

# AI-Powered Nutrition Analyzer For Fitness Enthusiasts

TEAM ID :PNT2022TMID10671

## 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

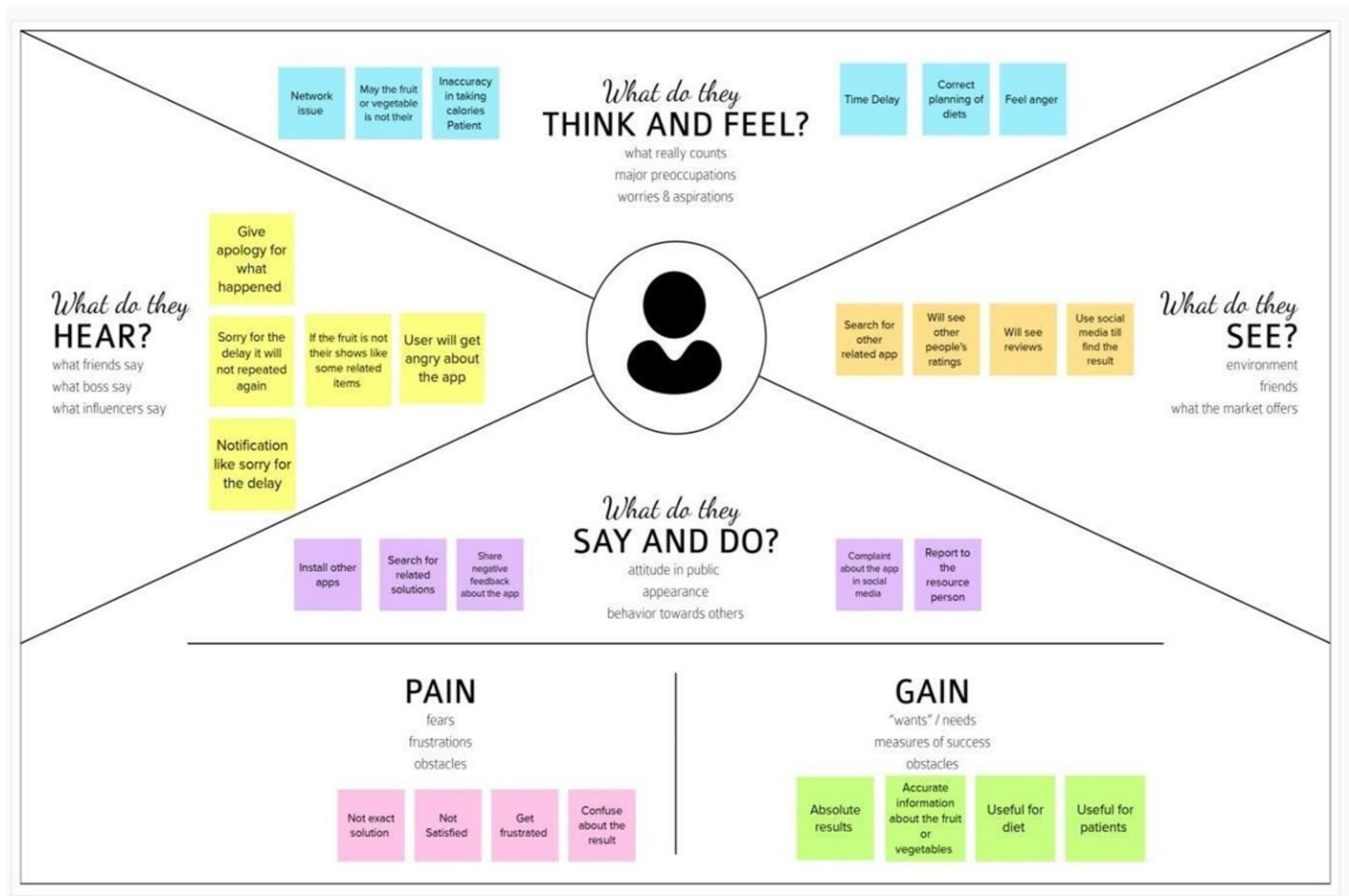
The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like colour, shape, texture etc. Here the user can capture the images of different fruits and then the image will be sent to the trained model. The model analyses the image 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.



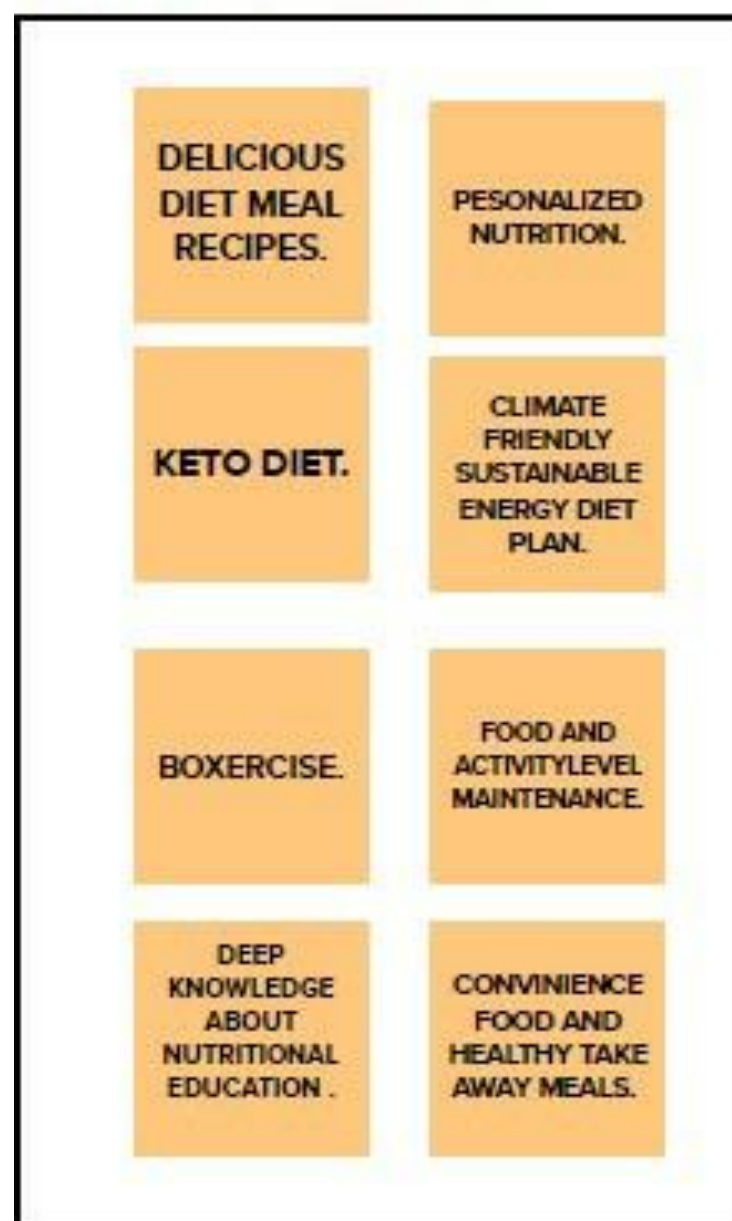
## 2.3 Problem Statement Definition

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 imagesofdiffernt 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

