

AI-Powered Nutrition Analyzer For Fitness Enthusiasts

Bachelor of Engineering In Computer Science and Engineering

Submitted by TEAMI ID: PNT2022TMID48802

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Project Report Format

1. INTRODUCTION

1.1 Project Overview

1.2 Purpose

2. LITERATURE SURVEY

2.1 Existing problem

2.2 References

2.3 Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

3.2 Ideation & Brainstorming

3.3 Proposed Solution

3.4 Problem Solution fit

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

4.2 Non-Functional requirements

5. PROJECT DESIGN

5.1 Data Flow Diagrams

5.2 Solution & Technical Architecture

5.3 User Stories

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

6.2 Sprint Delivery Schedule

6.3 Reports from JIRA

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

7.1 Feature 1

7.2 Feature 2

7.3 Database Schema (if Applicable)

8. TESTING

8.1 Test Cases

8.2 User Acceptance Testing

9. RESULTS

9.1 Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

13. APPENDIX

13.1Source Code

13.2GitHub & Project Demo Link

Project Report Format

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 colour, 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, Fibre, 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.

1. Artificial intelligence in food science and nutrition Information Technologies Institute (ITI) Kosmas Dimitropoulos April 2019 Published by Oxford University Press on behalf of the International Life Sciences Institute.

Advantage:

Tells exactly what to eat according to the body type. All of this is packaged in a comprehensive nutrition and activity tracker

Disadvantage:

The AI system may not always make the right decisions, but it will eventually learn from the errors and adjust its decision making processes

to improve over time.

2. Artificial Intelligence in Nutrients Science BALAKRISHNA .Y JUNE 2022

Advantage:

Creation of a global network that will be able to both actively support and monitor the personalized supply of nutrients..

Disadvantage:

The AI System May Be Buggy At First it can take time to work correctly This is normal

3. AI-Based Dietician Professor, Department of Computer Science, Dayananda Sagar Academy of Technology April 2022

Advantage:

Helps the user to interact better with the system, Provide information to the system as input and take the recommended diet plan as output

Disadvantage:

Doesn't have knowledgeable dietician Don't value customer time Worst service

4. Virtual Nutritionist using AI International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249- 8958, Volume-8 Issue-5 June 2019 Blue Eyes Intelligence Engineering and science publication

Advantage:

A user can track his/her progress towards his/her goal from the day he'd started using the application. Reminders for every meal. Inbuilt personalized customization of meals depending upon one's preferred foods

Disadvantage:

High Costs. No creativity. AI is that it cannot learn to think outside the box. Unemployment Make Humans Lazy. No Ethics. Emotionless. No Improvement

2.2 References

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8. Johnson K.W., Torres Soto J., Glicksberg B.S., Shameer K., Miotto R., Ali M., Ashley E., Dudley J.T. Artificial intelligence in cardiology. J. Am. Coll. Cardiol. 2018;71:2668–2679. doi: 10.1016/j.jacc.2018.03.521. [PubMed] [CrossRef] [Google Scholar]
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11. Demirci F., Akan P., Kume T., Sisman A.R., Erbayraktar Z., Sevinc S. Artificial neural network approach in laboratory test reporting: Learning algorithms. Am. J. Clin. Pathol. 2016;146:227–237. doi: 10.1093/ajcp/aqw104. [PubMed] [CrossRef] [Google Scholar]

2.3 ProblemStatement Definition

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

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.4 Proposed Solution

S.NO	PARAMETERS	SOLUTIONS
1.	Problem Statement	<ul style="list-style-type: none"> • Main objective is to detect the nutrition in a fruit from camera captured image. • The identification of nutrition and calories from a image is quite an interesting field. • Since nutrition monitoring plays an important role in leading healthy lifestyle, this product has the potential to become an essential in our day to day life.
2.	Idea / Solution description	<ul style="list-style-type: none"> • The solution is to develop AI-powered nutrition analyzer application. • By giving the image of the fruit as the input to the application, it will display the nutrition content in it. • By training the model with various inputs, image processing can be improved as well as the accuracy of the result.
3.	Novelty / Uniqueness	<ul style="list-style-type: none"> • Personalized nutrition for individuals. • Providing science based guidance for healthy living. • Balanced food diet and measured intake. • 24/7 support. • Serving size.

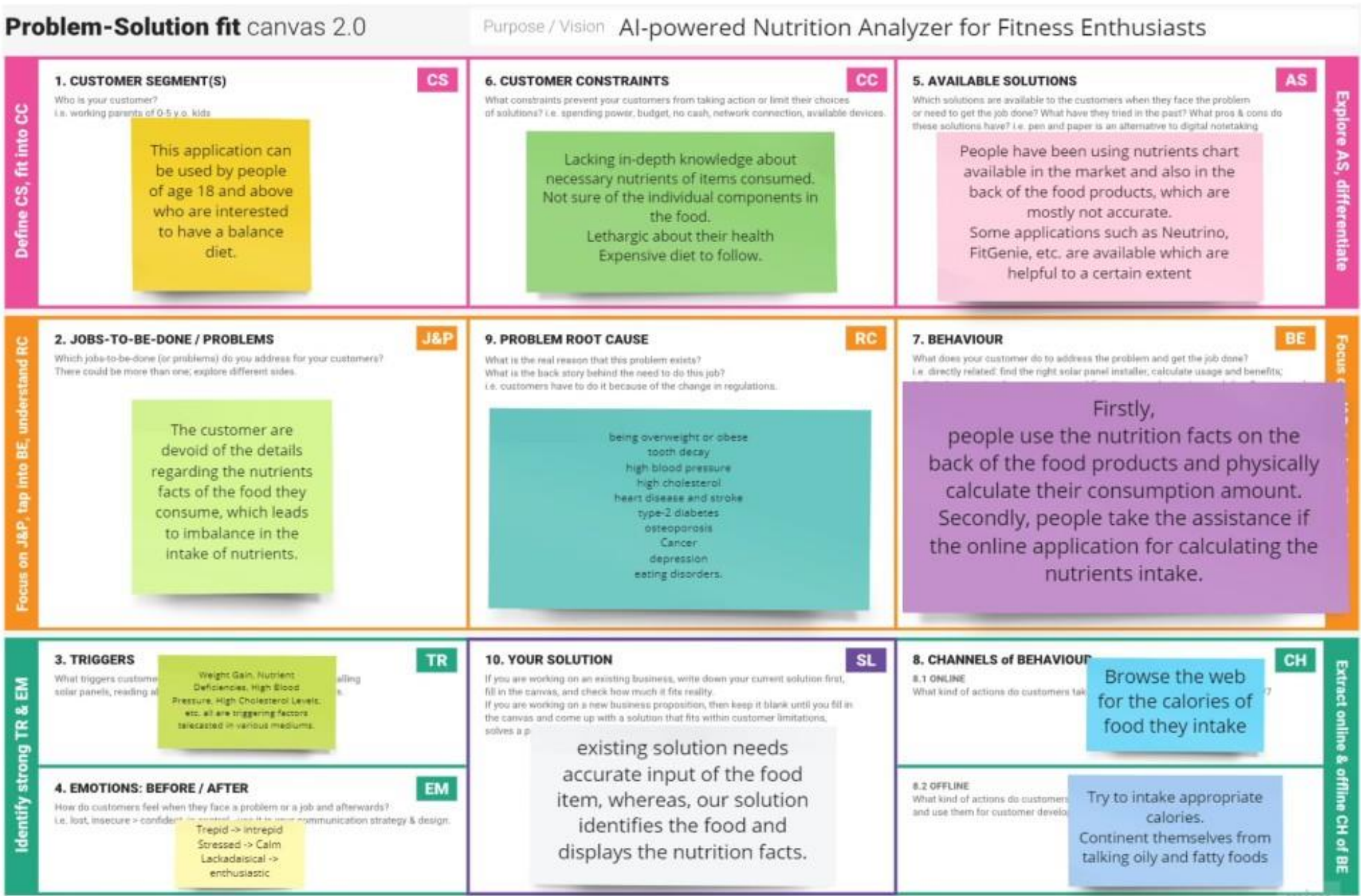
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> • Economically stable product. • Change one's view towards health and fitness. • Quality of service. • High fiber food. • Accurate amount of nutrition.
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> • User friendly interface which improves the constant use of the product. • Hence, Economical growth improves. • Product will be delivered in pocket size which results in consuming low memory. • Nutrition and fitness related ads to earn profit
6.	Scalability of the Solution	<ul style="list-style-type: none"> • Offers ingredients substance detail in food • Suggest best health solution and meal plans for different criteria proposed by different individuals. • Virtualization of your long term plan to provide motivation to the customer.

