AI-POWERED FRUIT NUTRITION ANALYZER

A MINI PROJECT REPORT

Submitted by

AKSHAYA R	**(AC19UCS004)**
ASIF M S	**(AC19UCS010)**
HARIKARASUDHAN K	**(AC19UCS032)**
HARINI T D	**(AC19UCS033)**
IMTHIYAS F	**(AC19UCS037)**

in partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

ADHIYAMAAN COLLEGE OF ENGINEERING

DR. M.G.R NAGAR, HOSUR-635109

ANNA UNIVERSITY: CHENNAI 600 025

NOVEMBER 2022

AI-POWERED FRUIT NUTRITION ANALYZER

A MINI PROJECT REPORT

Submitted by

AKSHAYA R	**(AC19UCS004)**
ASIF M S	**(AC19UCS010)**
HARIKARASUDHAN K	**(AC19UCS032)**
HARINI T D	**(AC19UCS033)**
IMTHIYAS F	**(AC19UCS037)**

in partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

ADHIYAMAAN COLLEGE OF ENGINEERING

DR. M.G.R NAGAR, HOSUR-635109

ANNA UNIVERSITY: CHENNAI 600 025

NOVEMBER 2022

ANNA UNIVERSITY: CHENNAI 600 025

BONAFIDE CERTIFICATE

Certified that this mini project report **"AI-POWERED FRUIT NUTRITION ANALYSER"** is the bonafide work of **"AKSHAYA R(AC19UCS004), ASIF M S (AC19UCS010), HARIKARASUDHAN K(AC19UCS032), HARINI T D (AC19UCS033), IMTHIYAS F(AC19UCS037)"** who carried out the project under my supervision.

SIGNATURE
Dr.G. FATHIMA, M.E., Ph.D.,

HEAD OF THE DEPARTMENT
PROFESSOR,
Department of CSE,
Adhiyamaan College of Engineering,
(Autonomous)
Dr. M.G.R. Nagar,
Hosur – 635 109.

SIGNATURE
Mrs.D.M. VIJAYA LAKSHMI M.E.,

SUPERVISOR
PROFESSOR,
Department of CSE,
Adhiyamaan College of Engineering,
(Autonomous)
Dr. M.G.R. Nagar,
Hosur – 635 109.

Submitted for the Mini project VIVA-VOCE Examination held on_____ at **Adhiyamaan College of Engineering (Autonomous), Hosur-635 109.**

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ACKNOWLEDGEMENT

It is one of the most efficient tasks in life to choose the appropriate words to express one's gratitude to the beneficiaries. We are very much grateful to God who helped us all the way through the project and how moulded us into what we are today.

We are grateful to our beloved Principal **Dr. G. RANGANATH, M.E., Ph.D.,** Adhiyamaan College of Engineering (Autonomous), Hosur for providing the opportunity to do this work in premises.

We acknowledge our heartfelt gratitude to **Dr. G. FATHIMA, M.E., Ph.D.,** Professor and Head of the Department, Department of Computer Science and Engineering, Adhiyamaan College of Engineering (Autonomous), Hosur, for her guidance and valuable suggestions and encouragement throughout this project.

We are highly indebted to **Mrs. VIJAYA LAKSHMI D M, M.E.,**Professor, Department of Computer Science and Engineering, Adhiyamaan College of Engineering (Autonomous), Hosur, whose immense support, encouragement and valuable guidance made us complete this project successfully.

We also extend our thanks to the Project Coordinator and all Staff Members for their support in completing this project successfully.

Finally, we would like to thank our parents, without their motivation and support it would not have been possible for us to complete this project successfully

AI-POWERED FRUIT NUTRITION ANALYZER

CONTENTS

ABSTRACT

Fruit is essential for healthy 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 maintaining a healthy diet. Nutritional analysis is the process of determining the nutritional content of fruit. It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of fruit.

The main aim of the project is to build a model which is used for classifying the fruit depending 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.).

Keywords: Convolution neural network, deep learning, fruit classification, fruit detection, fruit nutrition level.

CHAPTER 1
INTRODUCTION

1.1. INTRODUCTION

The main cause of obesity is a combination of overeating and lack of exercise. Therefore, the need for accurate nutrition balance is important. Preliminary research among young people suggests that new technologies may improve the accuracy of teen nutrition information. And as people become accustomed to a sedentary lifestyle, they become obsessed with their diet. There is overwhelming evidence that metabolic disorders, caused by obesity, increase the risk of developing serious health problems such as diabetes, high blood pressure, dyslipidemia and high blood pressure. People generally understand the link between food and health. In fact, there is a wide range of healthy eating information and guidelines available to users on their hands. However, such information alone did not prevent food-borne illness or help patients to eat healthy fruits.

The fruitarian, or fruit, diet is a highly restrictive vegan diet. It excludes all animal products, including dairy. People following this program eat a diet consisting primarily of raw fruits. When eaten in moderation, fruit can be a very healthy part of a nutritious diet. Fruits contain fibre, which can help lower your cholesterol and encourage regular bowel movements. Apples, pears, blackberries, and raspberries are examples of fruits high in dietary fibre. Oranges, red peppers, and strawberries are examples of fruits that contain lots of vitamin C. This helps keep teeth and gums healthy. Vitamin C also supports the immune system. Bananas, guavas, cantaloupe, and mangoes are examples of fruits higher in potassium. Potassium can help maintain a healthy blood pressure and regulate fluid balance in the body. Oranges and tropical fruits such as

mangoes are high in folate. This can help the body produce red blood cells. Folate also supports healthy fetal development. Black plums, prunes, and all berries are examples of fruits rich in antioxidants. Antioxidants limit the production of free radicals. They can protect your skin and fight off illness.