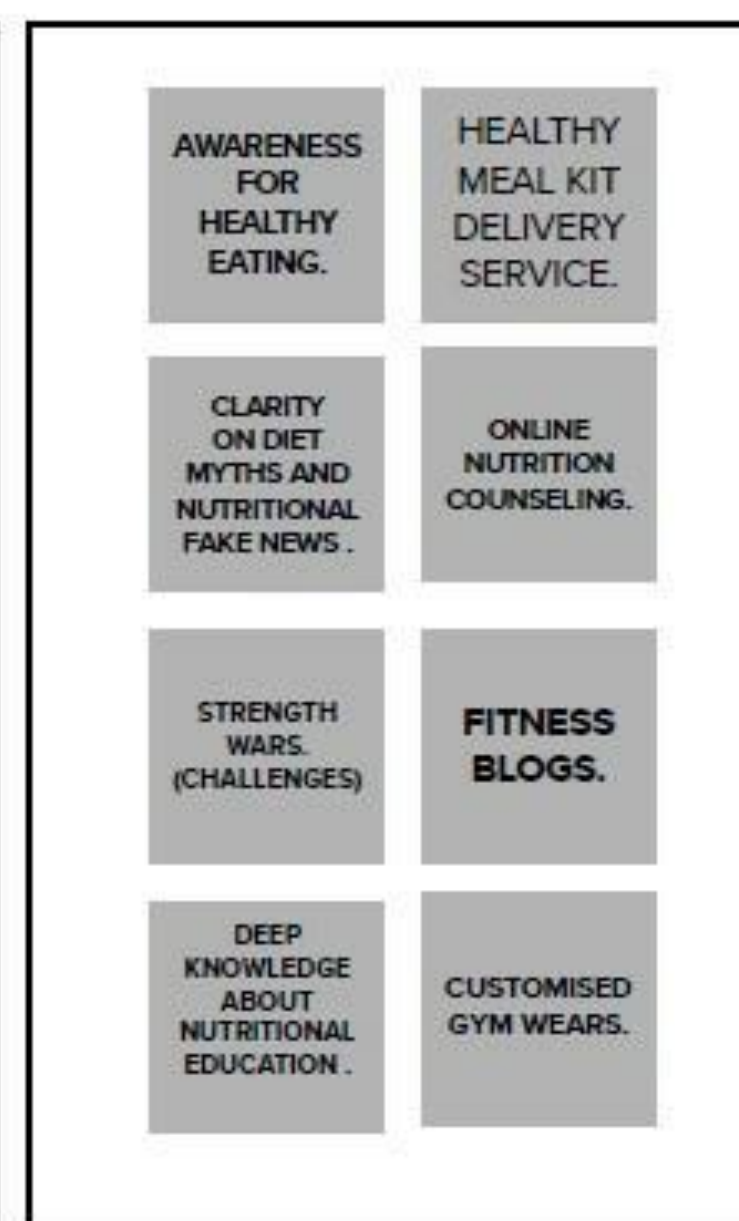
## NUTRITIONAL



## WORKOUT



## PROGRAMS



### 3.2 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	In order to distinguish between fruits and vegetables based on colour, texture, shape, and other features, an ordinary human needs employ cutting-edge AI-based analysis software. The user must be informed of the nutritional value of that particular food at the moment of identification..
2.	Idea / Solution description	<p><b>Main Solution:</b></p> <ul style="list-style-type: none"> <li>• Identification of the provided input data is accurate and clear.</li> <li>• Give nutritional information based on the collected information.</li> <li>• Analysis and upkeep of fitness based on the user's physical circumstances</li> </ul> <p><b>Additional benefits:</b></p> <ul style="list-style-type: none"> <li>• Analysis of daily dietary requirements</li> <li>• meticulously measuring daily nutritional intake.</li> </ul>
3.	Novelty / Uniqueness	<ul style="list-style-type: none"> <li>• The provision of bonus-added fitness plans</li> <li>• Home cures and easy fixes for common issues are suggested.</li> <li>• A diet tailored to each person's needs and health status.</li> <li>• Flexibility in diet is encouraged to encourage a nutritious and productive eating routine.</li> </ul>

4.	Social Impact	<ul style="list-style-type: none"> <li>• Healthy lifestyle development</li> <li>• Continuous calorie tracking produces a fitness attitude..</li> </ul>
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> <li>• Consultation with local nutritionists and trainers for customised strategies.</li> <li>• Adopt a specific diet under the guidance of a professional.</li> <li>• Promote and sell workout equipment and dietary supplements.</li> <li>• Promotion of hospitals and fitness facilities</li> </ul>

### 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	<b>1. CUSTOMER SEGMENT(S)</b> <b>CS</b> Who is your customer? i.e. working parents of 0-5 y.o. kids  1. Gym Trainers 2. Sportsmen 3. Fitness Trackers	<b>6. CUSTOMER CONSTRAINTS</b> <b>CC</b> What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.  1. Network Connection 2. Deviations from the diet 3. Straining of eyes	<b>5. AVAILABLE SOLUTIONS</b> <b>AS</b> Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking  To anticipate dietary intake utilising nutrition analysis technologies in order to maintain their stability and health.	Explore AS, differentiate
	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> <b>J&amp;P</b> Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.  1. Irrelevant details 2. Wrong calculation of nutrition from given details	<b>9. PROBLEM ROOT CAUSE</b> <b>RC</b> What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations.  1. Work pressure 2. They can't control their food habit Angry 3. Tiredness	<b>7. BEHAVIOUR</b> <b>BE</b> What does your customer do to address the problem and get the job done? i.e. Directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)	
Focus on J&P, tap into BE, understand RC				Focus on J&P, tap into BE, understand RC
Identify strong TR & EM	<b>3. TRIGGERS</b> <b>TR</b> What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.  Learn about the app through friends, advertisements, or social media	<b>10. YOUR SOLUTION</b> <b>SL</b> If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.  1. To calculate the person's calorie intake depending on several elements of their health. 2. To give them routine updates on the client's or individual's nutritional needs. 3. To offer the recommended daily intake of fruits and vegetables based on the model's anticipated calorie value.	<b>8. CHANNELS of BEHAVIOUR</b> <b>CH</b> <b>8.1 ONLINE</b> What kind of actions do customers take online? Extract online channels from #7  <b>8.2 OFFLINE</b> What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.  8.1 .Google advertisement through social media 8.2 .Ask friends or other previous users recommendation Suggestion from doctor	Identify strong TR & EM
	<b>4. EMOTIONS: BEFORE / AFTER</b> <b>EM</b> How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure ~ confident, in control - use it in your communication strategy & design.  Before: Fear, Hopeless After: Hopeful, Confident			