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.

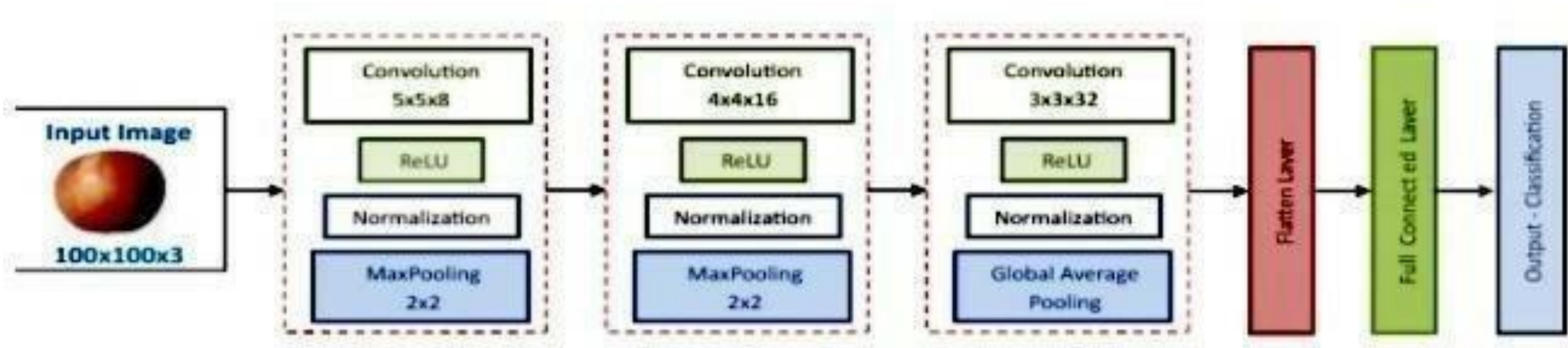


4.REQUIREMENT ANALYSIS

4.1Functional requirement

- It will generate the diet plan as well as monitor the user’s health to classify the category ofthe disease and to create the diet plan. It will also reduce the cost of consulting thepersonnutritionist.
 - he task of food detection/classification is not easy as it seems. All possible optionsrelatedto the given Image.
 - Image classification, object detection, segmentation, face recognition.
 - Classification of crystal structure using a convolutional neural network
 - Nutrition is vital to the growth of the human body. Nutritional analysis guarantees that the meal meets the appropriate vitamin and mineral requirements, and the examination of nutrition in food aids in understanding the fat proportion, carbohydrate dilution, proteins,fiber, sugar, and so on. Another thing to keep in mind is not to exceed our daily calorierequirements
- Computer-Assisted Nutritional Recognize Food Images – In order to solve this issue, a brand-new Convolutional Neural Network (CNN)- based food picture identification system wascreated, as described in this study. We utilized our suggested strategy on two sets of actualfood picture data.
- Here the user can capture the images of different fruits and then the image will be sent to the trained model. The model analyzes the image and detects the nutrition based on thefruits like (Sugar, Fiber, Protein, Calories, etc.)
 - The Ultimate Workout at Home Solution This fitness AI software is designed with personalized training regimens for each individual. It began as “gym only software,” but hasnow improved its system to satisfy “at home fitness” expectations.
 - You take a picture, dial in data such as whether you are eating breakfast or lunch and add aquick text label, and the app estimates the calorie content.
 - This software collaborated with IBM’s natural language capability to provide 24-hourassistance and dietary recommendations.

For Example:



