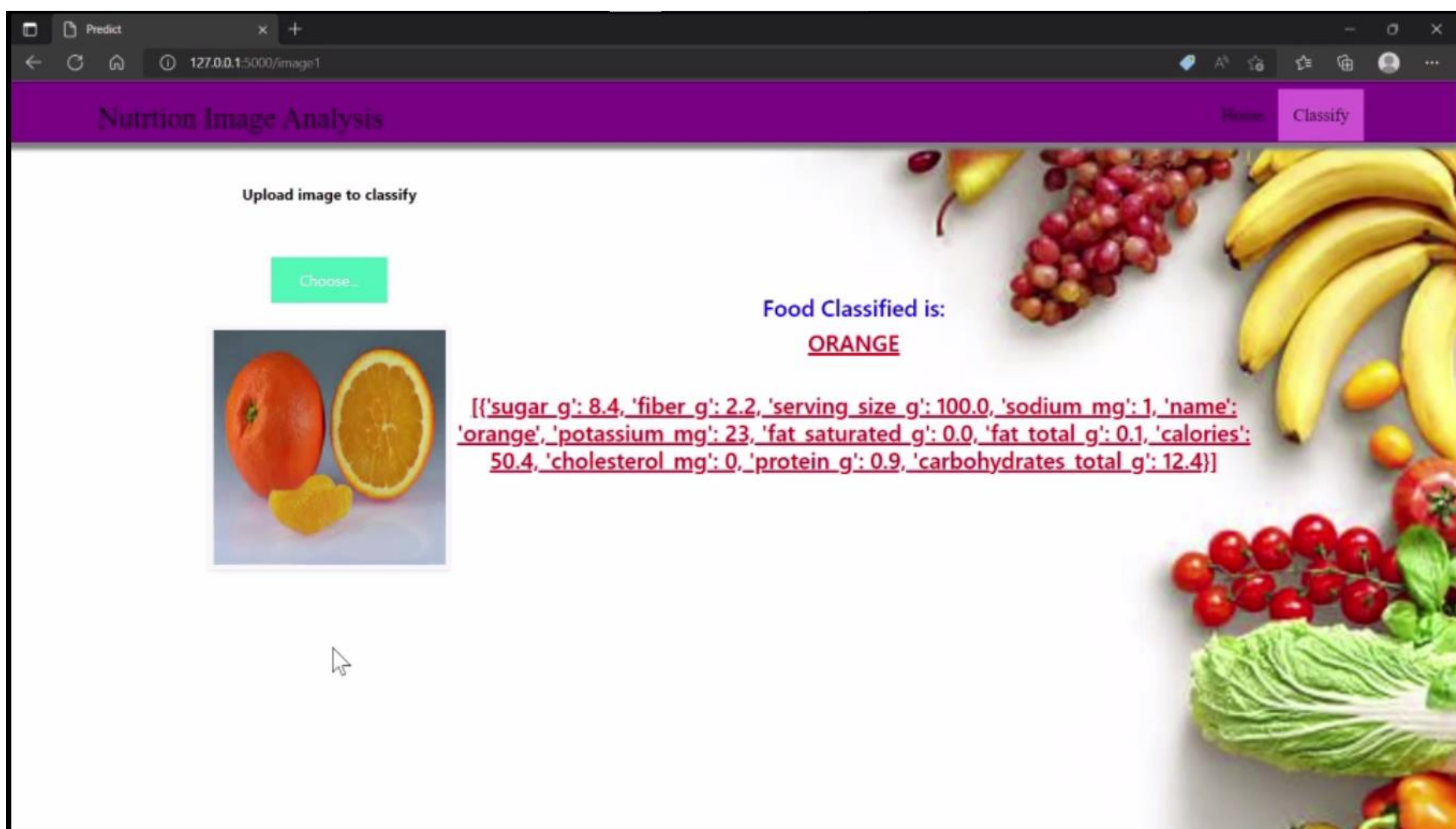
```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model = load_model("nutrition.h5")
img = image.load_img(r'/content/drive/MyDrive/Colab Notebooks/Sample_Images/Test_Image1.jpg',grayscale=False,target_size= (64,64))
x = img_to_array(img)
x = np.expand_dims(x,axis = 0)
predict_x=model.predict(x)
classes_x=np.argmax(predict_x,axis=-1)
classes_x
```