#### 4.REQUIREMENT ANALYSIS

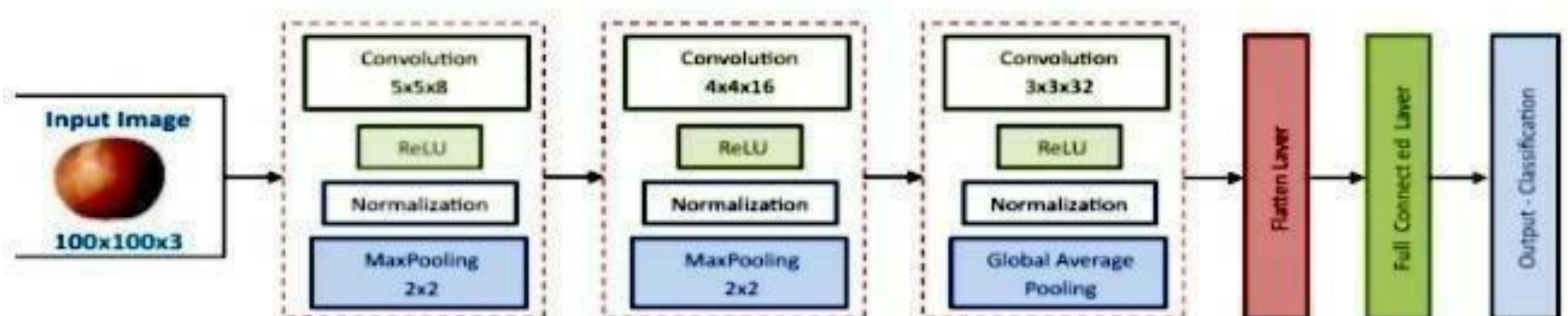
##### 4.1 Functional requirement

- It will generate the diet plan as well as monitor the user’s health to classify the category of the disease and to create the diet plan. It will also reduce the cost of consulting the person nutritionist.
- The task of food detection/classification is not easy as it seems. All possible options related to 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 calorie requirements

created, as described in this study. We utilized our suggested strategy on two sets of actual food picture data.

- vi. 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 the fruits like (Sugar, Fiber, Protein, Calories, etc.)
- vii. 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 has now improved its system to satisfy “at home fitness” expectations.
- viii. You take a picture, dial in data such as whether you are eating breakfast or lunch and add a quick text label, and the app estimates the calorie content.
- ix. This software collaborated with IBM’s natural language capability to provide 24-hour assistance and dietary recommendations.

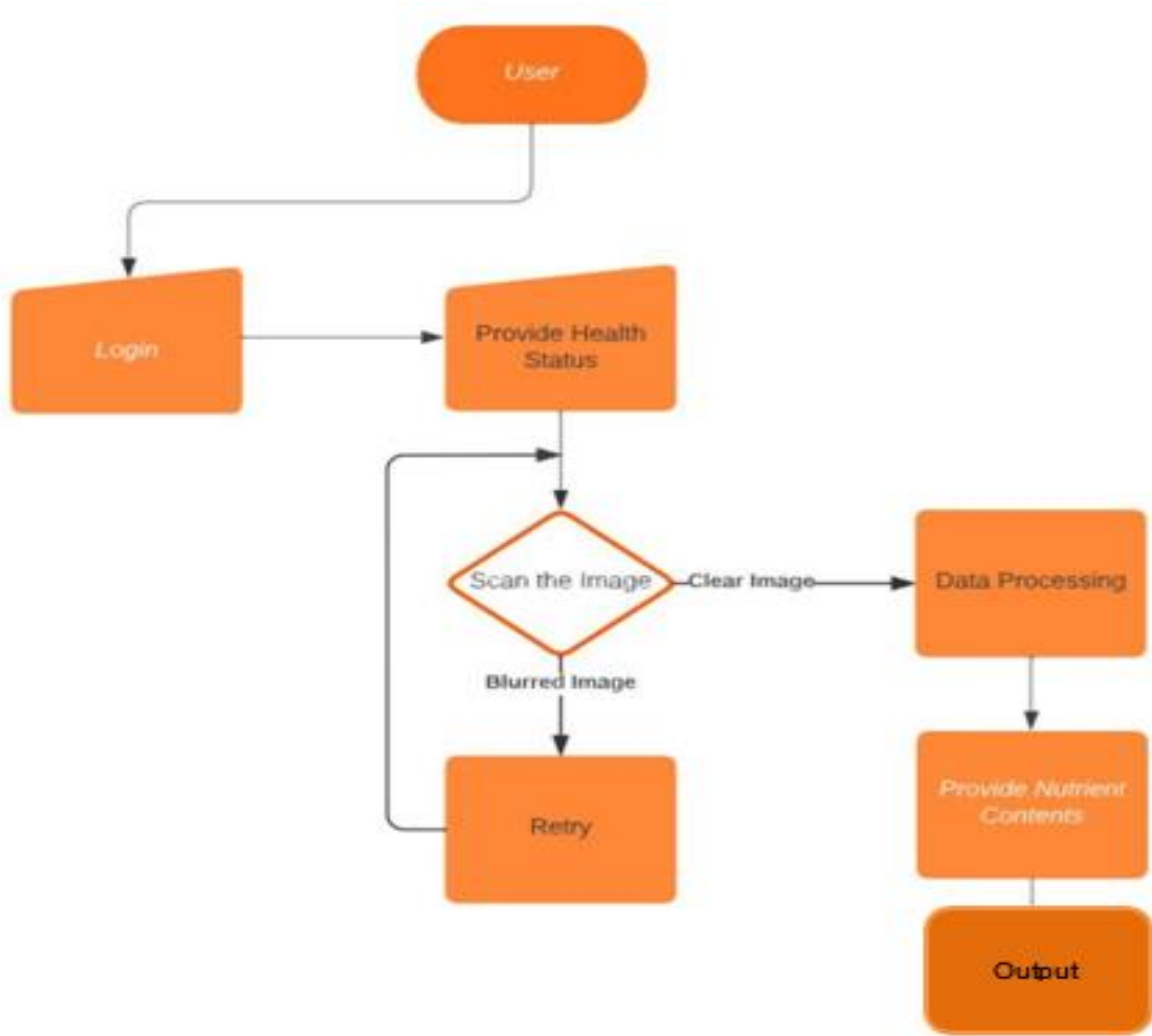
For Example:



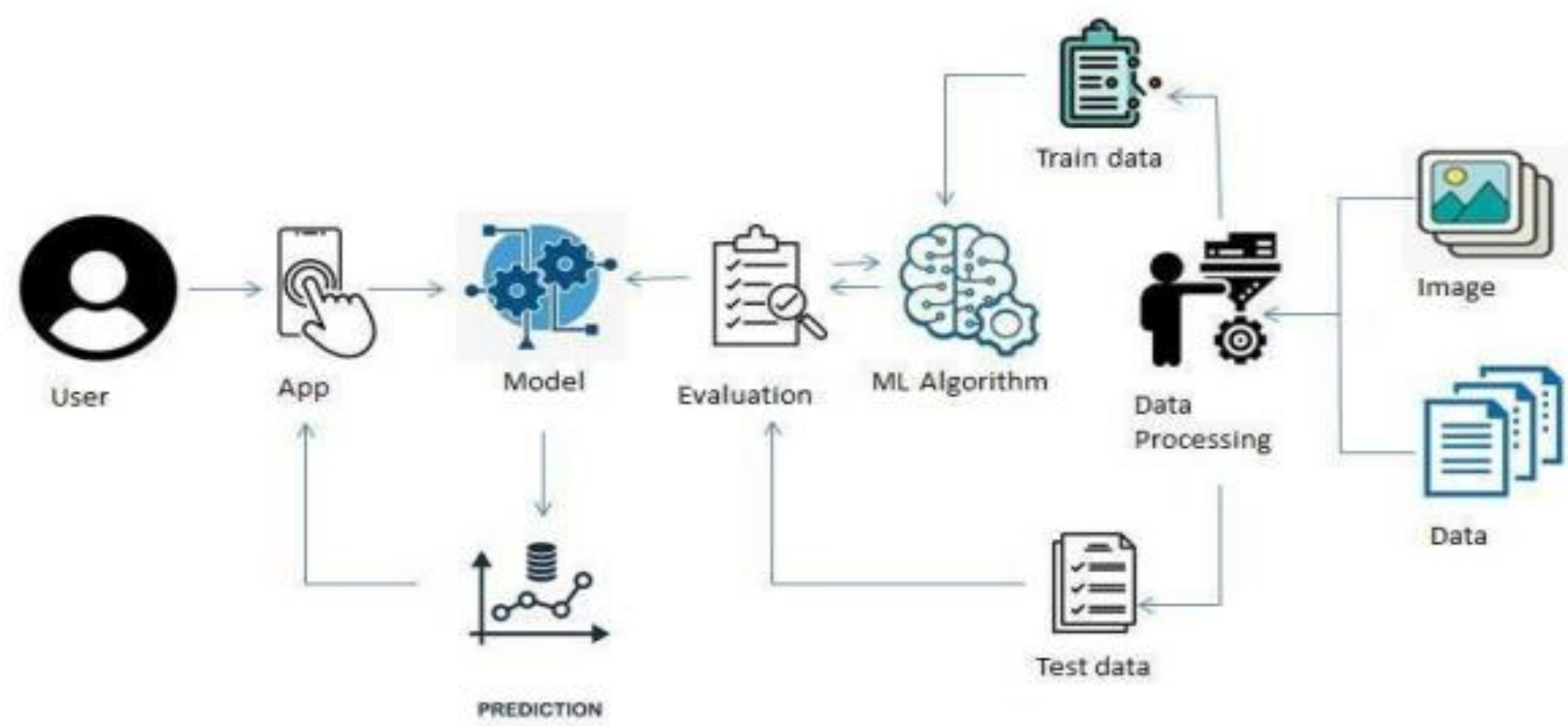
- x. The comparison of the proposed model with the conventional models shows that the results of this model are exceptionally good and promising to use in real-world applications.
- xi. This sort of higher accuracy and precision will work to boost the machine’s general efficiency in fruit recognition more appropriately.
- xii. A generic model for the dietary protein requirement (as with any nutrient) defines the requirement in terms of the needs of the organism,
- xiii. 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.

5 PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture

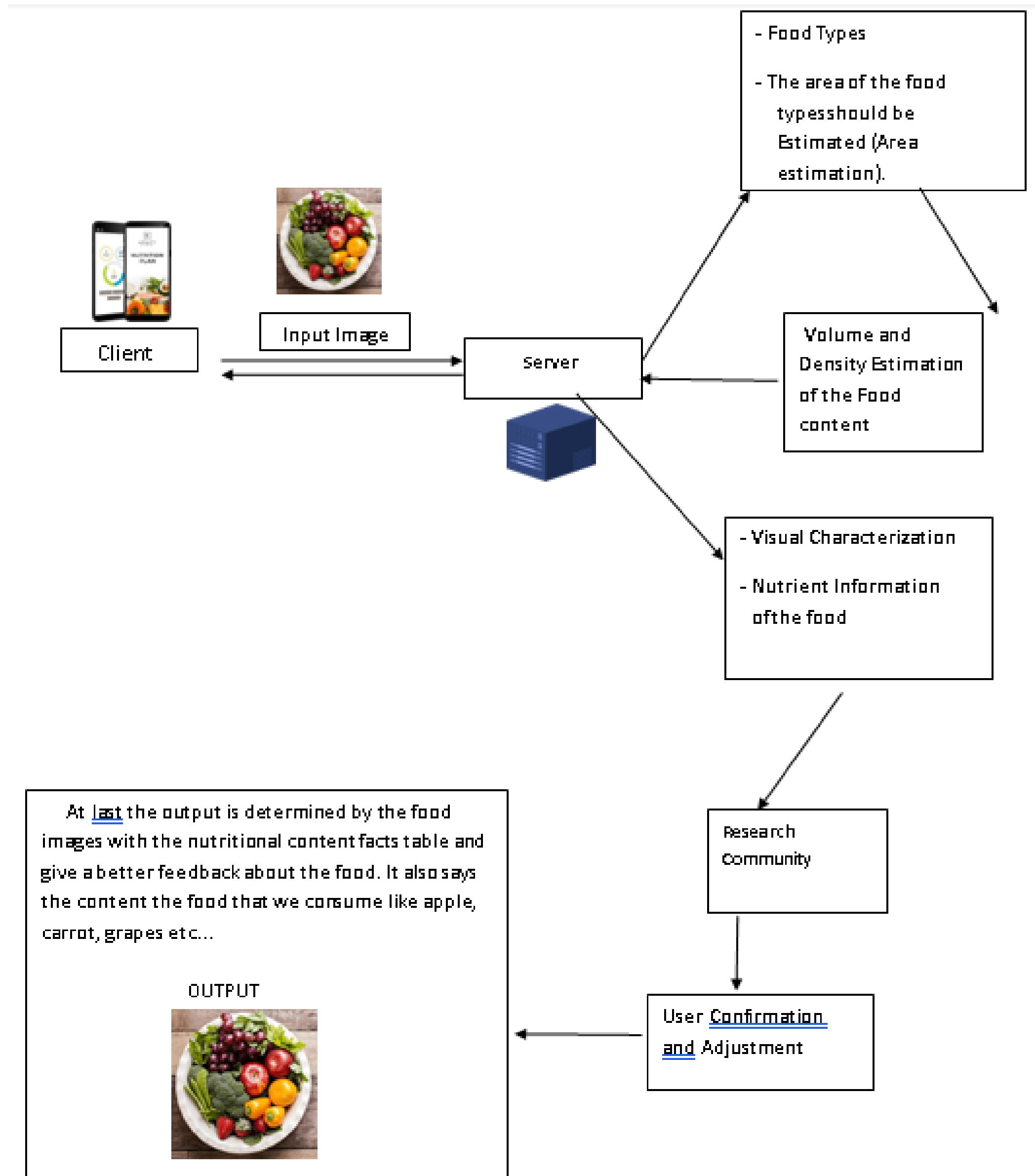


S.No	Component	Description	Technology
1.	App	User interacts with applicationfor the prediction of Nutrition	Python, Java, HTML, SQLite, Android studio
2.	Database	Data Type, Configurations and data will be stored	MySQL, JS
3.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
4.	File Storage	File storage requirements	Cloud -- > drive
5.	Machine Learning Model	Purpose of Machine Learning Model	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 architectureconsists of 3 tiers	Web Server – HTML, CSS ,Javascript Application Server –Python Flask Database Server – IBMCloud
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