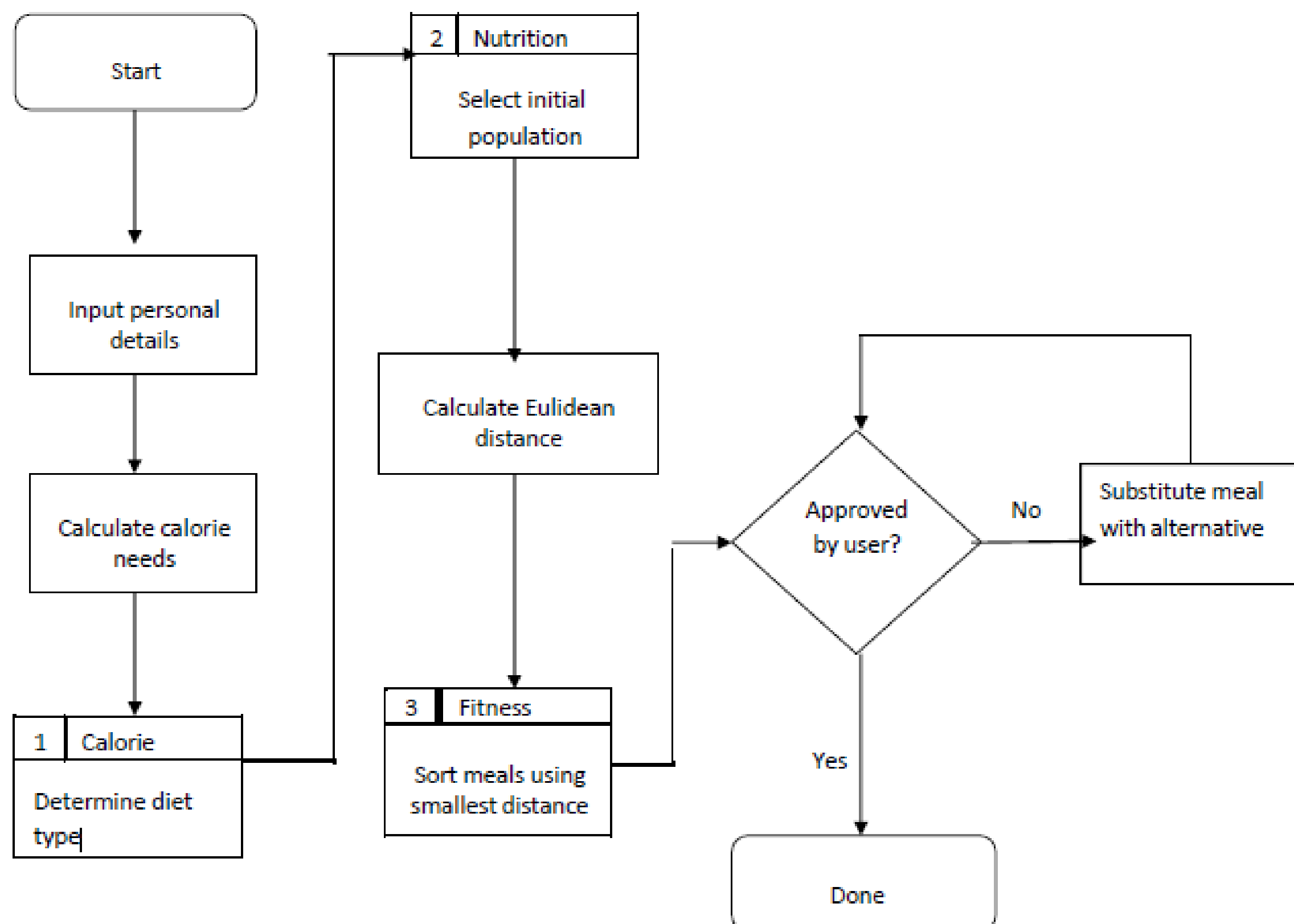
- The comparison of the proposed model with the conventional models shows that the results of this model are exceptionally good and promising to use in real-world applications.
- This sort of higher accuracy and precision will work to boost the machine's general efficiency in fruit recognition more appropriately.
- A generic model for the dietary protein requirement (as with any nutrient) defines the requirement in terms of the needs of the organism, i.e. metabolic demands, and the dietary amount which will satisfy those needs, i.e. efficiency of utilization, thus: dietary requirement = metabolic demand/efficiency of utilization.

Convolutional neural network (CNN)

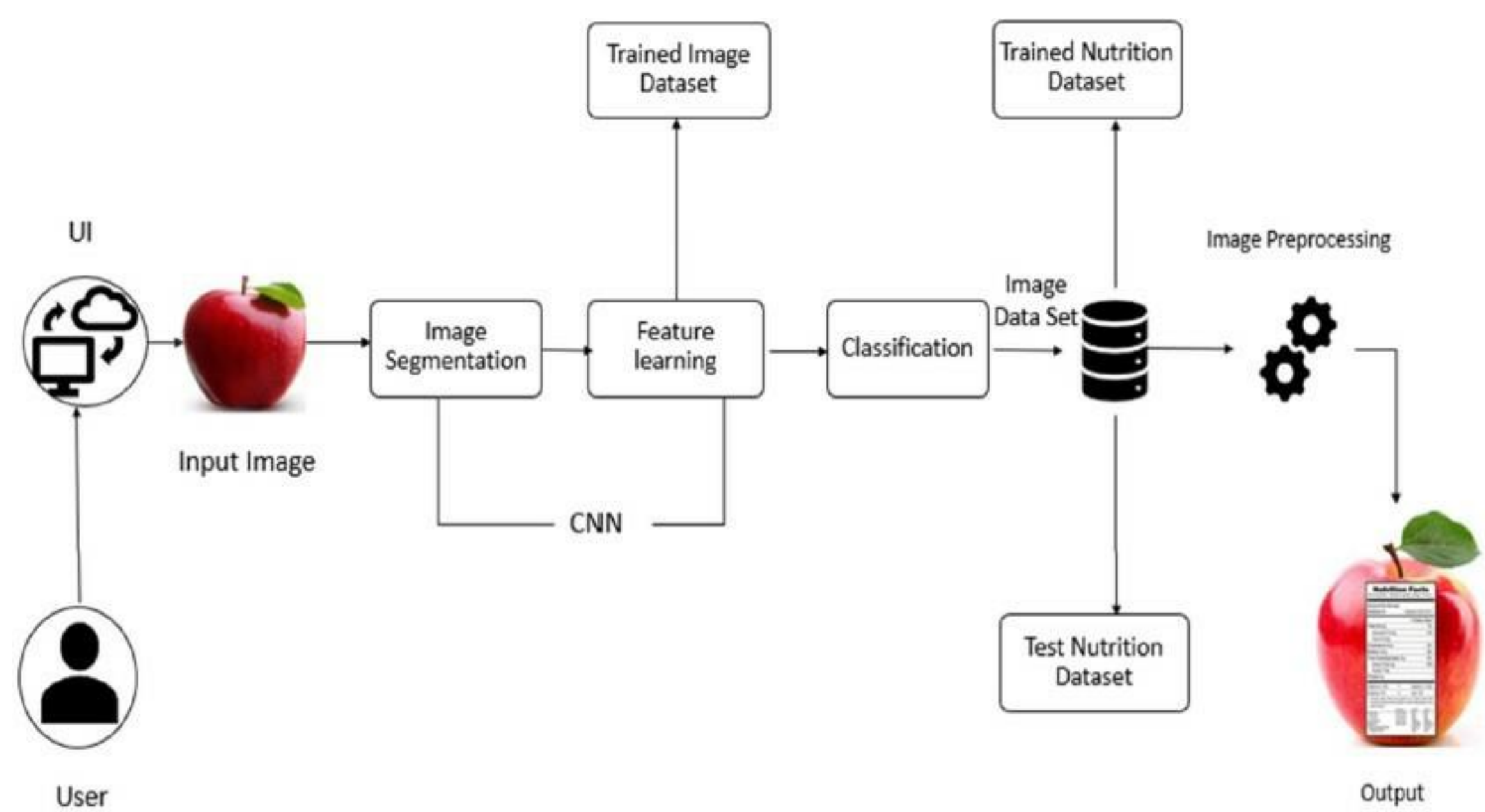
- Within Deep Learning, a Convolutional Neural Network or CNN is **a type of artificial neural network, which is widely used for image/object recognition and classification.**
- Deep Learning thus recognizes objects in an image by using a CNN.