In many cases, people find it difficult to check all the information about fruit and fruit choices. Fruitarian typically eat freely from multiple fruit groups. You may wish to stick to a three-meal-a-day plan, or build in four to five smaller meals throughout the day. The fruit groups to choose from include, acidic fruits, sub-acidic fruits, oily fruits, sweet fruits, starchy fruits, melons of all kinds, vegetable-fruits.

In addition, people do not pay attention to balancing or controlling their daily calorie intake due to lack of knowledge of healthy eating, abnormal eating patterns or lack of self-control. Empowering patients with a long-term effective solution requires new methods that help them make lasting changes in their diet and calorie intake. Statistics show that 95% of people no longer follow any diet plan as this prevents people from eating their daily diet. Therefore, the main cause of obesity is an imbalance in the amount of food and energy consumed by the individual, and a healthy diet is necessary. Thus, maintaining a healthy diet is an important goal for most people.

One of the healthy diets includes a fruitarian diet where fruits are the main part of consumption. Fruits are packed with fibre and powerful antioxidants that can help lower inflammation in the body and reduce the risk of cancer, digestive diseases and heart disease. The fibre in fruits can provide nourishment for good bacteria in the gut and potentially help boost the immune system, as much of our immune system is located in our gut.

The process of tracking the fruit nutrition level that is being consumed can be very tedious as it requires the user to keep a fruit intake pattern and

perform calculations to estimate the nutrition level consumed in all fruits. With this study we try to classify images of fruit according to their categories. The proposed software model uses deep learning as a basis for recognizing a fruit image uploaded as a user input, processing the image, viewing it, and measuring nutrition level from the predicted image. People are recording, uploading, and sharing food photos voluntarily more than ever on websites like Instagram, Facebook etc. Therefore, it is very easy to find additional data (photos) related to fruit. Therefore, to support users in fruit consumption management and to reduce the need for a manual paper method.

CHAPTER 2

LITERATURE REVIEW

2.1 REVIEWS ON VARIOUS FOOD ESTIMATIONS

1. **Author: Raikwar H., Jain H. and Baghel A.**

Title: Calorie Estimation from Fast Food Images Using Support Vector Machine

Year: 2019

Proposed a model which focused on estimation of the number of calories in the food item by just taking its image as input using SVM. The proposed model applies some techniques of image processing followed by feature extraction. The authors designed the dataset, and applied some image processing techniques, then the processed dataset is made to extract features through the feature extraction process. The features extracted from all the images are then applied to the classifier support vector machine (SVM) which classifies the images in different classes as specified in the learning algorithm.

2. **Author:J R Rajayogi ,G Manjunath, G Shobha**

Title: Indian Food Image Classification with Transfer Learning

Year: 2019

In this paper image classification is performed on Indian food dataset using different transfer learning techniques. Unlike the traditional methods of building

a model from the scratch, pre trained models are used in this project which saves the computation time and cost and also has given better results. The Indian food dataset of 20 classes with 500 images in each class is used for training and validating. The models used are InceptionV3, VGG16, VGG19 and ResNet.

3. **Author: Pathanjali, C., Salis, V.E., Jalaja, G. and Latha, A.**

Title: A Comparative Study of Indian Food Image Classification Using K-Nearest-Neighbor and Support Vector Machines

Year: 2020

Proposed an automatic food detection system that detects and recognizes varieties of Indian food. The proposed food recognition system is developed in such a way that it can classify the Indian food items based on two different classification models i.e., SVM and KNN. The proposed system uses a combined color and shape features. A comparative study on the performance of both the classification models is performed. Parameters such as food density tables, color, and shape acknowledgment as a part of image processing, and classification with the SVM and KNN have been considered. The data set contains the feature vector extracted from the sample images.

CHAPTER 3

SYSTEM ANALYSIS

3.1. EXISTING SYSTEM

The existing framework uses the Deep Convolution Neural Network (DCNN) based on the development of ResNet 50. Due to the limited calculation training tools for each model, the ResNet model is simulated and pre-trained weights are imported. This section introduces a proposed food monitoring system based on ResNet50 which is one of the winning networks in the ImageNet machine learning competition. The reason why the ResNet50 Architecture is chosen over other buildings is because of the small parameter size. This makes model loading and weights and model training much faster. Solution includes pre-processing, training and classification. The training includes the extraction and weight learning features performed by CNN's SoftMax layer. Separation is also done on CNN. In the present system only find foods that you cannot measure the level of nutritious food.

CHAPTER 4

IDEATION PHASE

4.1 EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

Fig.1 Empathy map canvas

4.2 IDEATION AND BRAINSTORMING

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich number of creative solutions. Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Step-1: Team Gathering, Collaboration and Select the Problem Statement

In this step team members gather and provide their ideas and collaborate those ideas and select their problem statement. The ideas should be relevant to their problem statement.