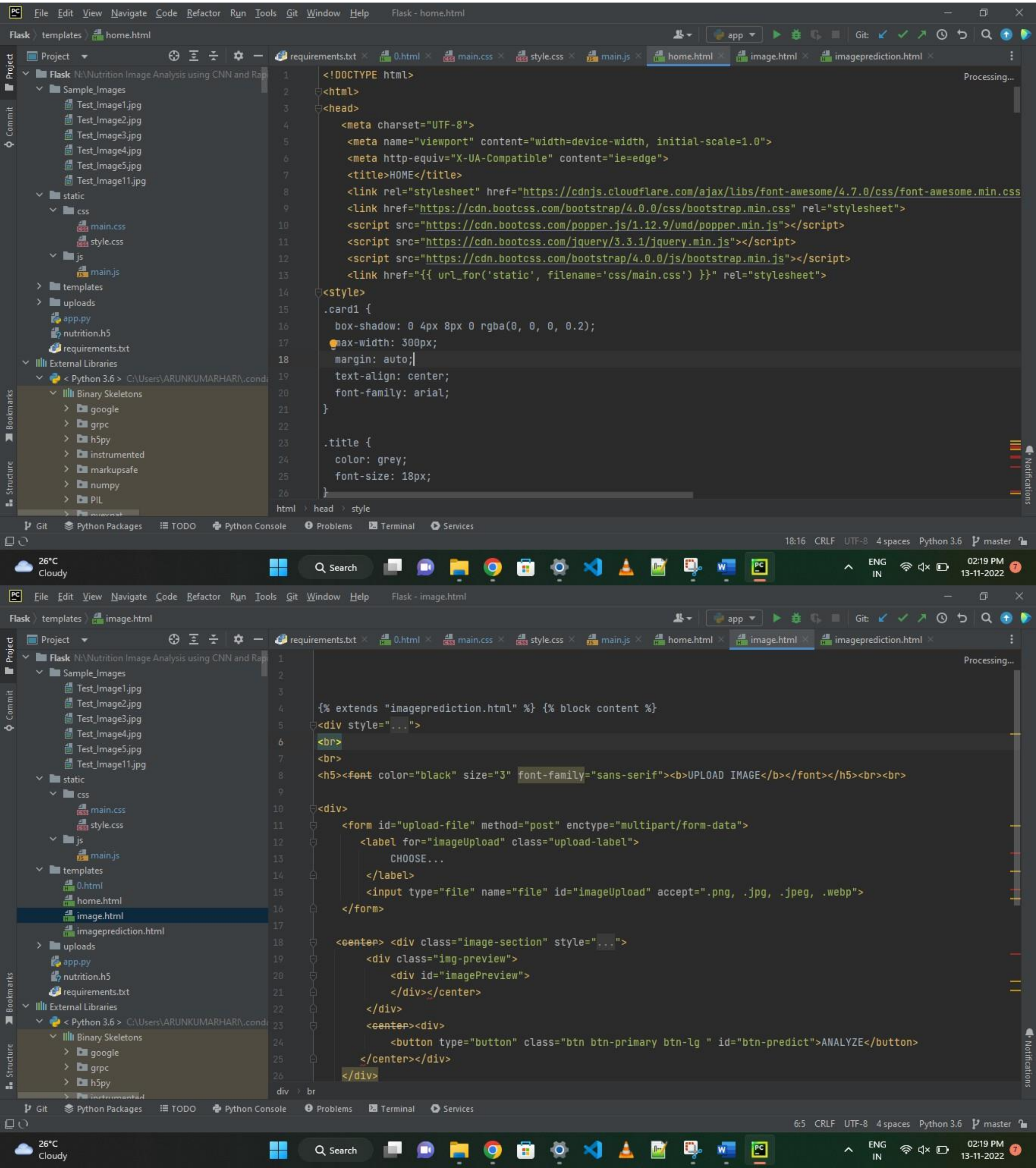
```
[ ] from tensorflow.keras.models import load_model
from keras.preprocessing import image
model = load_model("nutrition.h5")
```

```
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
```