2. PROJECT DESIGN

2.1 Data Flow Diagrams



2.2 Solution & Technical Architecture

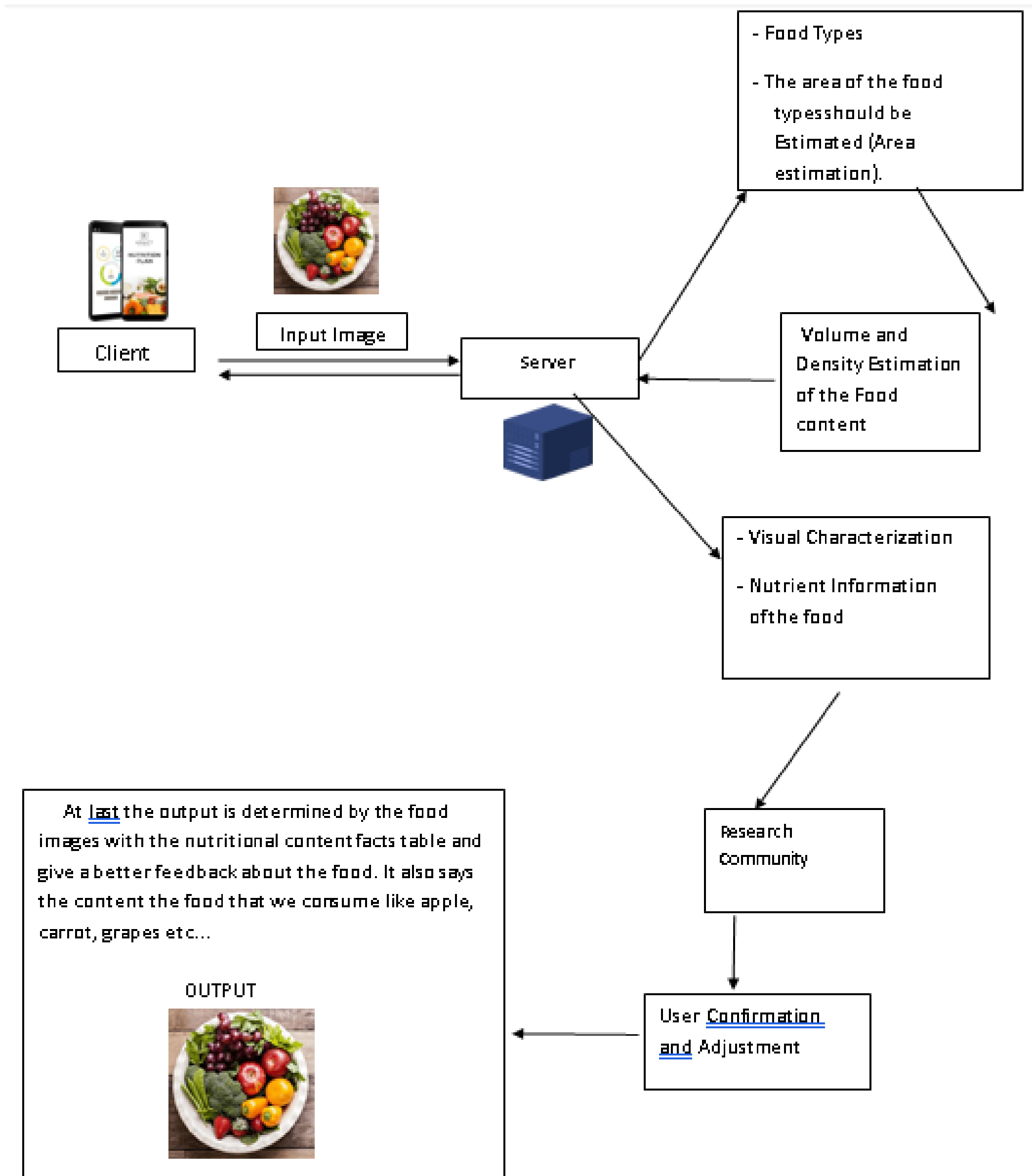


2.3 Solution & Technical Architecture

S.No	Component	Description	Technology
1.	App	User interacts with applicationforthe prediction of Nutrition	Python, Java, HTML, SQLite, Android studioMySQL, JS
2.	Database	Data Type, Configurations anddata will be stored	
3.	Cloud Database	Database Service on Cloud	IBMDB2, IBM Cloudant etc.
4.	File Storage	File storage requirements	Cloud --> drive
5.	Machine LearningModel	Purpose of Machine LearningModel	ANN, CNN, RNN
6.	Notification	Notification will be sent from the server	SendGrid

Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Open-source frameworks used	SendGrid, Python, JQuery
2.	Security Implementations	Request authentication using encryption	Encryptions, SSL certs
3.	Scalable Architecture	The scalability of architecture consists of 3 tiers	Web Server – HTML, CSS ., Javascript Application Server – Python Flask Database Server – IBM Cloud
4.	Availability	Availability is increased by load 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. Please use `Model.fit` instead.