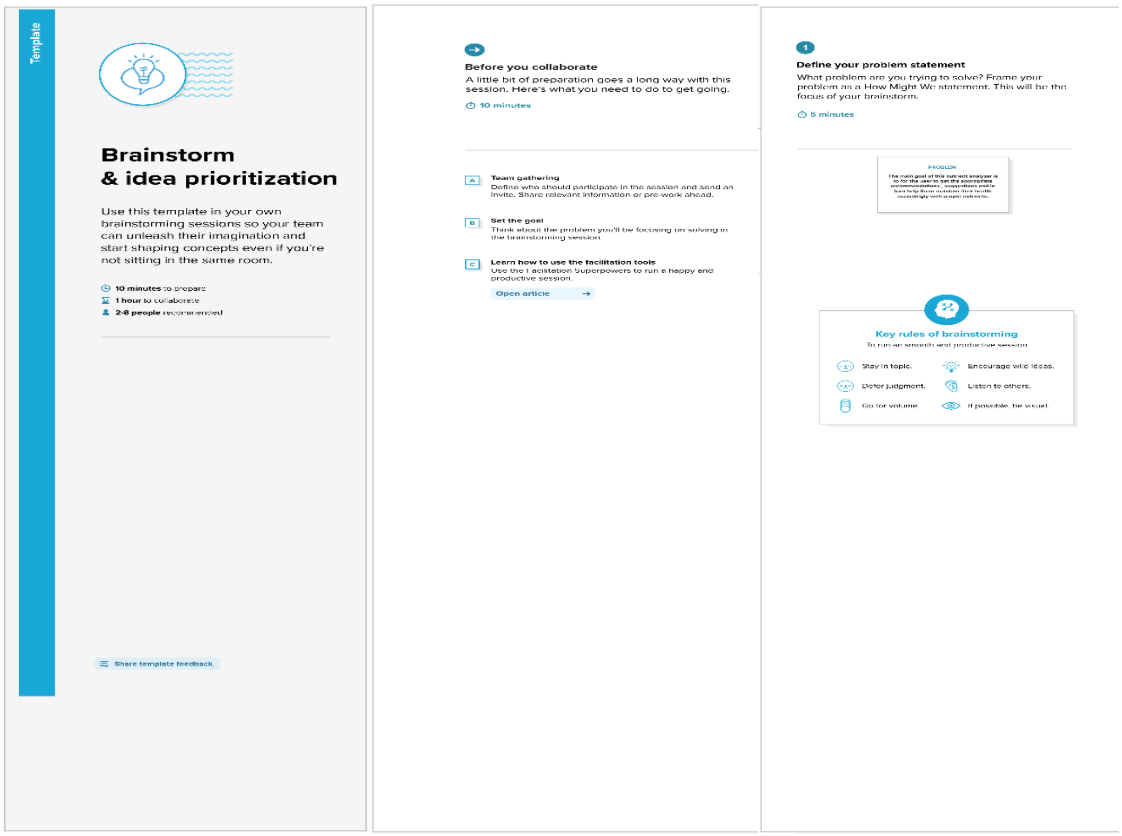


Fig.2 i) Brainstorming and idea prioritization

Step-2: Brainstorm, Idea Listing and Grouping

In this step they put their ideas and views which are prioritized based on their importance and the ideas are grouped. These ideas are categorized according to their relevant classifications.