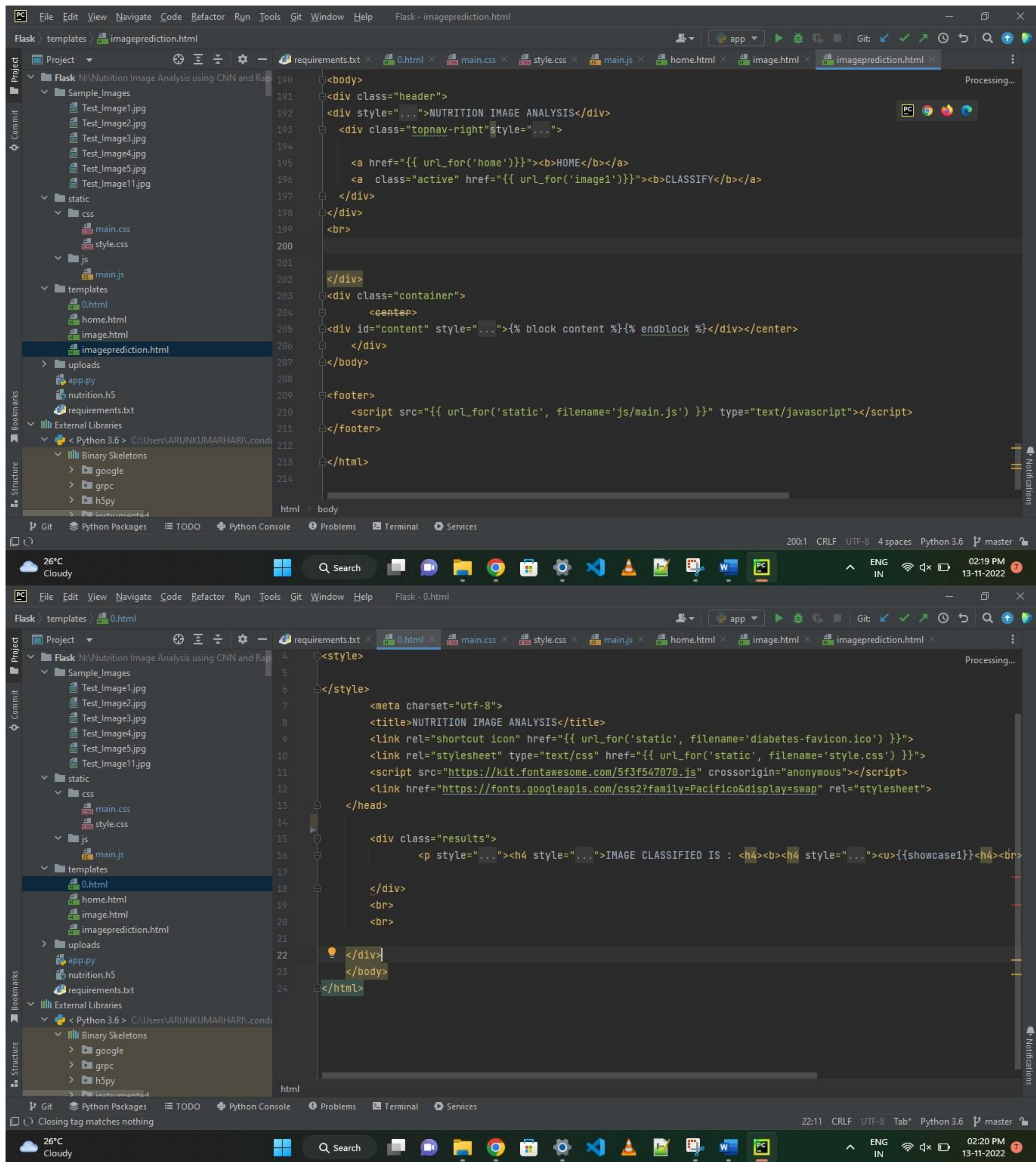
```
1/1 [=====] - 0s 62ms/step
array([0])
```

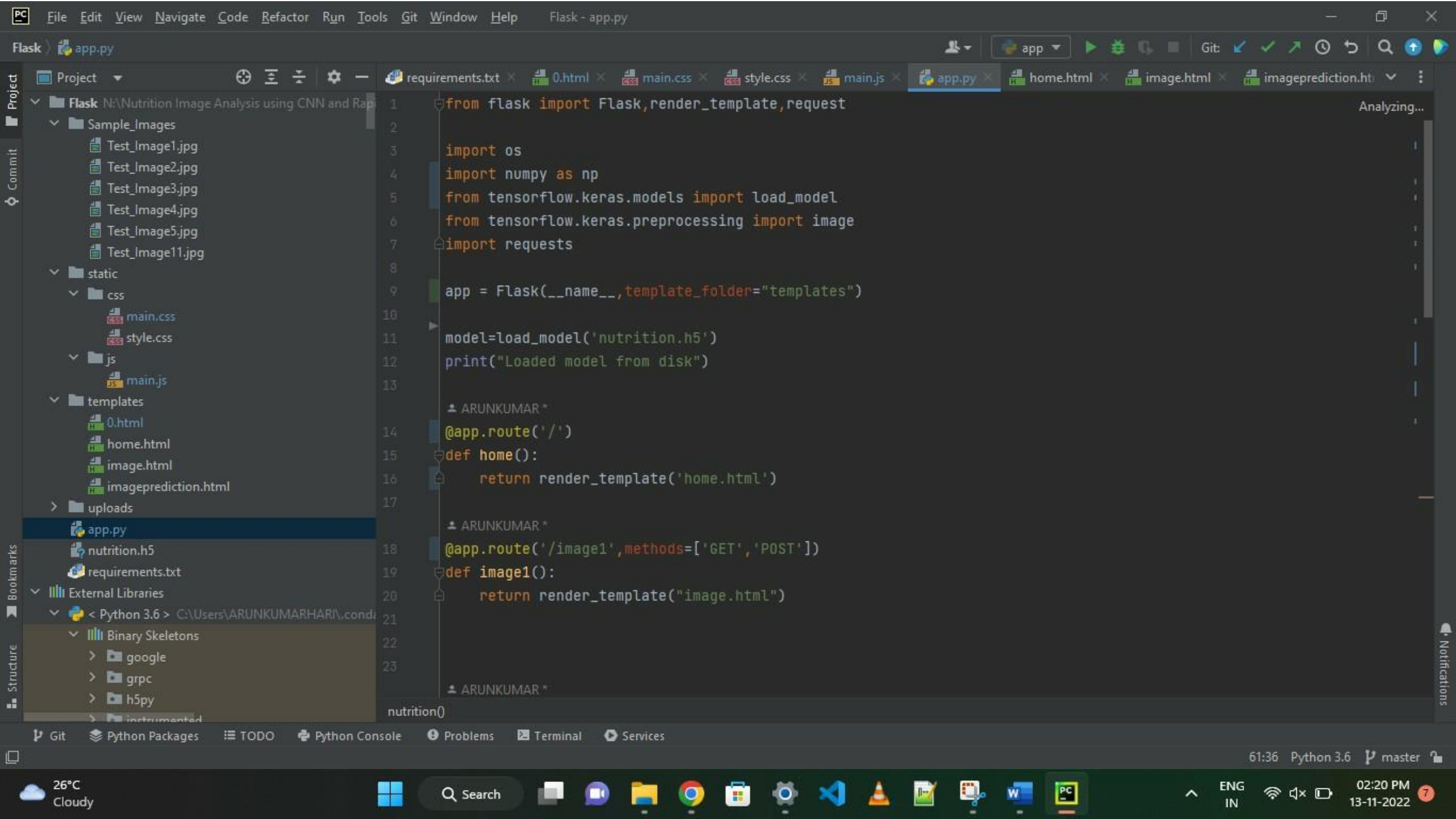
```
[ ] index=['APPLES', 'BANANA', 'ORANGE', 'PINEAPPLE', 'WATERMELON']
result=str(index[classes_x[0]])
result
```

