

# AI POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIAST

**TEAM ID : PNT2022TMID23771**

## Project Report

### 1. INTRODUCTION

#### a. 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.

#### b. 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 the trained model. The model analyses the image and detect the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.).

### 2. LITERATURE SURVEY

#### a. 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.

## b. Problem Statement Definition

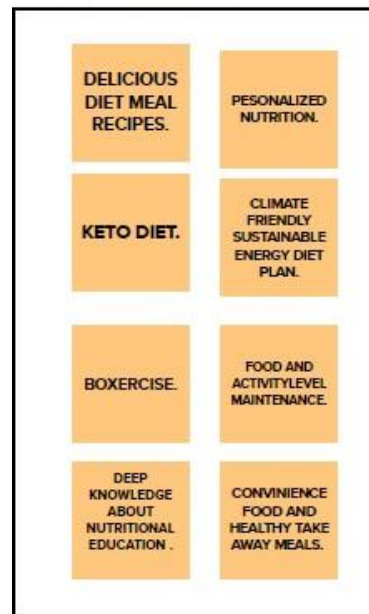
The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like colour, shape, texture etc. Here the user can capture the images of different fruits and then the image will be sent the trained model. The model analyses the image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

## 3. IDEATION & PROPOSED SOLUTION

### a. Empathy Map Canvas



## NUTRITIONAL



## WORKOUT



## PROGRAMS



### b.Proposed Solution

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

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

### c.Problem Solution fit

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> Who is your customer? i.e. working parents of 0-5 y.o. kids  People who want to make their body fit and maintain a balanced healthy life with the sustained nutrients.	<b>6. CUSTOMER CONSTRAINTS</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.  Constraints may contribute his choices towards the junk foods which are not good for health. It is mostly seen in the modern countries	<b>5. AVAILABLE SOLUTIONS</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 <ul style="list-style-type: none"><li>Eats lot of fruit and vegetables</li><li>Cut down on saturated fat and sugar</li><li>Get active and be a healthy weight</li><li>Reduce intake of harmful facts</li></ul>	Explore AS, differentiate
	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one, explore different sides.  The person who has completed his or her academics in the nutrition called as dietitian or nutrition educator will look the user problems.	<b>9. PROBLEM ROOT CAUSE</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. <ul style="list-style-type: none"><li>They suffer from hypertension cancer</li><li>Protein energy malnutrition</li><li>Maternal nutritional anemia</li></ul>	<b>7. BEHAVIOUR</b>  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)  Total of all planned, instantly and habitual actions or social groups to prepare or follow or proceed and consume food.	
Focus on J&P, tap into BE, understand	<b>3. TRIGGERS</b> What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news  The chemical substance like tablets which are harmful to body and those act as antiagents in our body and affect our immune system..	<b>10. YOUR SOLUTION</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 <ul style="list-style-type: none"><li>Here our model provide good nutritional idea to be fit</li><li>Have a safety health with relaxation mind</li><li>Don't be stressed with more oscillations</li></ul>	<b>8. CHANNELS of BEHAVIOUR</b> <b>8.1 ONLINE</b> What kind of actions do customers take online? Extract online channels from #7  Refer through advertisements and online advertisements and attending medical camp Of how to be healthy  <b>8.2 OFFLINE</b> What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.  Taking Proteins vitamins and minerals through some sea foods and others and doing daily exercise or activity.	Focus on BE, tap into TR, understand
	<b>4. EMOTIONS: BEFORE / AFTER</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: They feel so depressed and have dilemma in taking correct intake and they need doctor to take him.  After: Now they feel completely satisfied with their nutrition and have greater confidence.			
Identify strong TR & EM				Extract online or offline CH of BE

## 4. REQUIREMENT ANALYSIS

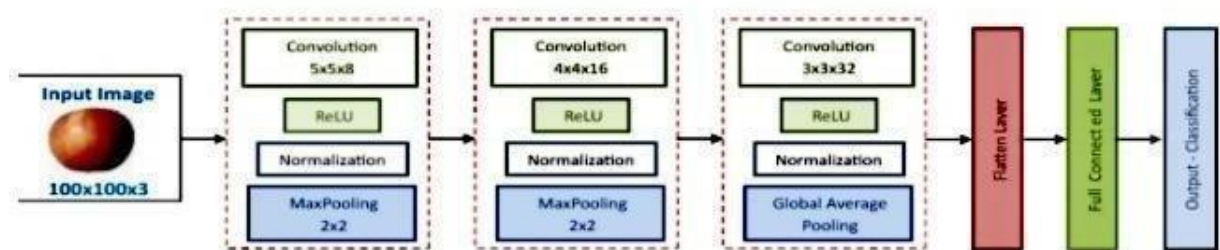
### a.Functional requirement

- 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
- Computer-Assisted Nutritional Recognize Food Images – In order to solve this issue, a brand-new Convolutional Neural Network (CNN)- based food picture identification system was

created, as described in this study. We utilized our suggested strategy on two sets of actual food 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 the fruits 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 has now 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 a quick text label, and the app estimates the calorie content.
- This software collaborated with IBM’s natural language capability to provide 24-hour assistance and dietary recommendations.

**For Example:**



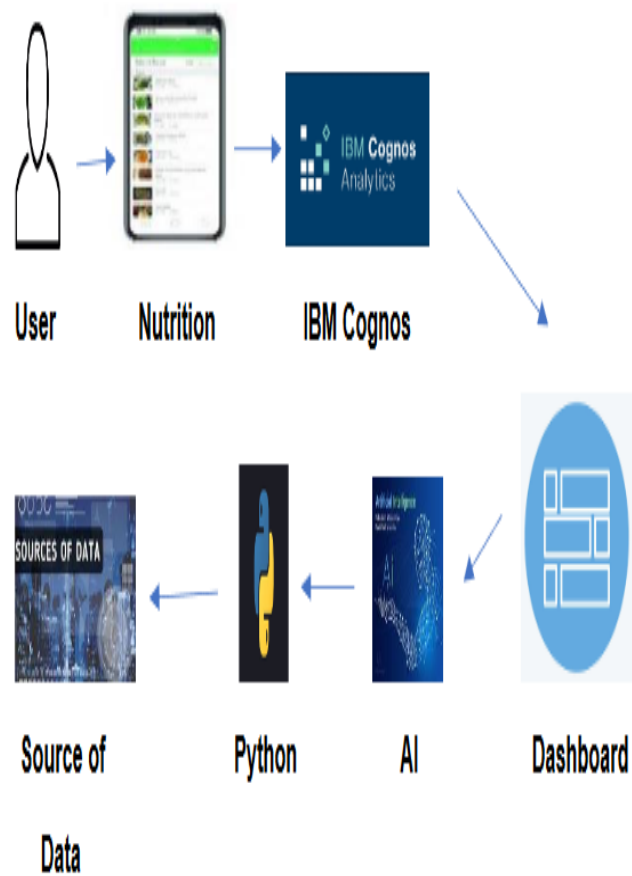
- The comparison of the proposed model with the conventional models shows that the results of this model are exceptionally good and promising to use in real-world applications.
- This sort of higher accuracy and precision will work to boost the machine’s general efficiency in fruit recognition more appropriately.
- 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.