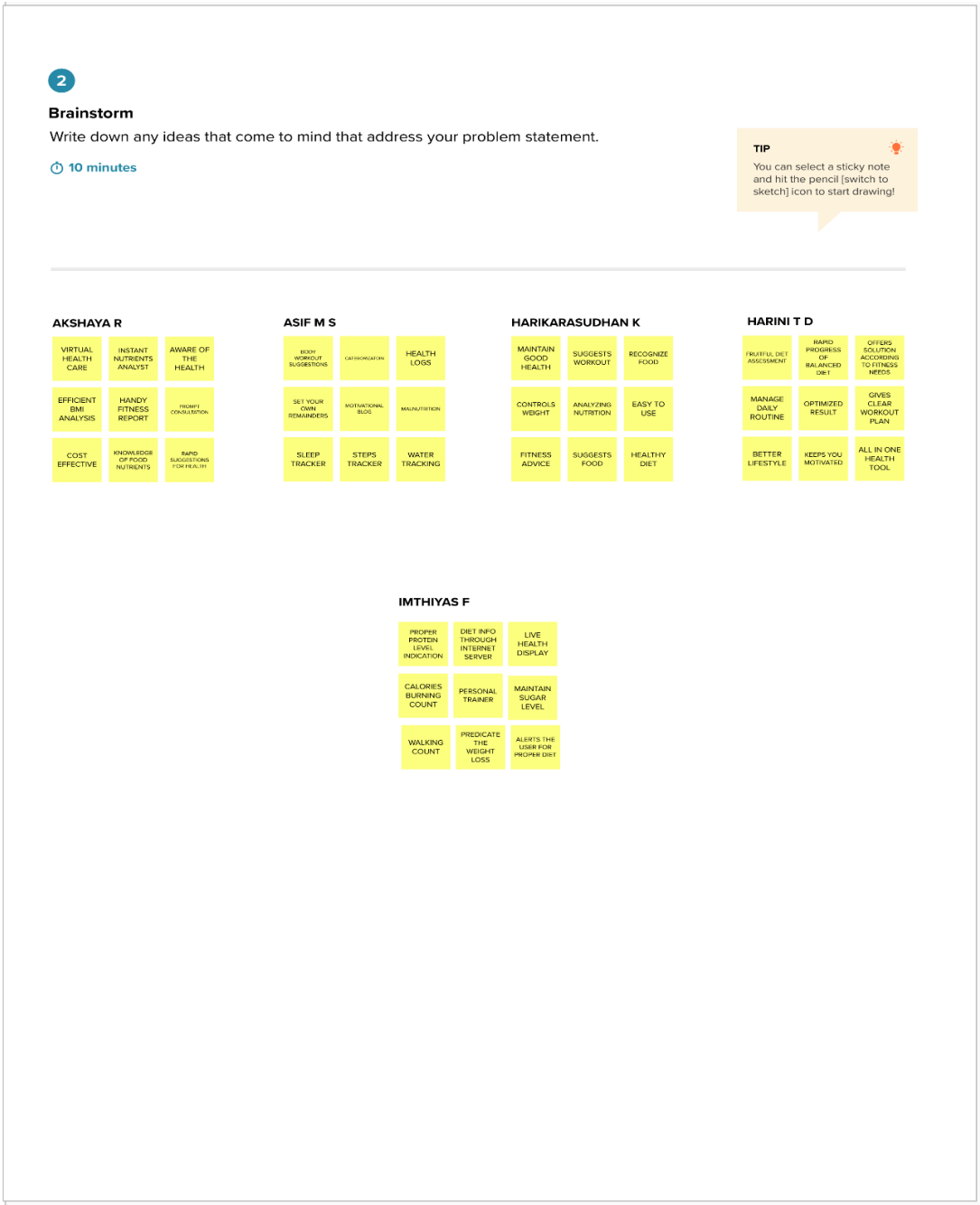


Fig.2 ii) Brainstorming and idea prioritization

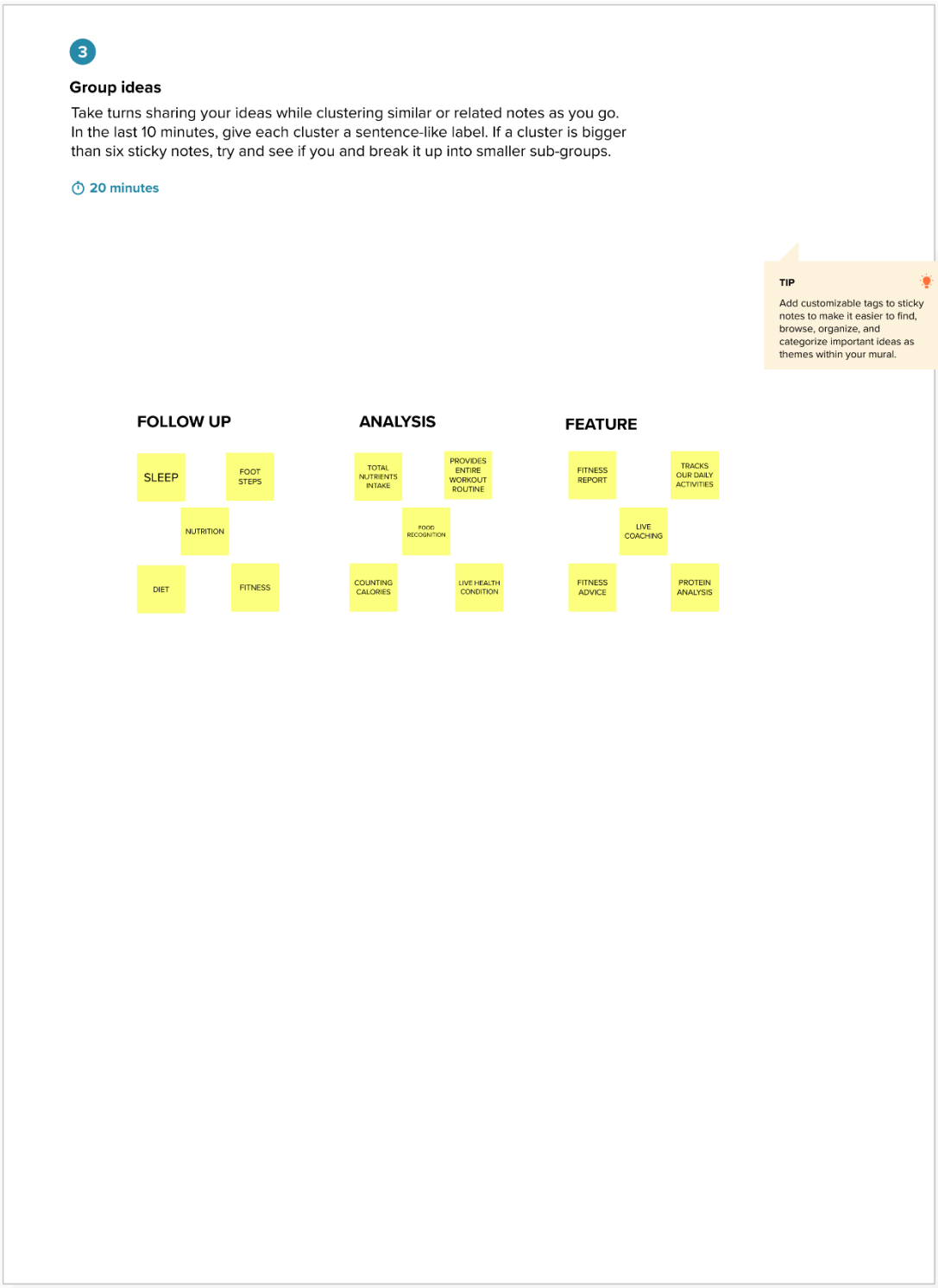


Fig.2 iii) Brainstorming and idea prioritization

Step-3: Idea Prioritization

As mentioned, idea prioritization is just a part of the idea management process. Having a structured idea management process and a systematic way of gathering, evaluating and prioritizing new ideas takes time. To make it work, the entire idea management process should be integrated into everyday ways of working.