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

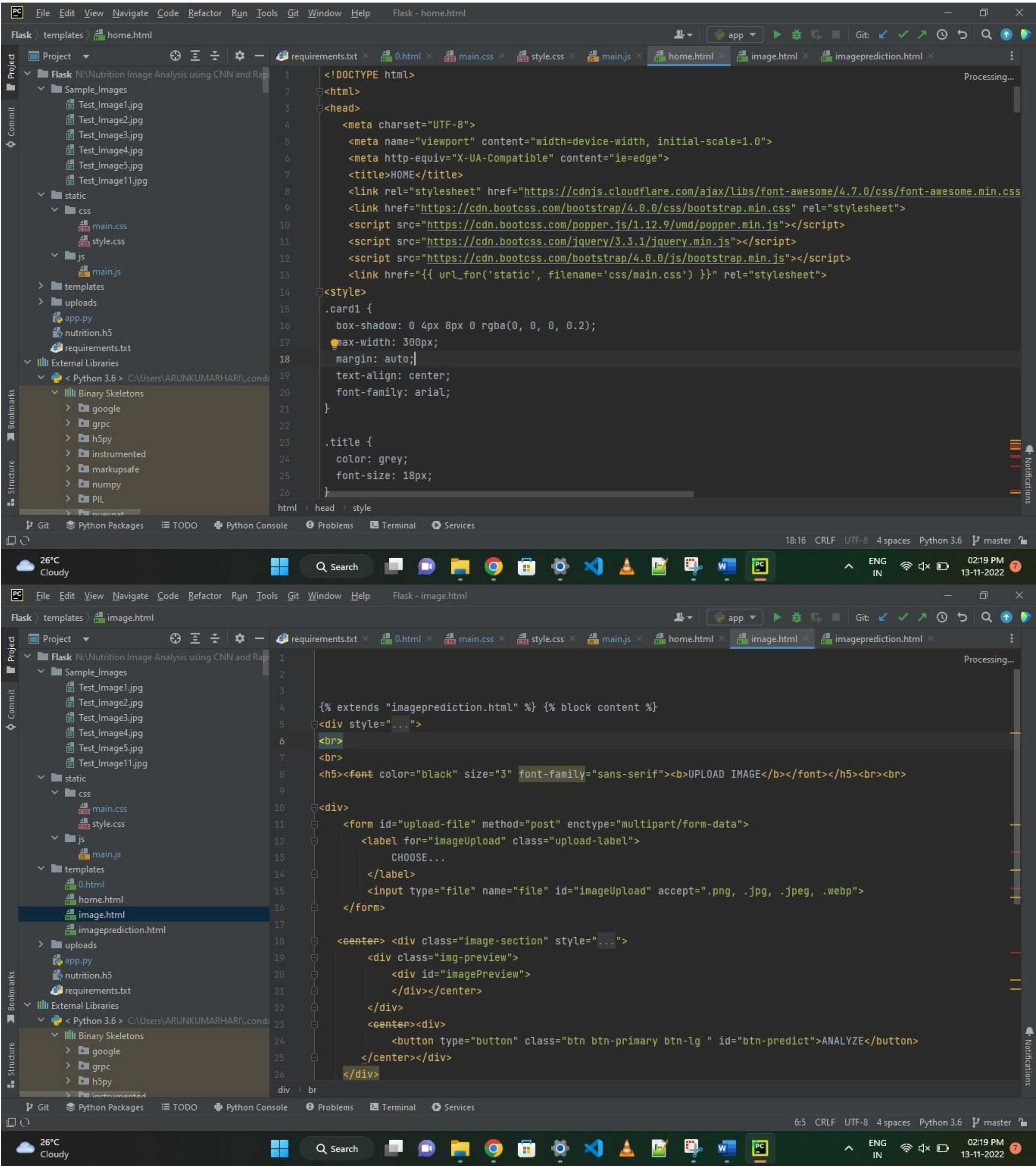
```
[ ] from tensorflow.keras.models import load_model  
from keras.preprocessing import image  
model = load_model("nutrition.h5")
```