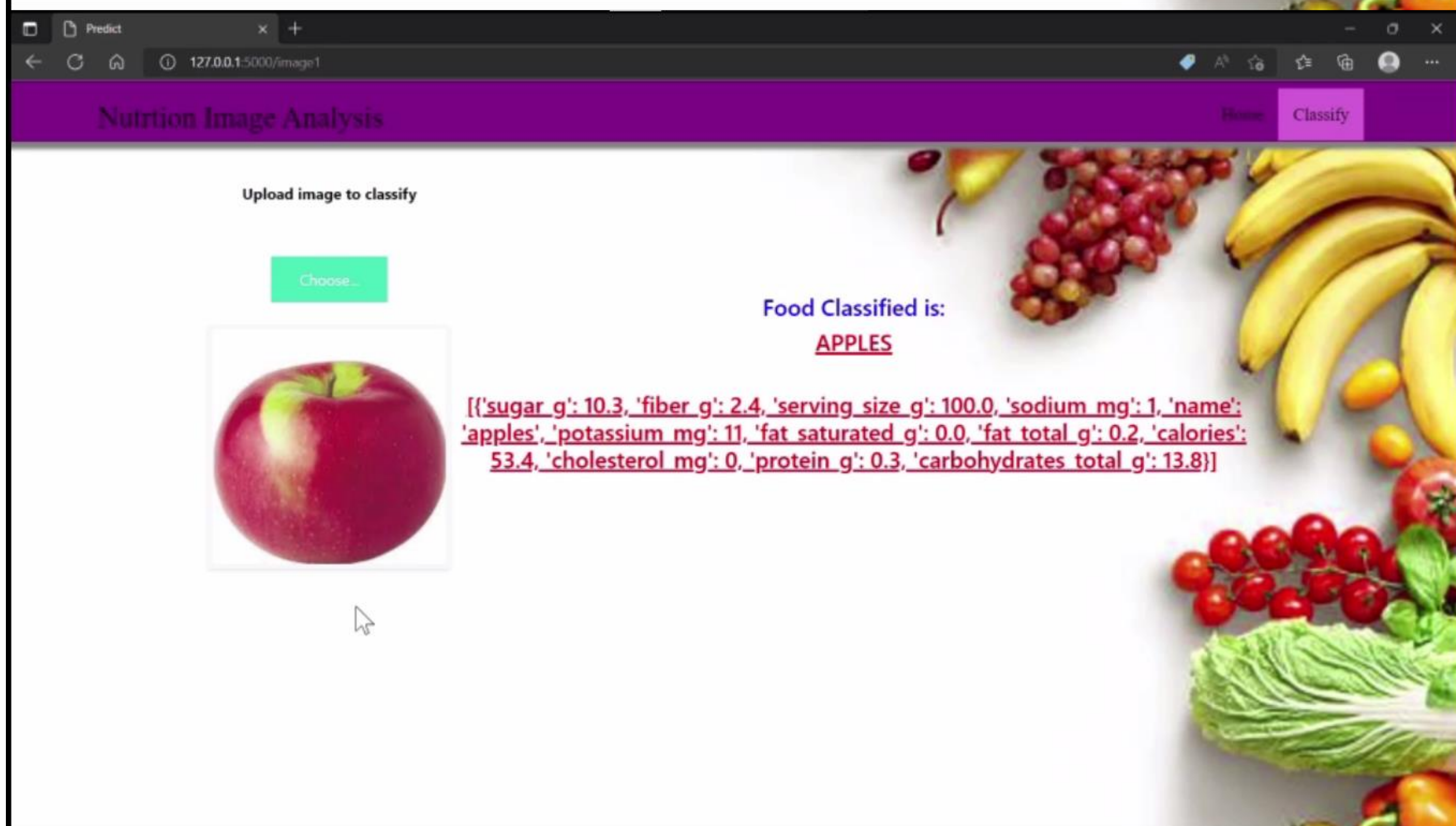
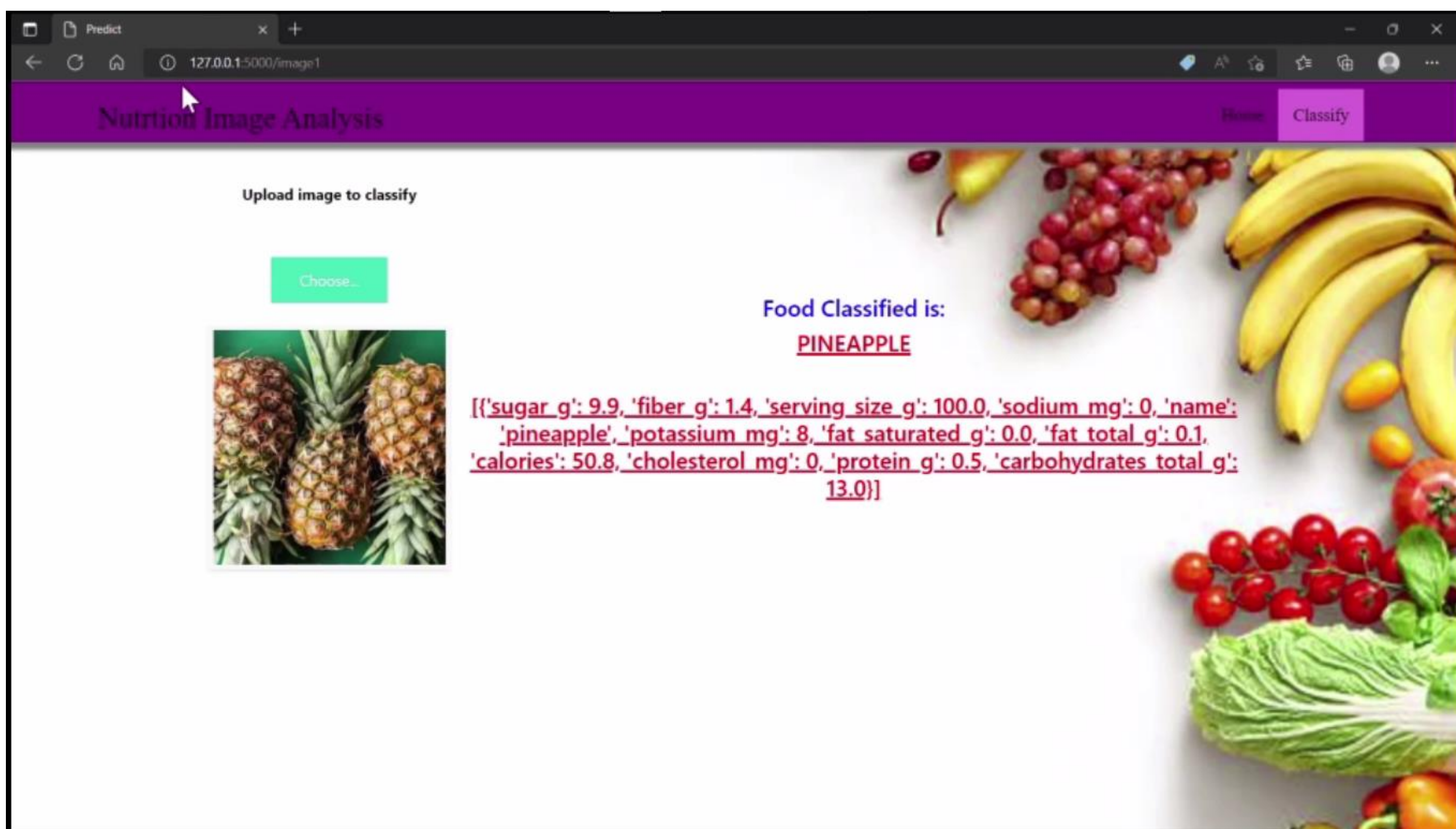
```
1/1 [=====] - 0s 62ms/step
array([0])
```

```
[ ] index=['APPLES', 'BANANA', 'ORANGE','PINEAPPLE','WATERMELON']
    result=str(index[classes_x[0]])
    result
```

OUTPUT:







CONCLUSION:

By the end of this project we will

- know fundamental concepts and techniques of Convolutional Neural Network.
- gain a broad understanding of image data
- know how to build a web application using the Flask framework.
- know how to pre-process data and
- know how to clean the data using different data preprocessing techniques.

7. FUTURE SCOPE

- AI is revolutionizing the health industry.
- It is majorly used in improving marketing and sales decisions, AI is now also being used to reshape individual habits.
- In future we don't want to go to gym and do any diets. By using this nutrition fitness analyzer we can maintain our diet plans without any help from others and we can lead a happy and healthy life with good wealth.
- AI can easily track health behaviors and repetitive exercise patterns and use the data to guide you towards your fitness journey and diet plans .