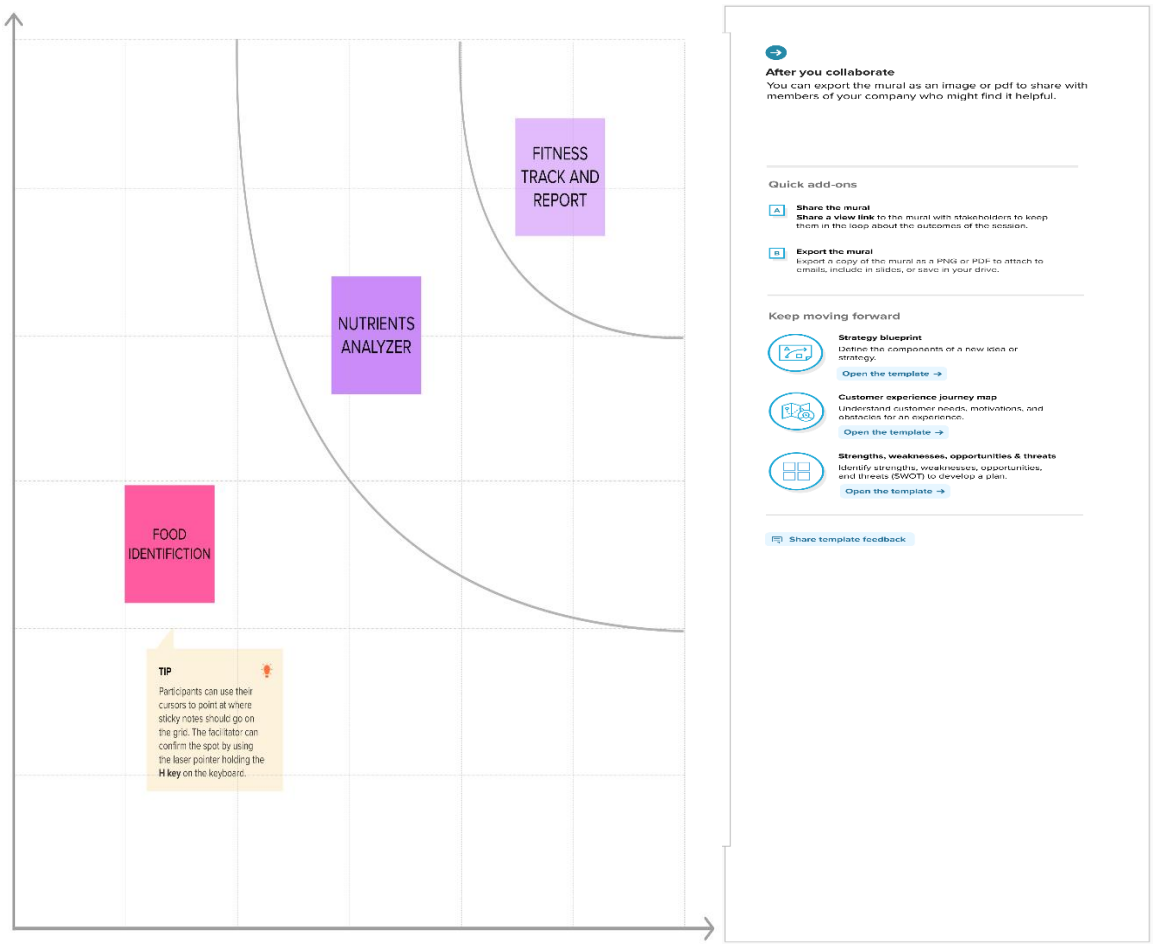


Fig.2 iv) Brainstorming and idea prioritization

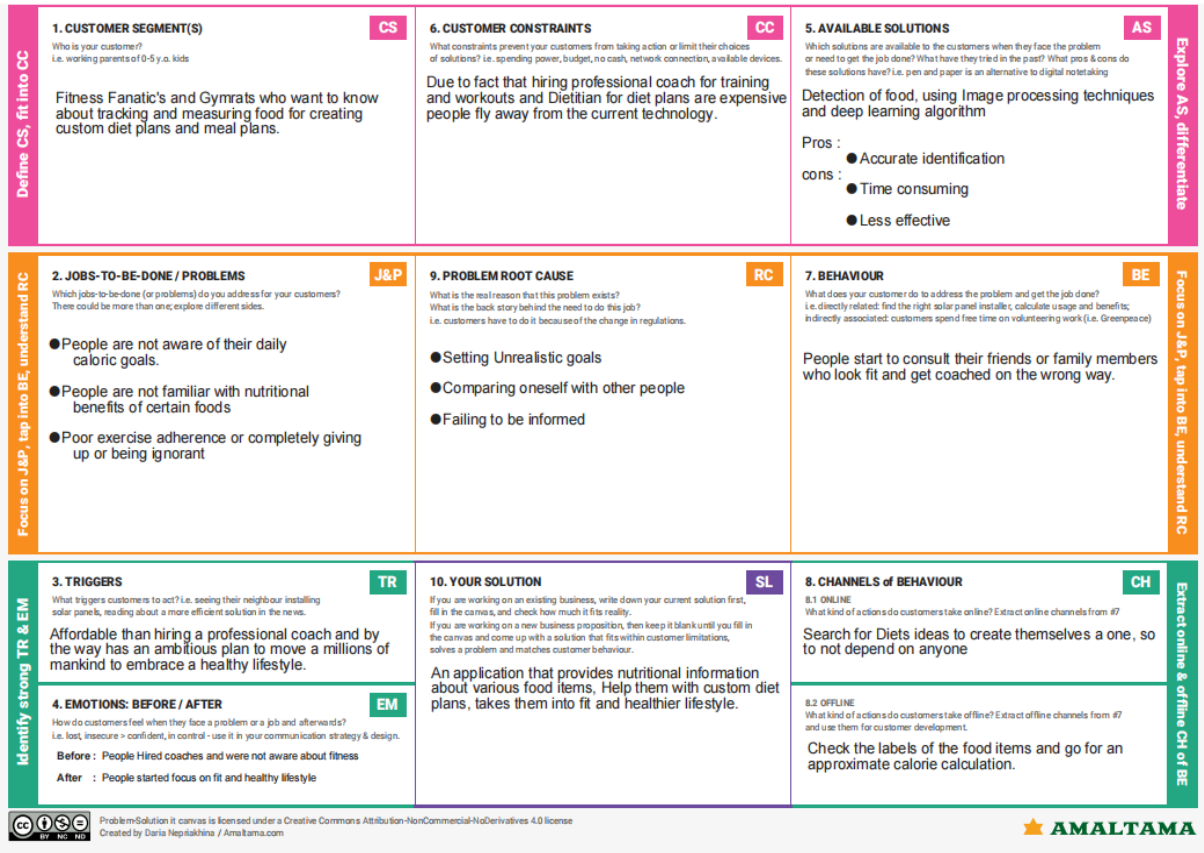
4.3. PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	AI-Powered Nutrition Analyzer For Fitness Enthusiasts.
2.	Idea / Solution description	The proposed solution is to classify the fruits using CNN based model and detect the nutrition based on the fruit (like sugar, calories ,fibre ,protein ,etc.)
3.	Novelty / Uniqueness	For detecting the nutrition an API is used which very efficient than other methods where we need to create a user defined model for nutrition detection.
4.	Social Impact / Customer Satisfaction	By this model the customer can efficiently keep track of their health and accordingly get required consultations in a less time-consuming manner.
5.	Business Model (Revenue Model)	• Input module • Image preprocessing and segmentation module • Feature extraction module • Data set training module • Nutrition level estimation API module • Suggestion module
6.	Scalability of the Solution	The accuracy of the result for the training data set is 99%. We can build a large data set which includes different fruit images to get a better result.

The main aim of the project is to build a model which is used to classify the fruit depending on the different characteristics. Here the user can capture the images of different fruits and then the image will be sent to the trained model.

It is a deep learning-based system to satisfy the need to measure daily nutrition intake value. The value of nutrition intake is recorded. Hence, we proposed a measurement method to estimate the amount of nutrition from different fruit images.

4.4. PROBLEM SOLUTION FIT



CHAPTER 5

REQUIREMENT ANALYSIS

5.1. FUNCTIONAL REQUIREMENTS

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Login	Login through Google Login through Email
FR-4	Choose package	Selection of desired package
FR-5	Generate the daily plan	Daily plans will be generated by dietician
FR-6	Manage progress report	Gathering information from database and generating report
FR-7	Query	The user can ask for changes in plan

FR-1