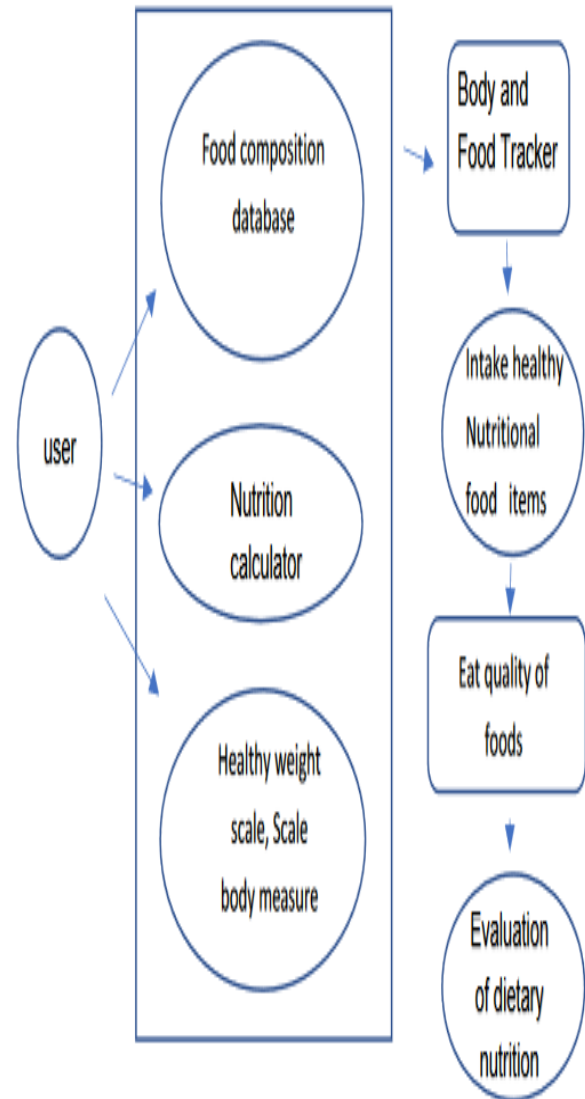
## 5. PROJECT DESIGN

### a.Data Flow Diagrams

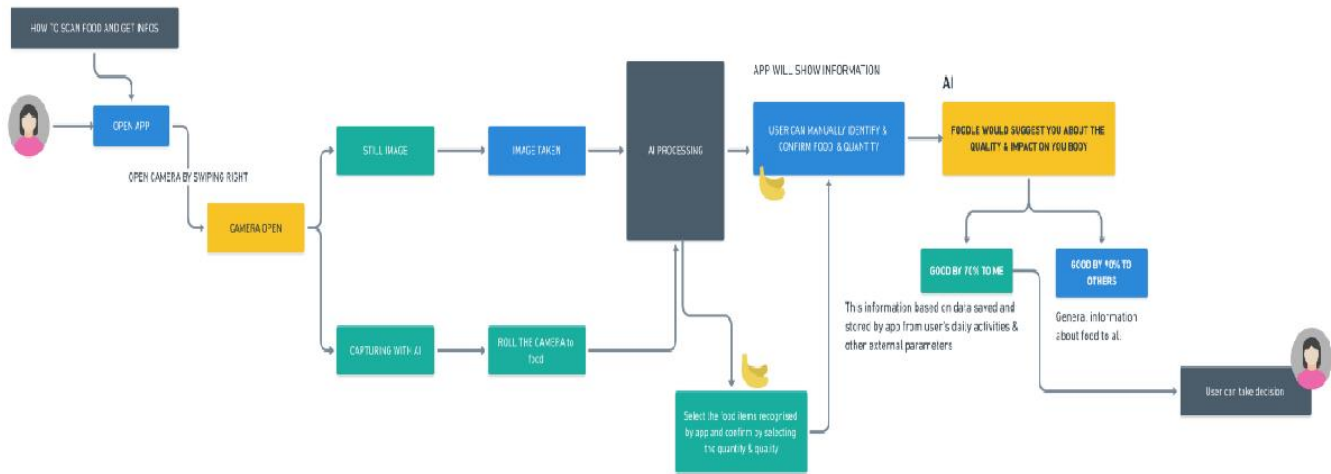
Example: (Simplified)



Example: DFD Level 0 (Industry Standard)