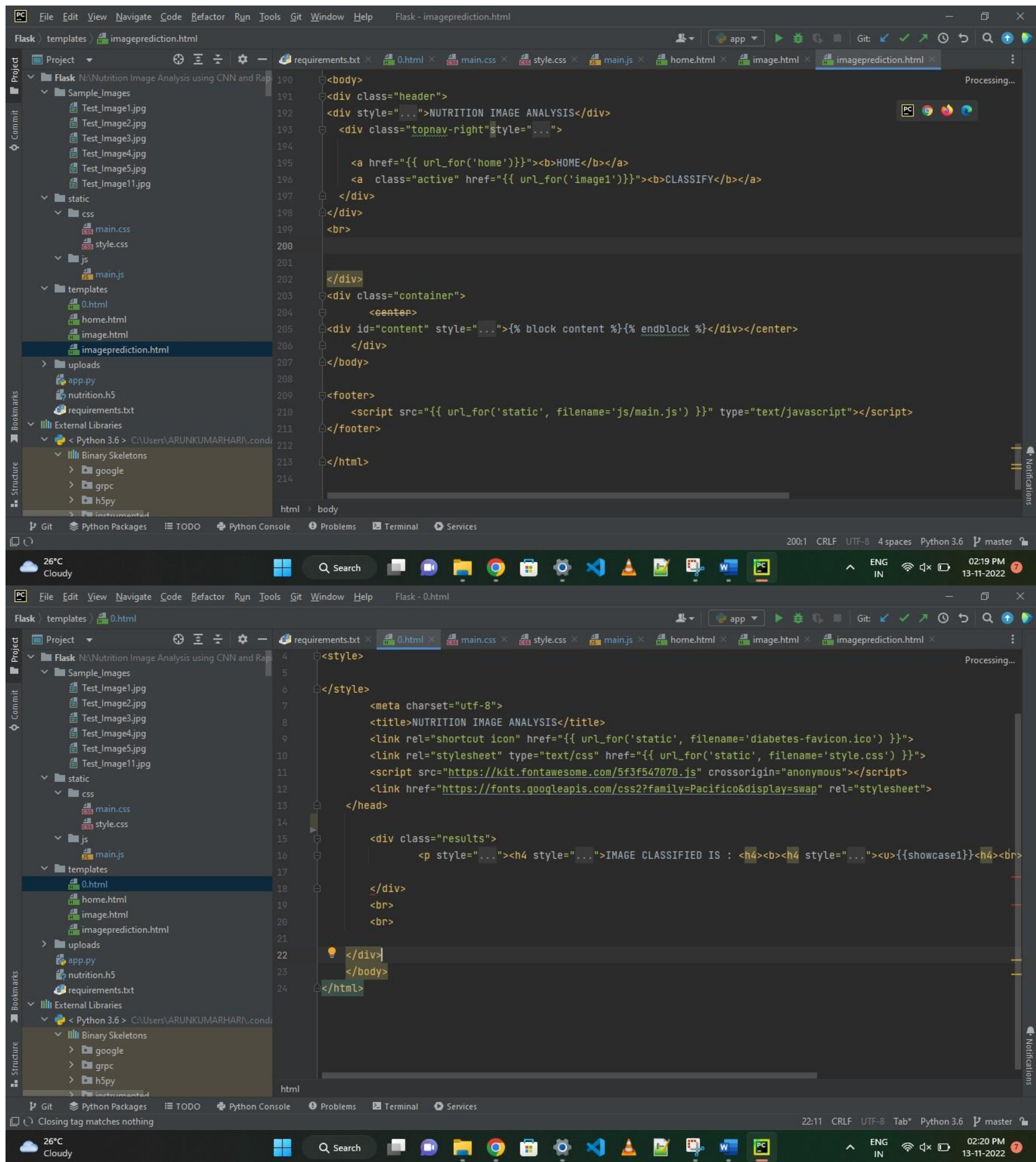
```
from tensorflow.keras.models import load_model  
from tensorflow.keras.preprocessing import image  
model = load_model("nutrition.h5")  
img = image.load_img(r'/content/drive/MyDrive/Colab Notebooks/Sample_Images/Test_Image1.jpg',grayscale=False,target_size= (64,64))  
x = img_to_array(img)  
x =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

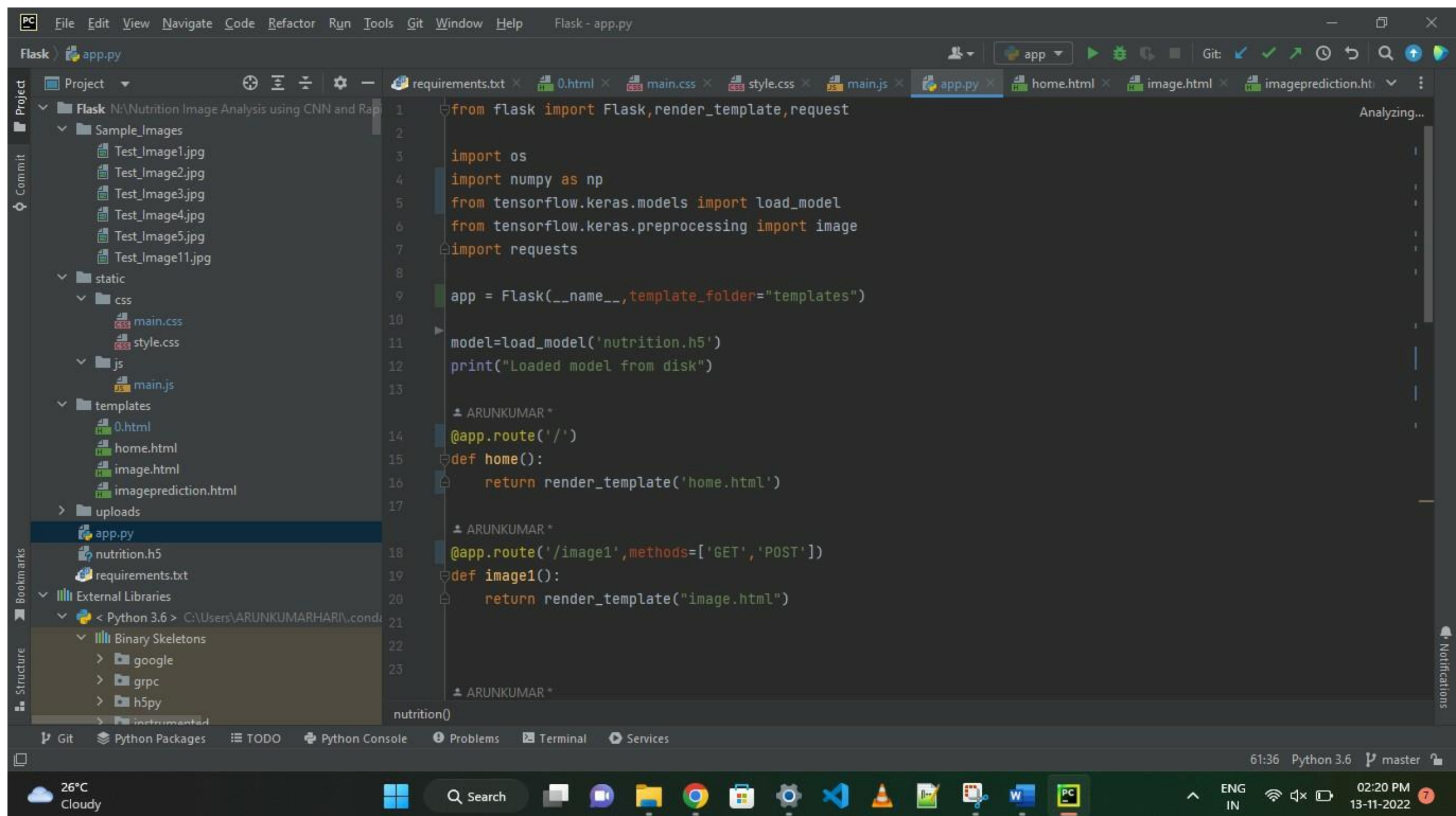
1/1 [=====] - 0s 62ms/step
array([0])

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

6.2 Feature 2

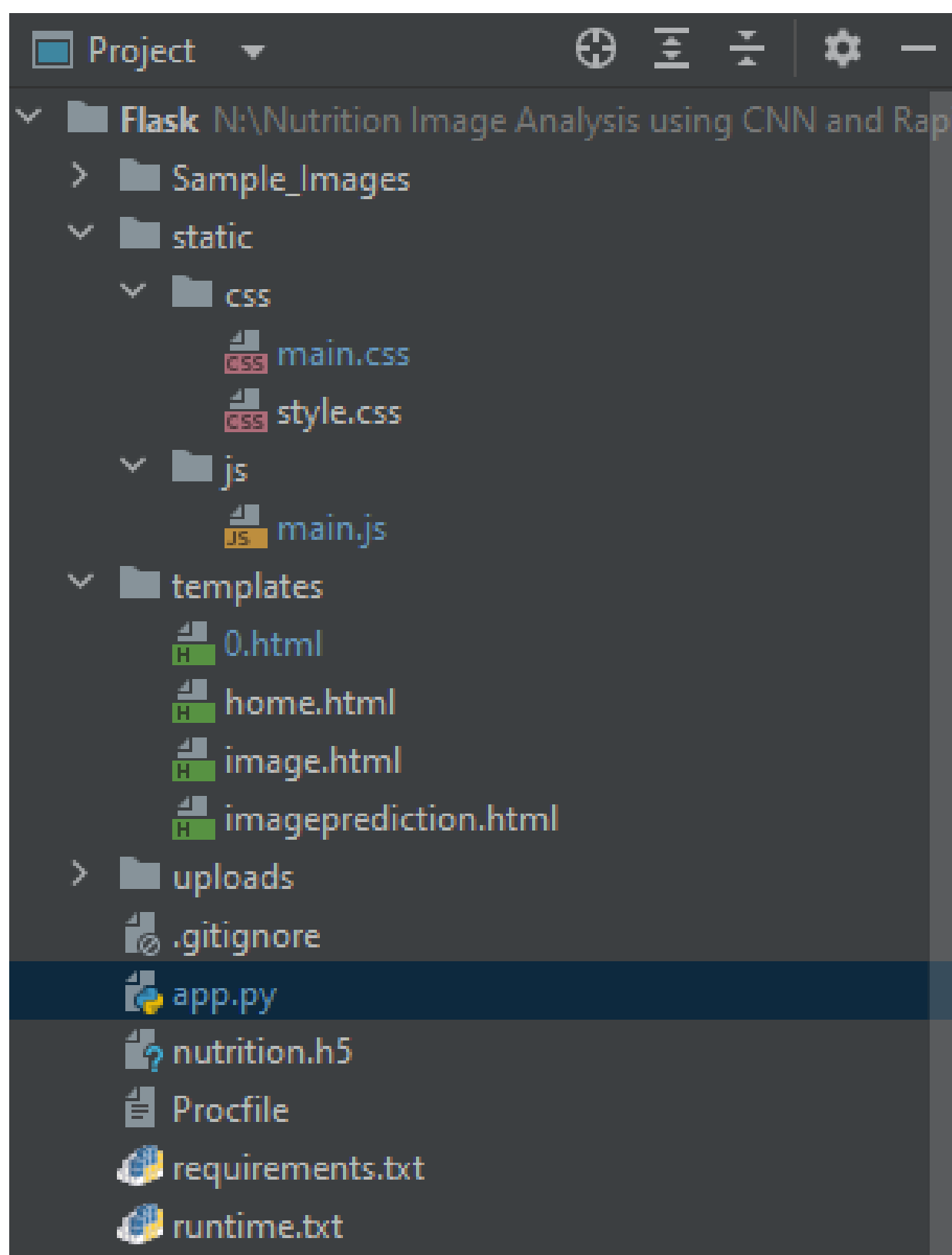






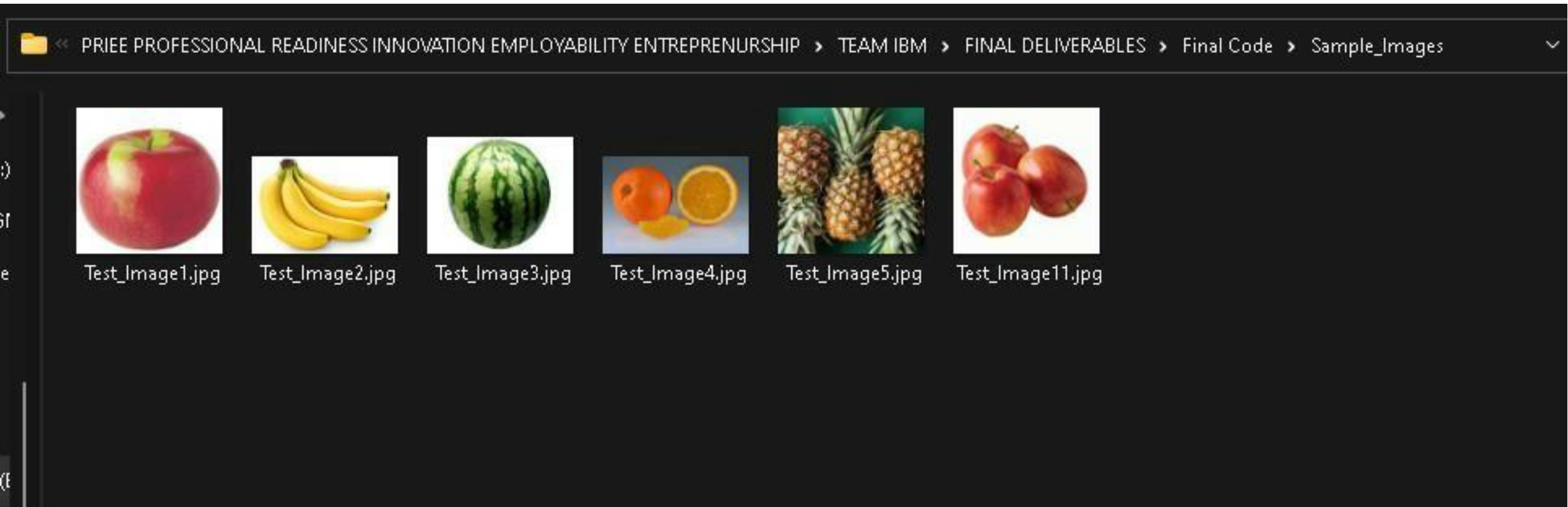
7. TESTING