Functional Requirement (Epic) - User Registration

Sub Requirement (Story/Sub-Task) -

Registration through Form

Registration through Gmail

Registration through LinkedIn

FR-2

Functional Requirement (Epic) - User Confirmation

Sub Requirement (Story/Sub-Task) -

Confirmation via Email

Confirmation via OTP

FR - 3

Functional Requirement (Epic) - User Login

Sub Requirement (Story/Sub-Task) -

Login through Google

Login through Email

FR - 4

Functional Requirement (Epic) - Choose package

Sub Requirement (Story/Sub-Task) - Selection of desired package

FR - 5

Functional Requirement (Epic) - Generate the daily plan

Sub Requirement (Story/Sub-Task) - Daily plans will be generated by dietician

FR - 6

Functional Requirement (Epic) - Manage progress report

Sub Requirement (Story/Sub-Task) - Gathering information from database and generating report

FR - 7

Functional Requirement (Epic) - Query

Sub Requirement (Story/Sub-Task) - The user can ask for changes in plan

5.1. NON-FUNCTIONAL REQUIREMENTS

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Easy to use with interactive User Interface
NFR-2	**Security**	User can access only their personal information and not that of other users.
NFR-3	**Reliability**	The average time of failure shall be 7 days.
NFR-4	**Performance**	The results have to be shown within 10 sec
NFR-5	**Availability**	The dietician shall be available to users 24 hours a day, 7 days a week.
NFR-6	**Scalability**	Supports various food items

NFR-1

Non-Functional -Usability

Requirement Description - Easy to use with interactive User Interface

NFR-2

Non-Functional -Security

Requirement Description - User can access only their personal information and not that of other users.

NFR-3

Non-Functional -Reliability

Requirement Description - The average time of failure shall be 7 days.

NFR-4

Non-Functional -Performance

Requirement Description The results have to be shown within 10 sec

NFR-5

Non-Functional - Availability

Requirement Description - The dietician shall be available to users 24 hours a day, 7 days a week.

NFR-6

Non-Functional - Scalability

Requirement Description - Supports various food items.