## 5.1 Solution & Technical Architecture

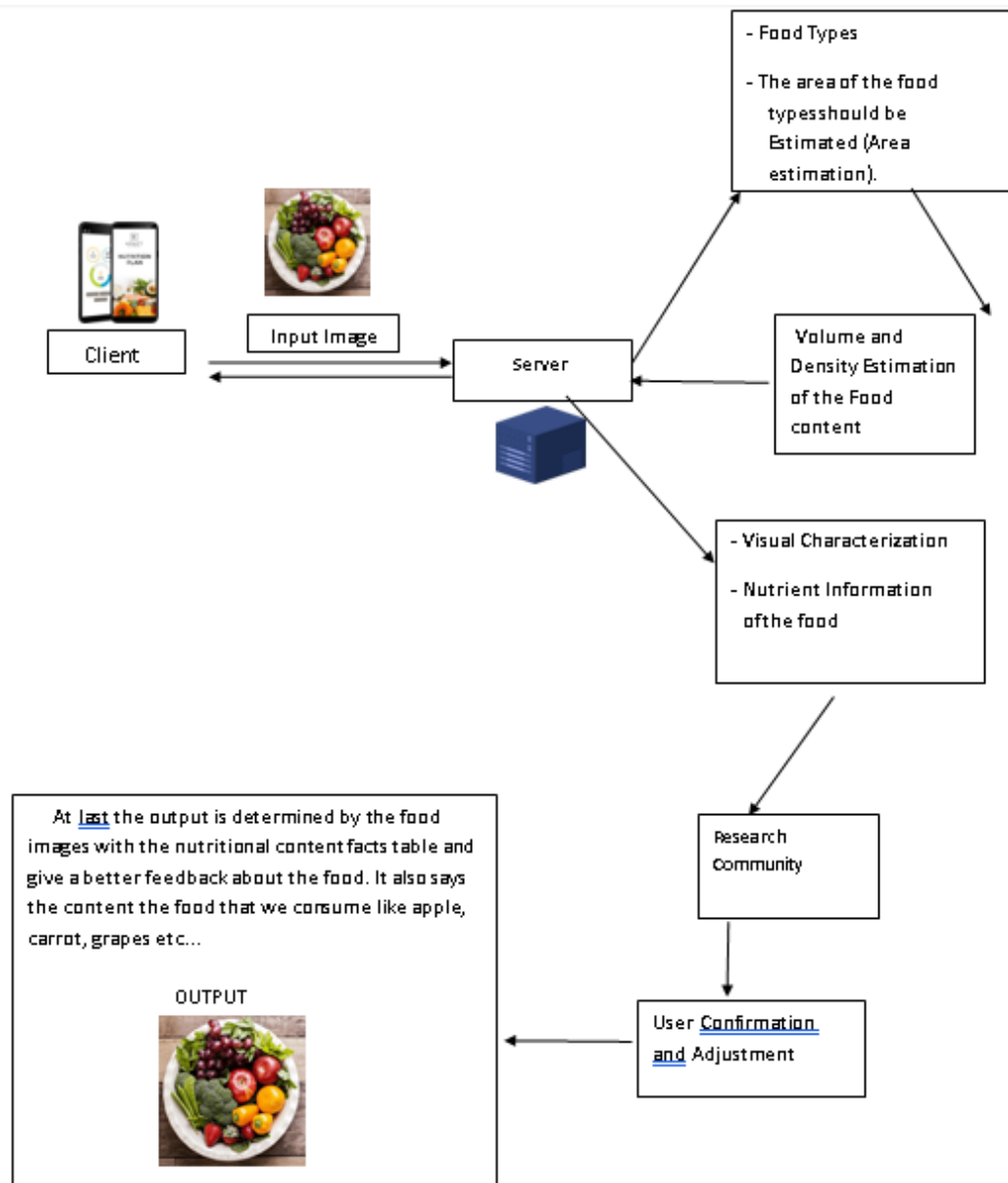


S.No	Component	Description	Technology
1.	App	User interacts with application for the prediction of Nutrition	Python, Java, HTML, SQLite, Android studio
2.	Database	Data Type, Configurations and data will be stored	MySQL, JS
3.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
4.	File 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



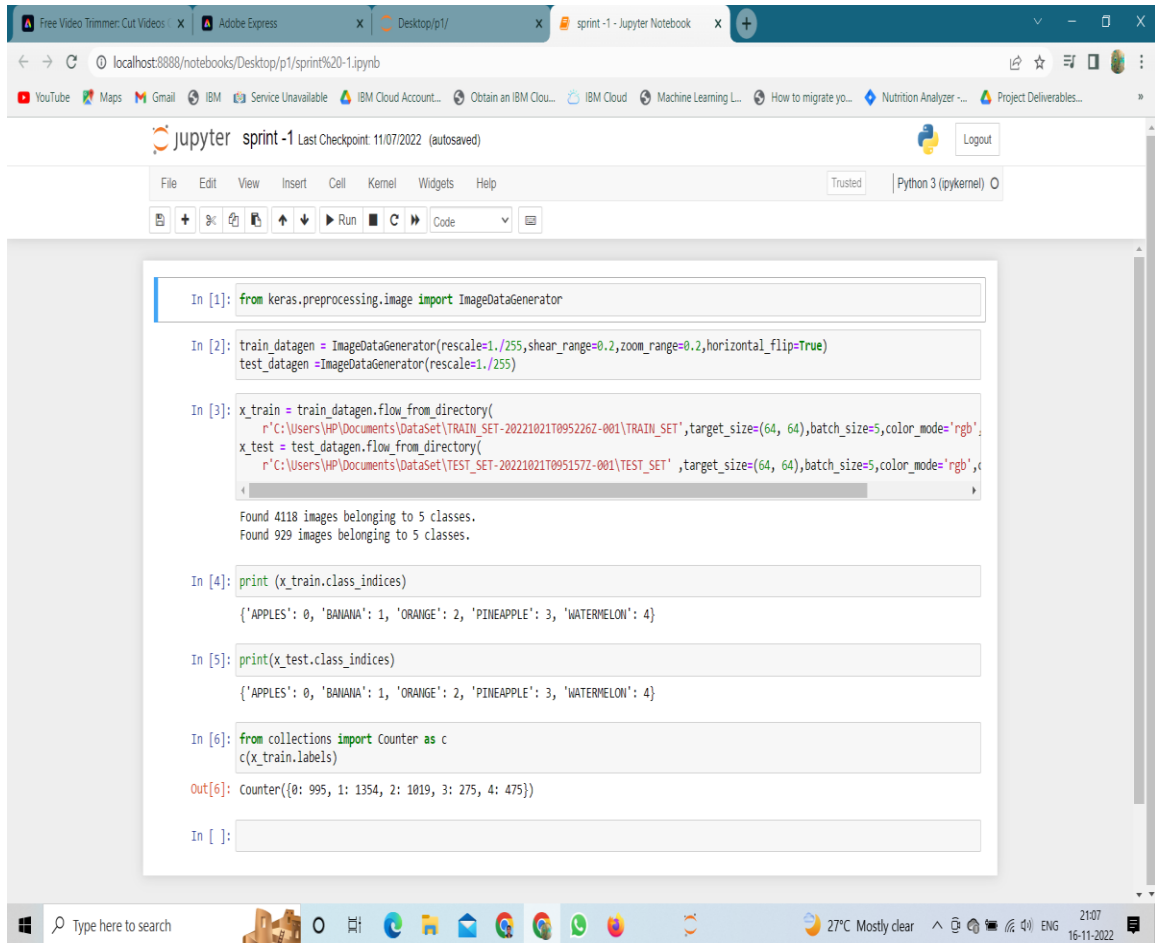
**Application Characteristics:**

<b>S.No</b>	<b>Characteristics</b>	<b>Description</b>	<b>Technology</b>
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 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