## 6.2 Feature 2



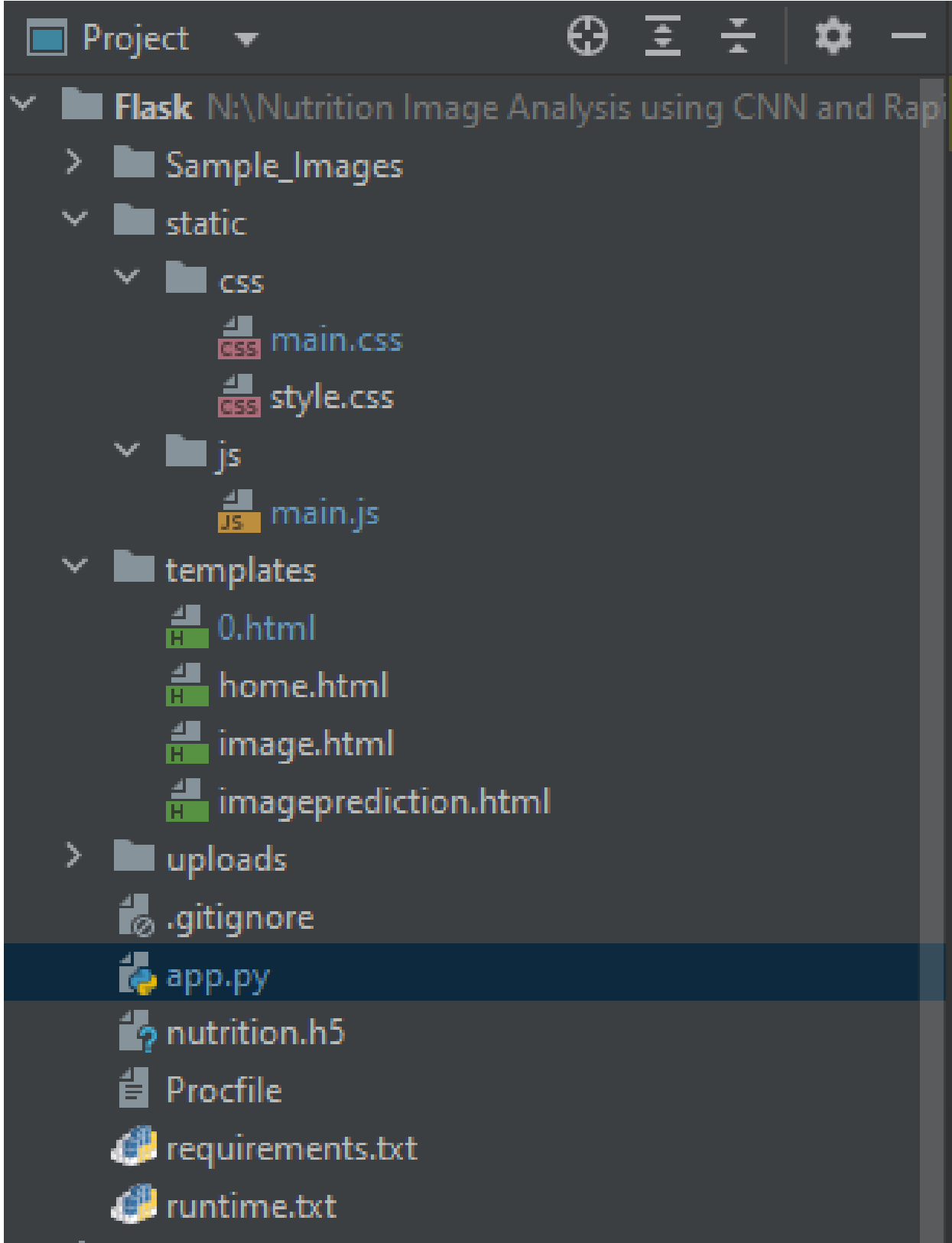






## 7. TESTING

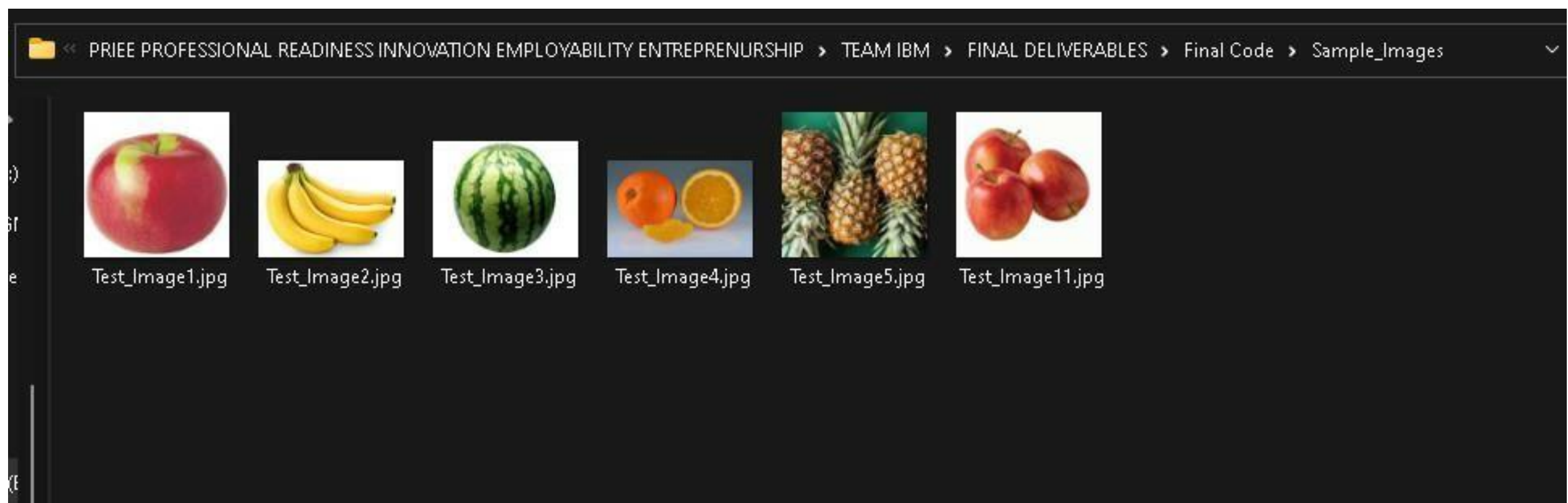
### 7.1 TestCases





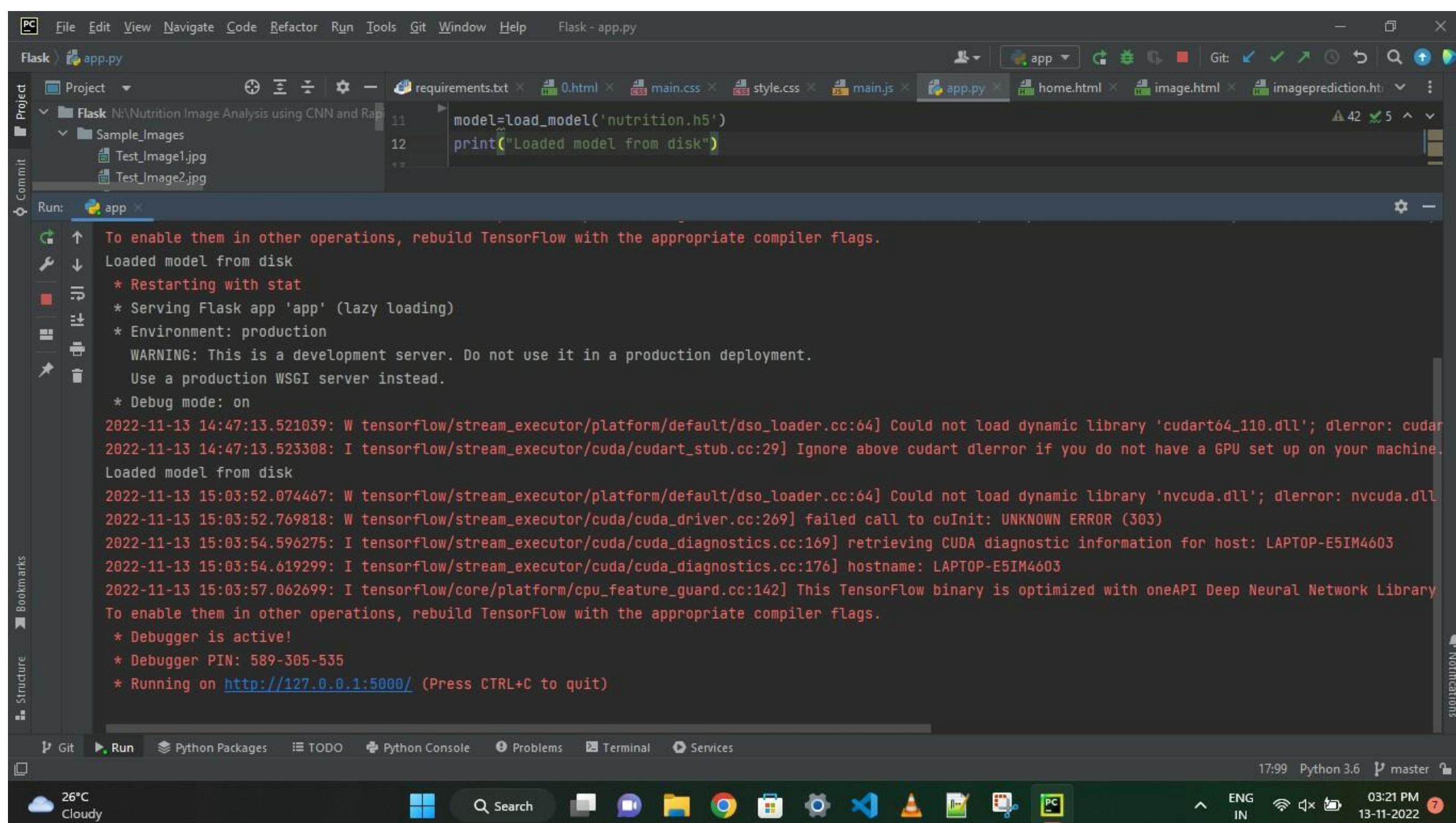


## 7.2 User Acceptance Testing



## 8. RESULTS

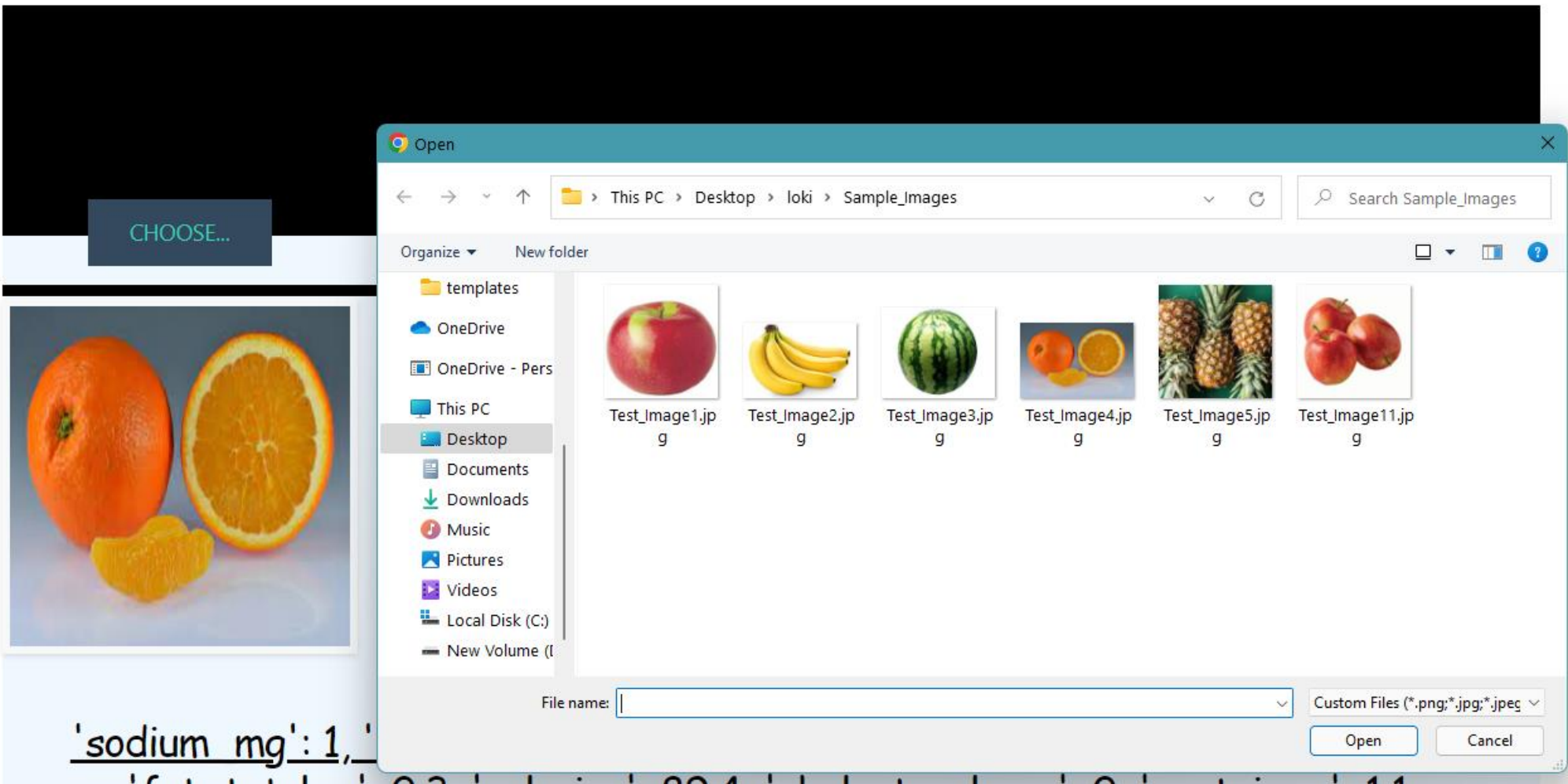
### 8.1 Performance Metrics





8.2 Output

NUTRITION  
IMAGE  
ANALYSIS




NUTRITION  
IMAGE  
ANALYSIS



NUTRITION  
IMAGE  
ANALYSIS

CHOOSE...



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}]]

[[{'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}]]

9.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.

10.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 .