7.1 TestCases



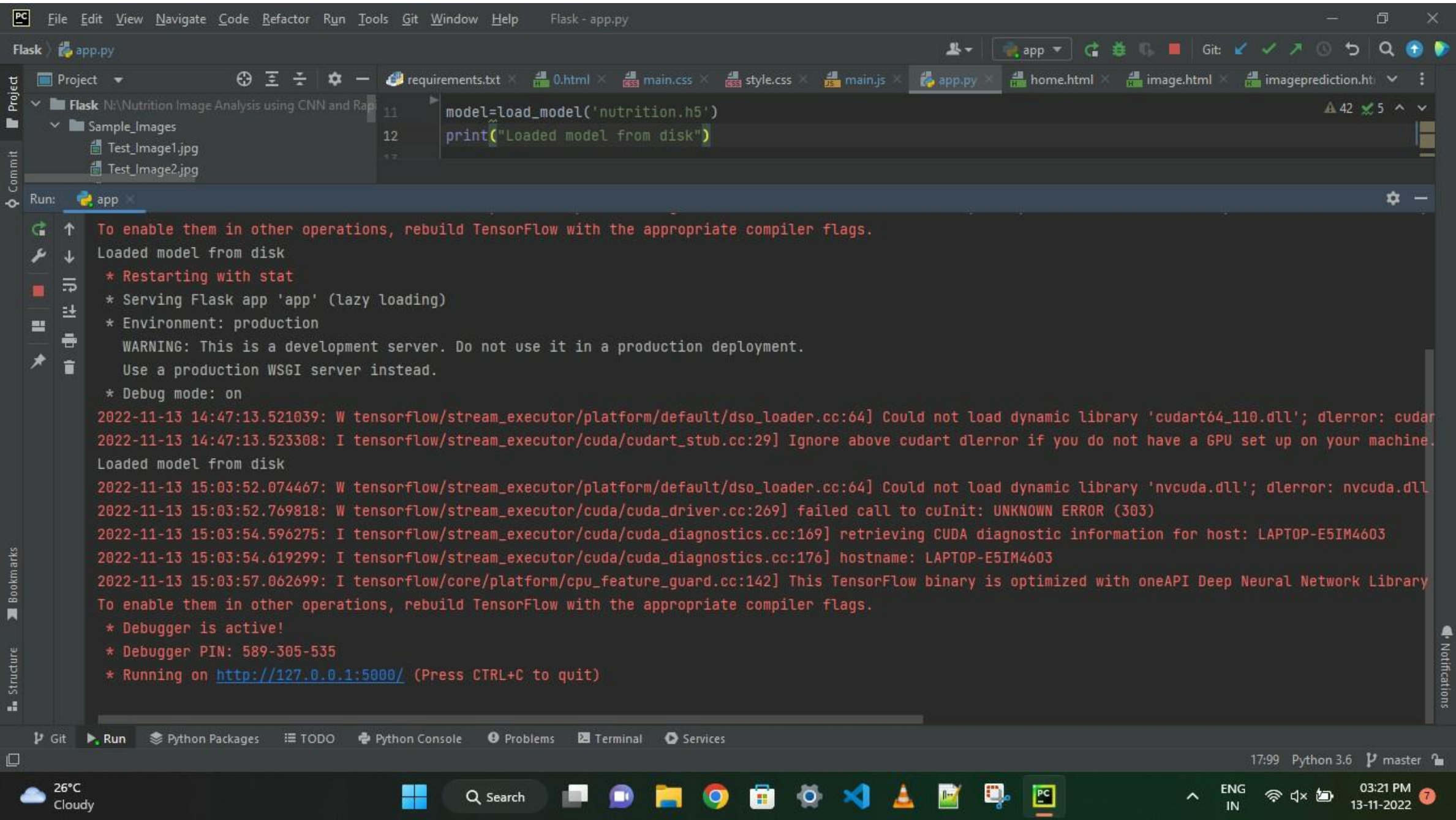


7.2 User AcceptanceTesting

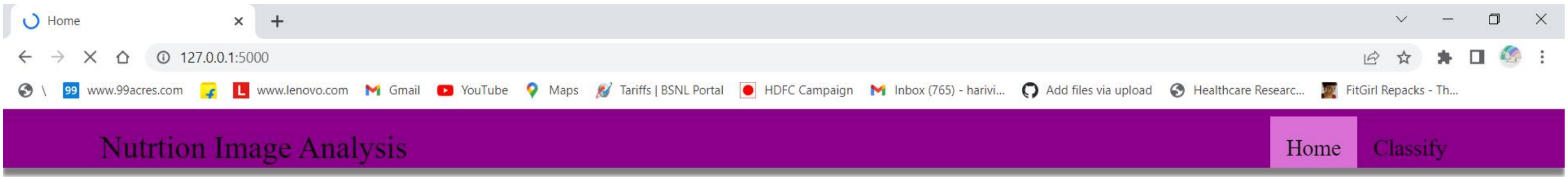


8. RESULTS

8.1 PerformanceMetrics

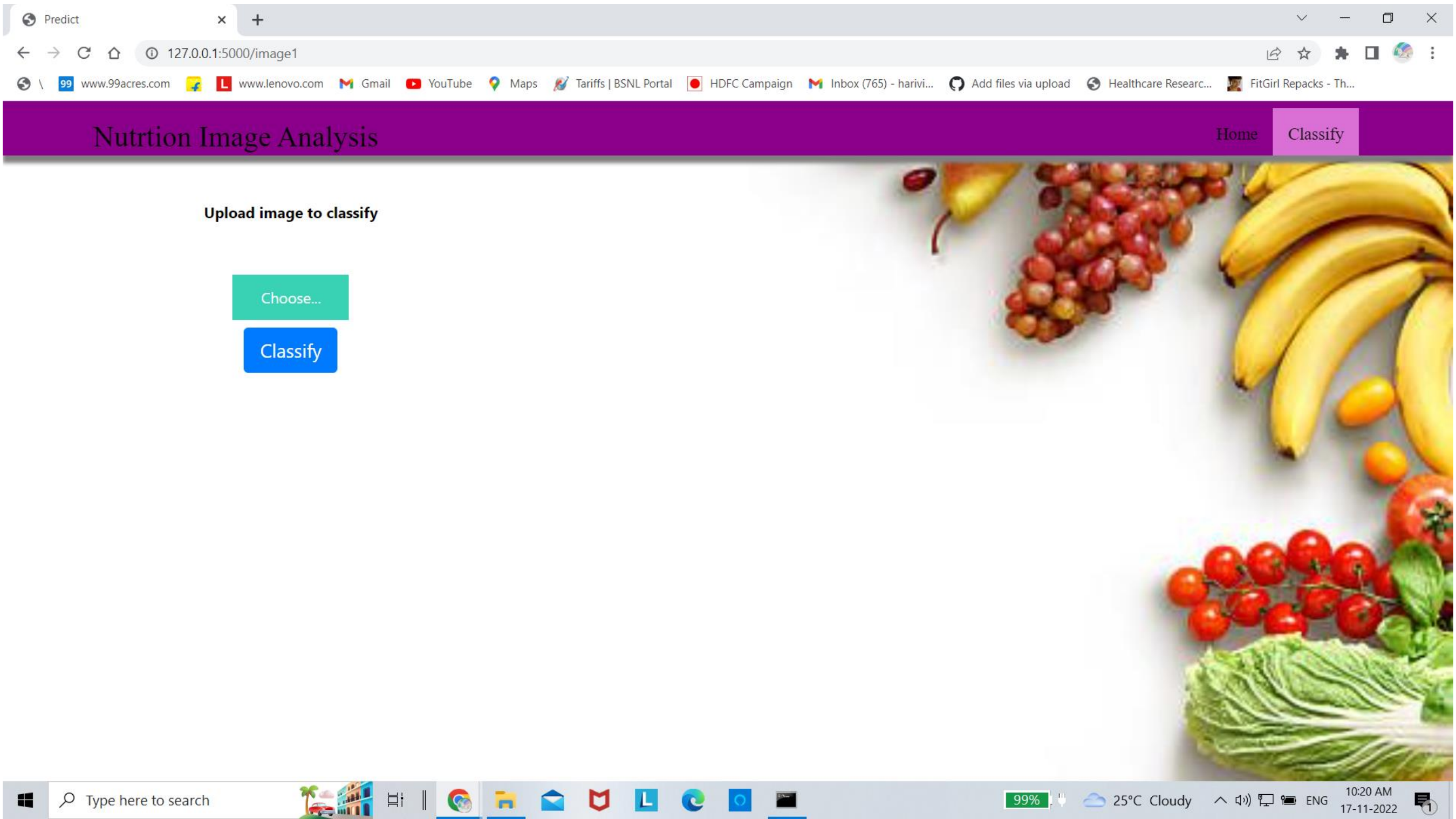


8.2 Output



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. It ensures compliance with trade and food laws.





Predict

127.0.0.1:5000/image1


www.99acres.comwww.lenovo.comGmailYouTubeMapsTariffs | BSNL PortalHDFC CampaignInbox (765) - harivi...Add files via uploadHealthcare Researc...FitGirl Repacks - Th...

Nutrion Image Analysis

HomeClassify

Upload image to classify

Choose...




Food Classified is:

APPLES

[{'sugar_g': 10.3, 'fiber_g': 2.4, 'serving_size_g': 100.0, 'sodium_mg': 1, 'name': 'apples', 'potassium_mg': 11, 'fat_saturated_g': 0.0, 'fat_total_g': 0.2, 'calories': 53.4, 'cholesterol_mg': 0, 'protein_g': 0.3, 'carbohydrates_total_g': 13.8}]

Type here to search



99%

25°C Cloudy

10:21 AM
17-11-2022

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.

9. FUTURESCOPE

- 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.

13.2GitHub & Project Demo Link:

Github link:

<https://github.com/IBM-EPBL/IBM-Project-41325-1660641253>

Project demo link:

https://drive.google.com/file/d/17DU7eJnJtL7-nvLin6QaXGc5leKIc1At/view?usp=share_link