The screenshot shows a Jupyter Notebook titled 'sprint -1' with a last checkpoint on 11/07/2022. The notebook is running on Python 3 (ipykernel). The code in the cells is as follows:

```
In [1]: from keras.preprocessing.image import ImageDataGenerator

In [2]: train_datagen = ImageDataGenerator(rescale=1./255, shear_range=0.2, zoom_range=0.2, horizontal_flip=True)
        test_datagen = ImageDataGenerator(rescale=1./255)

In [3]: x_train = train_datagen.flow_from_directory(
        r"C:\Users\HP\Documents\DataSet\TRAIN_SET-20221021T095226Z-001\TRAIN_SET", target_size=(64, 64), batch_size=5, color_mode='rgb')
        x_test = test_datagen.flow_from_directory(
        r"C:\Users\HP\Documents\DataSet\TEST_SET-20221021T095157Z-001\TEST_SET", target_size=(64, 64), batch_size=5, color_mode='rgb')

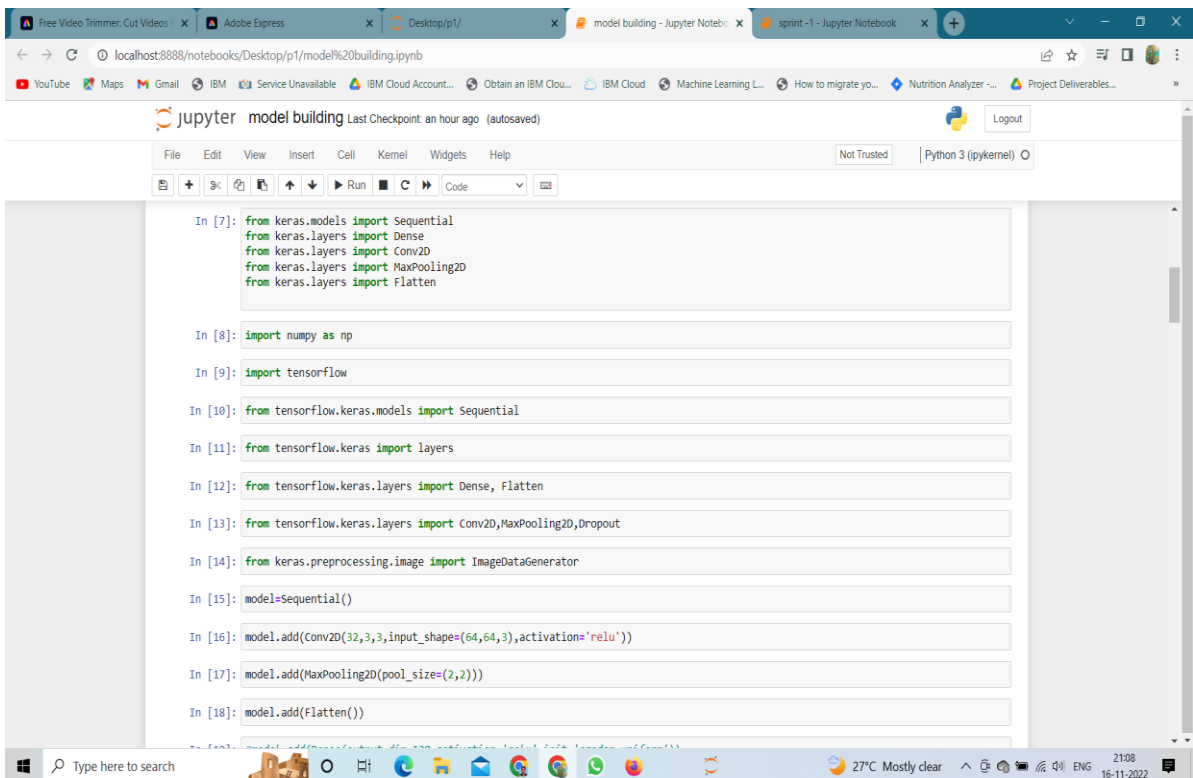
Found 418 images belonging to 5 classes.
Found 929 images belonging to 5 classes.

In [4]: print(x_train.class_indices)
{'APPLES': 0, 'BAJANIA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}

In [5]: print(x_test.class_indices)
{'APPLES': 0, 'BAJANIA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}

In [6]: from collections import Counter as c
        c(x_train.labels)
Out[6]: Counter({0: 995, 1: 1354, 2: 1019, 3: 275, 4: 475})

In [ ]:
```



The screenshot shows a Jupyter Notebook titled 'model building' with a last checkpoint an hour ago. The notebook is running on Python 3 (ipykernel). The code in the cells is as follows:

```
In [7]: from keras.models import Sequential
        from keras.layers import Dense
        from keras.layers import Conv2D
        from keras.layers import MaxPooling2D
        from keras.layers import Flatten

In [8]: import numpy as np

In [9]: import tensorflow

In [10]: from tensorflow.keras.models import Sequential

In [11]: from tensorflow.keras import layers

In [12]: from tensorflow.keras.layers import Dense, Flatten

In [13]: from tensorflow.keras.layers import Conv2D, MaxPooling2D, Dropout

In [14]: from keras.preprocessing.image import ImageDataGenerator

In [15]: model=Sequential()

In [16]: model.add(Conv2D(32,3,3,input_shape=(64,64,3),activation='relu'))

In [17]: model.add(MaxPooling2D(pool_size=(2,2)))

In [18]: model.add(Flatten())
```

```
Free Video Trimmer: Cut Videos | Adobe Express | Desktop/p1/ | model building - Jupyter Notebo... | sprint-1 - Jupyter Notebook | +
localhost:8888/notebooks/Desktop/p1/model%20building.ipynb
Jupyter model building Last Checkpoint: an hour ago (autosaved)
File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel)
In [22]: classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))

In [23]: classifier.add(Conv2D(32, (3, 3), activation='relu'))

In [24]: classifier.add(MaxPooling2D(pool_size=(2, 2)))

In [25]: classifier.add(Flatten())

In [26]: classifier.add(Dense(units=128, activation='relu'))
classifier.add(Dense(units=5, activation='softmax'))

In [27]: classifier.summary()

Model: "sequential_1"
Layer (type) Output Shape Param #
-----
conv2d_1 (Conv2D) (None, 62, 62, 32) 896
max_pooling2d_1 (MaxPooling (None, 31, 31, 32) 0
2D)
conv2d_2 (Conv2D) (None, 29, 29, 32) 9248
```

```
Free Video Trimmer: Cut Videos | Adobe Express | Desktop/p1/ | model building - Jupyter Notebo... | sprint-1 - Jupyter Notebook | +
localhost:8888/notebooks/Desktop/p1/model%20building.ipynb
Jupyter model building Last Checkpoint: an hour ago (autosaved)
File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel)
Total params: 813,733
Trainable params: 813,733
Non-trainable params: 0

In [28]: classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])

In [29]: classifier.fit_generator(
generator=x_train, steps_per_epoch = len(x_train),
epochs=5, validation_data=x_test, validation_steps = len(x_test))

C:\Users\HP\AppData\Local\Temp\ipykernel_10680\976157484.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators.
  classifier.fit_generator(

Epoch 1/5
824/824 [=====] - 33s 40ms/step - loss: 0.6221 - accuracy: 0.7610 - val_loss: 0.5292 - val_accuracy: 0.7933
Epoch 2/5
824/824 [=====] - 28s 34ms/step - loss: 0.4205 - accuracy: 0.8424 - val_loss: 0.5139 - val_accuracy: 0.8009
Epoch 3/5
824/824 [=====] - 33s 41ms/step - loss: 0.3860 - accuracy: 0.8572 - val_loss: 0.4326 - val_accuracy: 0.8375
Epoch 4/5
824/824 [=====] - 36s 44ms/step - loss: 0.3678 - accuracy: 0.8606 - val_loss: 0.4088 - val_accuracy: 0.8568
Epoch 5/5
824/824 [=====] - 32s 39ms/step - loss: 0.3379 - accuracy: 0.8686 - val_loss: 0.4244 - val_accuracy: 0.8299

Out[29]: <keras.callbacks.History at 0x19e830c76a0>

In [30]: classifier.save('nutrition.h5')
```

Free Video Trimmer: Cut Videos x Adobe Express x Desktop/p1/ x model building - Jupyter Notebo x sprint -1 - Jupyter Notebook x

localhost:8888/notebooks/Desktop/p1/model%20building.ipynb


jupyter model building Last Checkpoint: an hour ago (autosaved)

File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel)

```
In [31]: from tensorflow.keras.models import load_model

In [32]: from keras.preprocessing import image
         from tensorflow.keras.preprocessing import image
         model = load_model("nutrition.h5")
WARNING:tensorflow:No training configuration found in the save file, so the model was "not" compiled. Compile it manually.

In [33]: img = image.load_img(r"E:\Flask\Sample_Images-20221104T061454Z-001\Sample_Images\Test_Image1.jpg", grayscale=False, target_size=(
         img

Out[33]: 

```
In [34]: x=image.img_to_array(img)

In [35]: x

Out[35]: array([[[[255., 255., 255.],
                  [255., 255., 255.],
                  [255., 255., 255.],
                  ...,
                  [255., 255., 255.],
                  [255., 255., 255.],
                  [255., 255., 255.],
                  ...,
                  [255., 255., 255.],
                  [255., 255., 255.],
                  [255., 255., 255.]]]])
```



Type here to search 27°C Mostly clear 21:08 16-11-2022


```

Free Video Trimmer: Cut Videos x Adobe Express x Desktop/p1/ x model building - Jupyter Notebo x sprint -1 - Jupyter Notebook x

localhost:8888/notebooks/Desktop/p1/model%20building.ipynb

jupyter model building Last Checkpoint: an hour ago (autosaved)

File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel)

```
In [36]: x.ndim

Out[36]: 3

In [37]: x=np.expand_dims(x,axis=0) #expand the dimension

In [38]: pred = classifier.predict(x)

1/1 [=====] - 0s 124ms/step

In [39]: pred

Out[39]: array([[1., 0., 0., 0., 0.]], dtype=float32)

In [40]: labels=['APPLES', 'BANANA', 'ORANGE', 'PINEAPPLE', 'WATERMELON']
         labels[np.argmax(pred)]

Out[40]: 'APPLES'

In [ ]:

In [41]: labels=['APPLES', 'BANANA', 'ORANGE', 'PINEAPPLE', 'WATERMELON']
         labels[np.argmax(pred)]

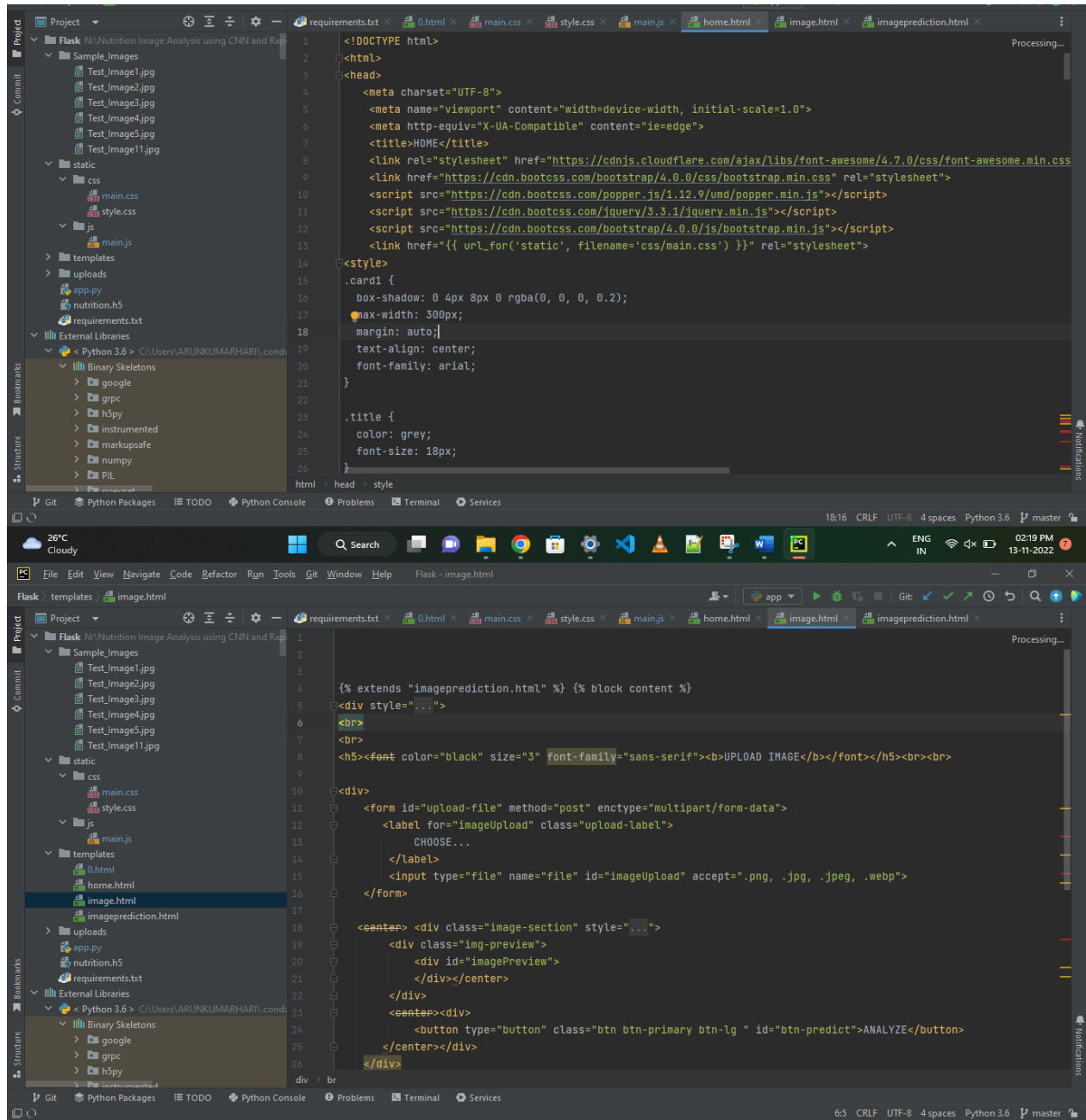
Out[41]: 'APPLES'

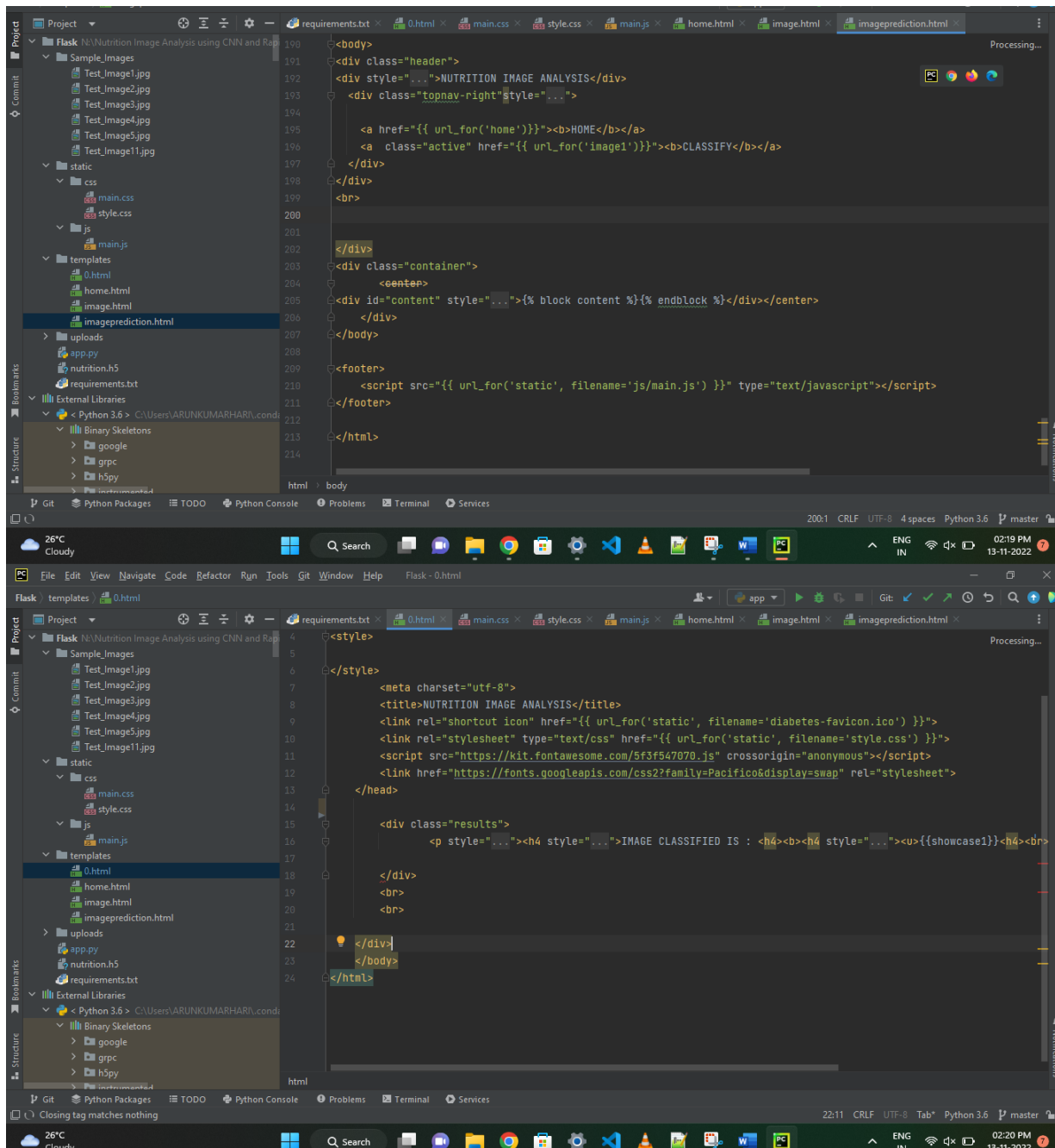
In [ ]:

In [69]:
```

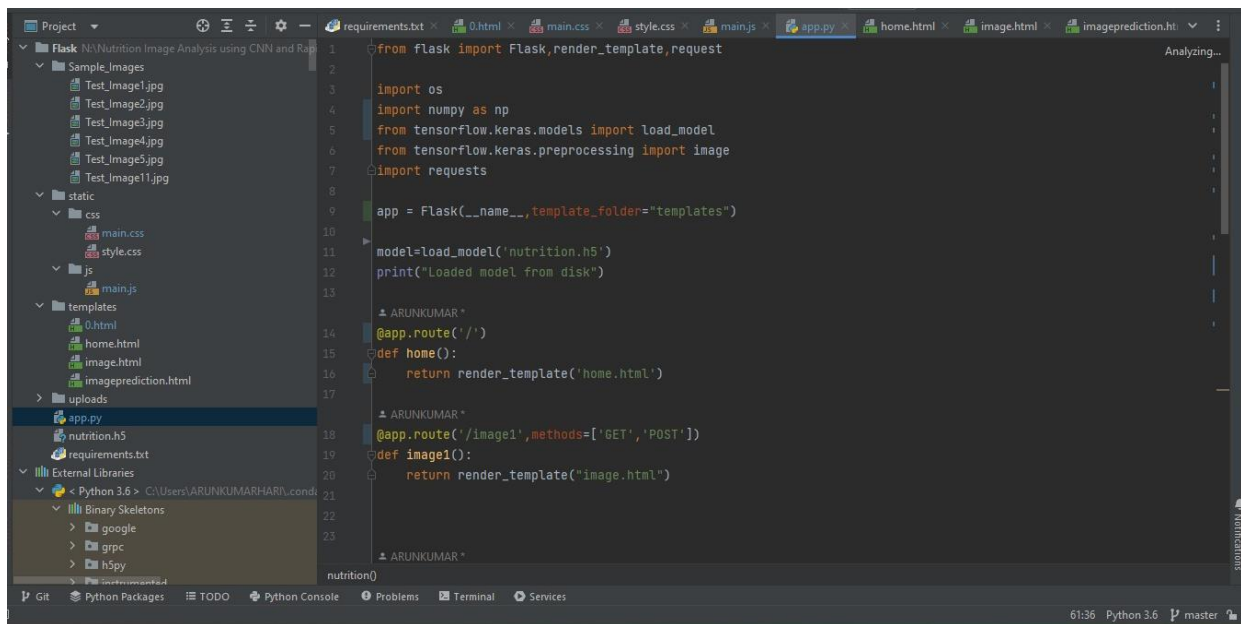
Type here to search 27°C Mostly clear 21:09 16-11-2022

## 6.1 Feature 2



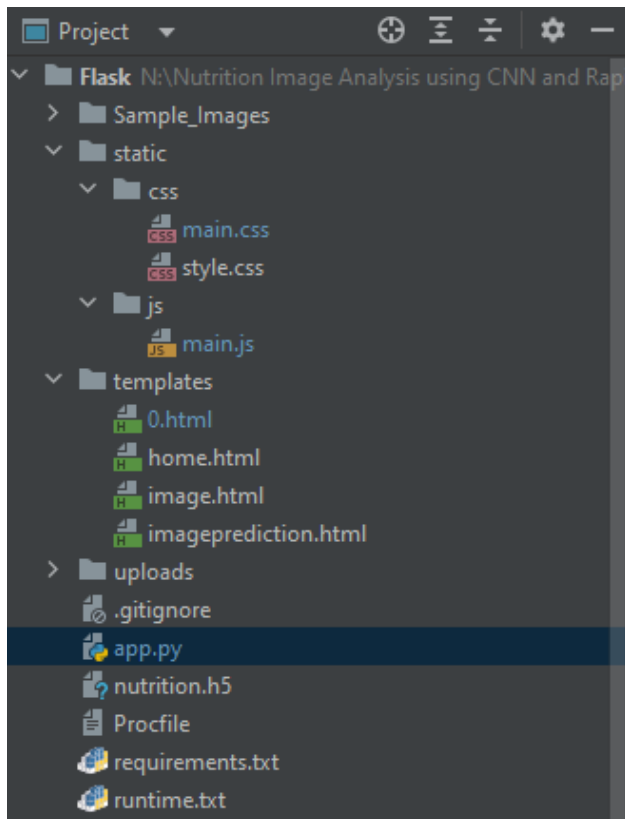






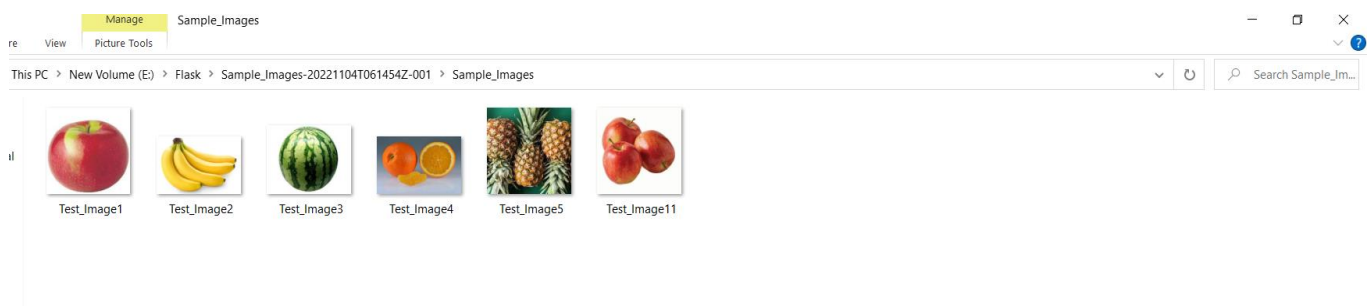
## 7. TESTING

### 7.1 Test Cases



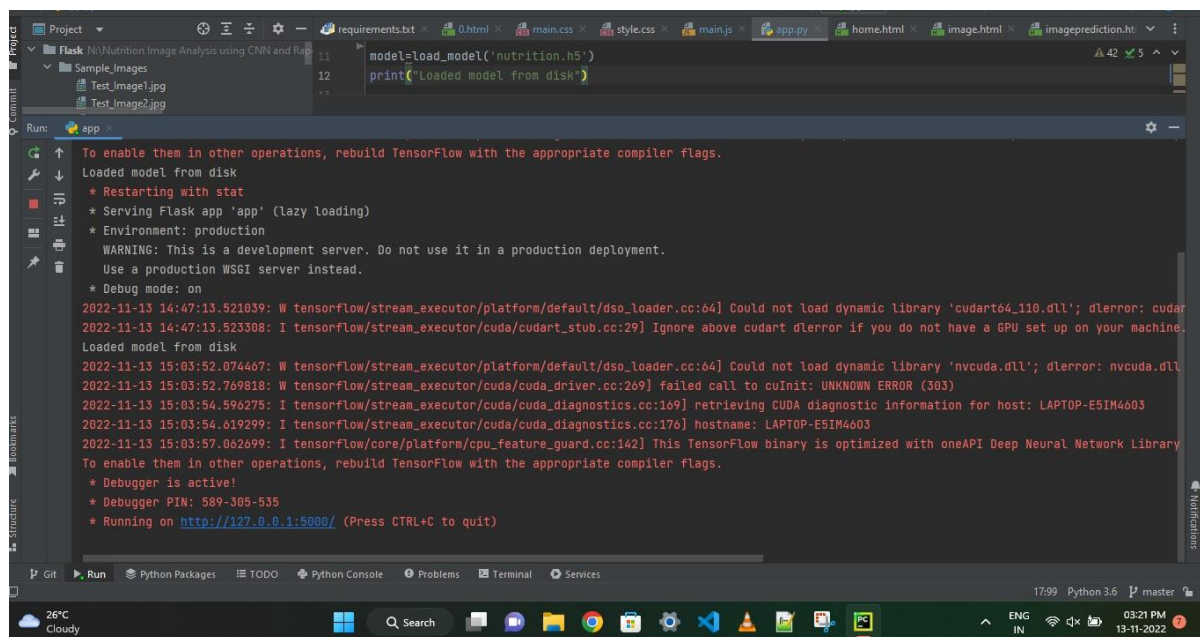


## 7.2 User Acceptance Testing

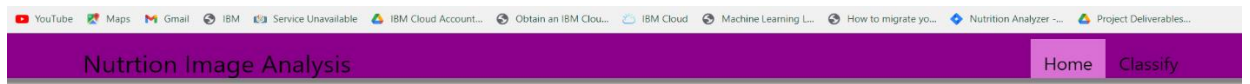


## 8. RESULTS

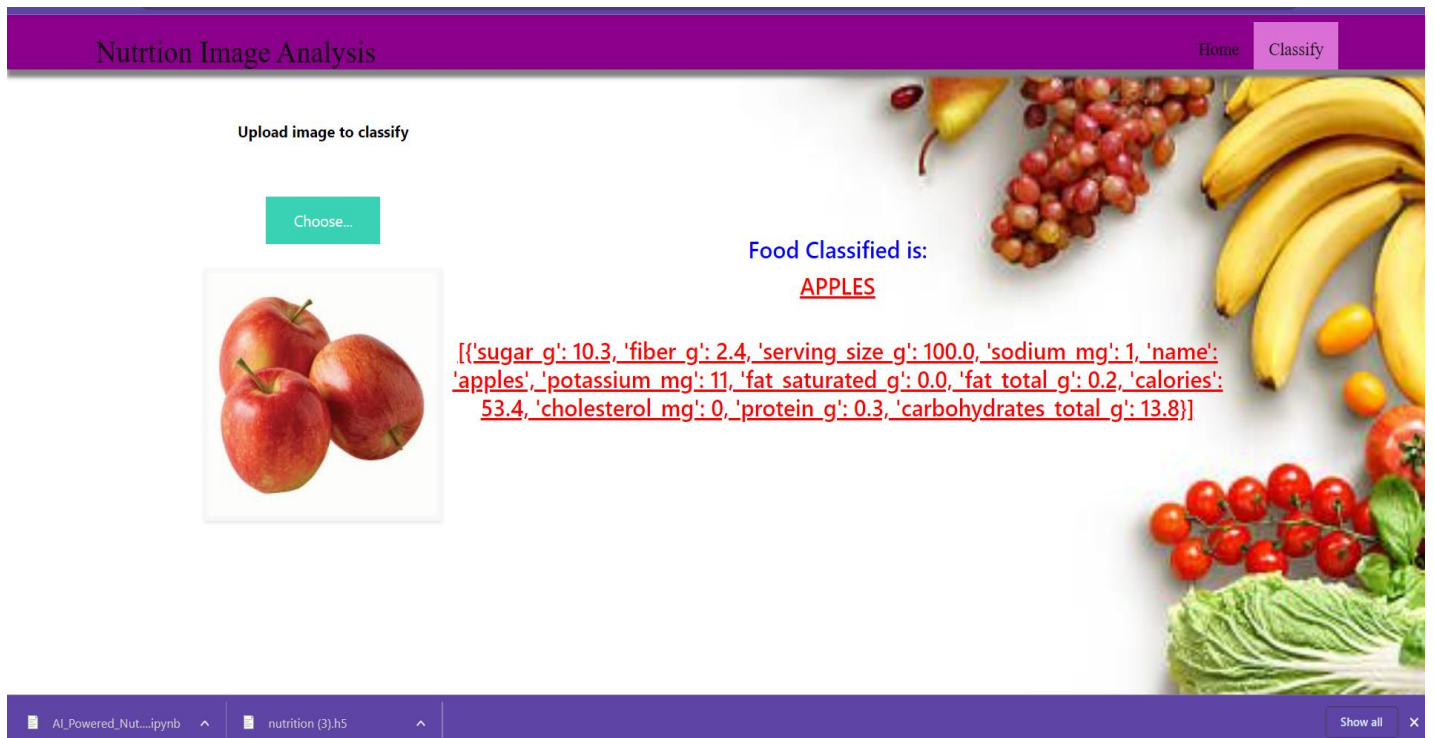
### 8.1 Performance Metrics



## 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.*



## 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 .

---

---

---