CHAPTER 6

PROJECT DESIGN

6.1. ARCHITECTURE DESIGN

TECHNICAL ARCHITECTURE:

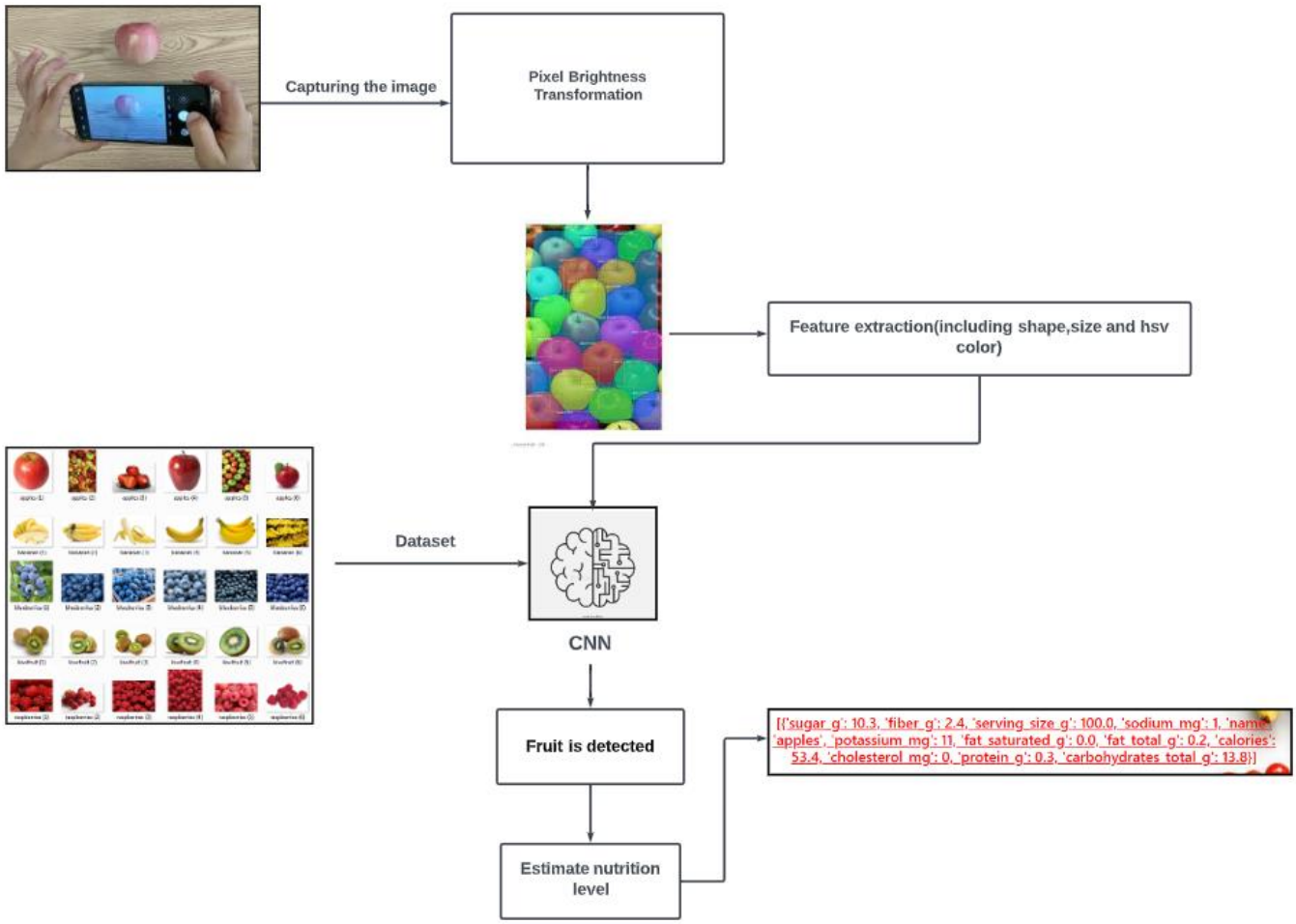


Fig.3 Technical Architecture diagram

Fig.3 shows the flow of the application, it starts with user capturing or uploading an image from the internet and eventually the fruit detected using an CNN model and for the detected fruit appropriate nutrition is displayed as an output to the user.

SOLUTION ARCHITECTURE:

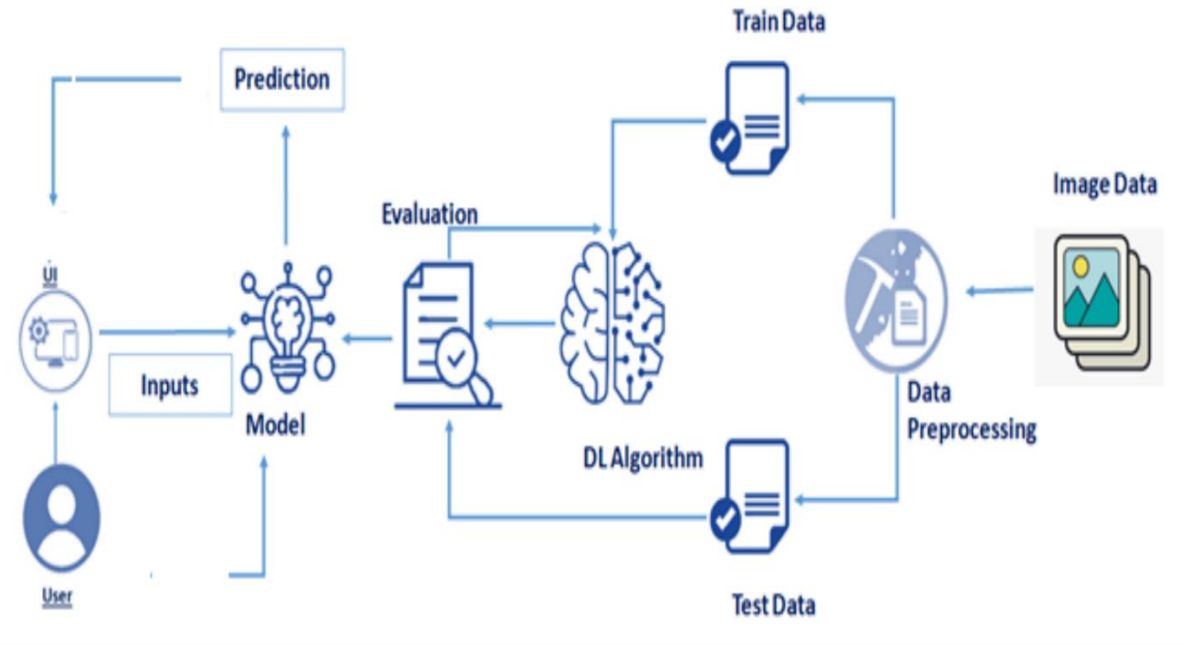


Fig.4 Solution Architecture Diagram

6.2. DATA FLOW DIAGRAM

Dataflow is a model which defines how the data i.e., values get travelled across the Deep learning prediction model. In this project, the data flow starts from in-person data collection from the test images from the user given as an input. Firstly, the CNN model will be trained with some fruit images like apple, banana, pineapple, watermelon, orange. The dataset will be preprocessed and it will be splitted according to various fruit categories and the model will be trained. For validation there will be separate testing dataset images. When the testing image is sent by the user it goes to the convolution layer where images will be converted to binary image by extracting features with a help filter that is present in the kernel and are saved in a single neuron.

In max pooling it selects the maximum element from the region of the feature map covered by the filter. Thus, the output after max-pooling layer would be a feature map containing the most prominent features of the previous feature map. Fig.5 shows how the image binary values are filtered using pooling techniques i.e., max pooling and average pooling.

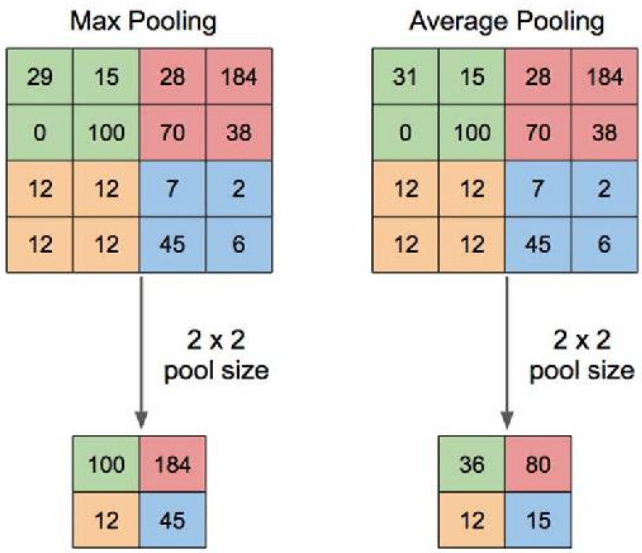


Fig.5 a) Max pooling b) Average pooling

The Dropout layer is a mask that nullifies the contribution of some neurons towards the next layer and leaves unmodified all other neuron. We can apply a dropout layer to the input vector, in which case it nullifies some of its features; but we can also apply it to a hidden layer, in which case it nullifies some hidden neurons.

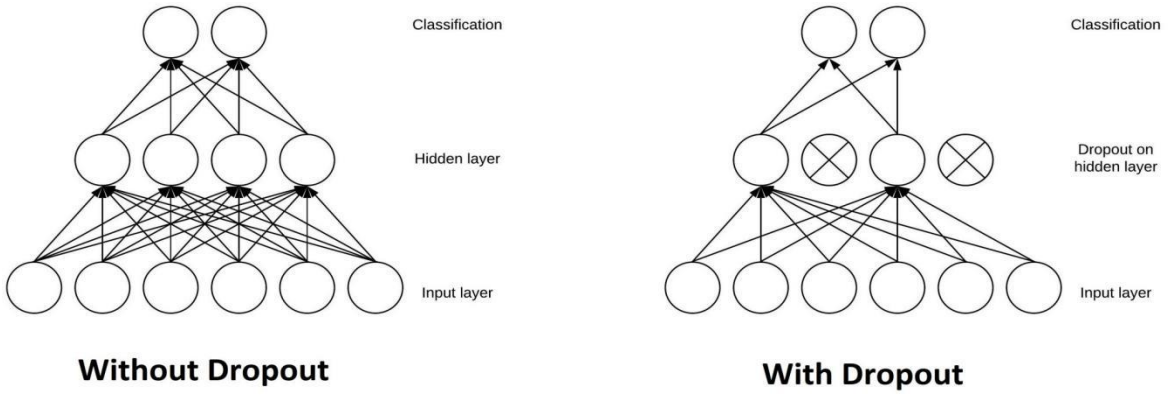


Fig.6 Dropout layers a) Without dropout b) With dropout

Dropout layers are important in training CNNs because they prevent over-fitting on the training data. If they aren't present, the first batch of training samples influences the learning in a disproportionately high manner. This, in turn, would prevent the learning of features that appear only in later samples or batches. We

can understand how the absence of dropout layer may affect the neural network with fig.6.

Flattening is used to convert all the resultant 2-Dimensional arrays from pooled feature maps into a single long continuous linear vector. The flattened matrix is fed as input to the fully connected layer to classify the image. The process of how a matrix values are flattened using the flattening layer is shown in fig.7.

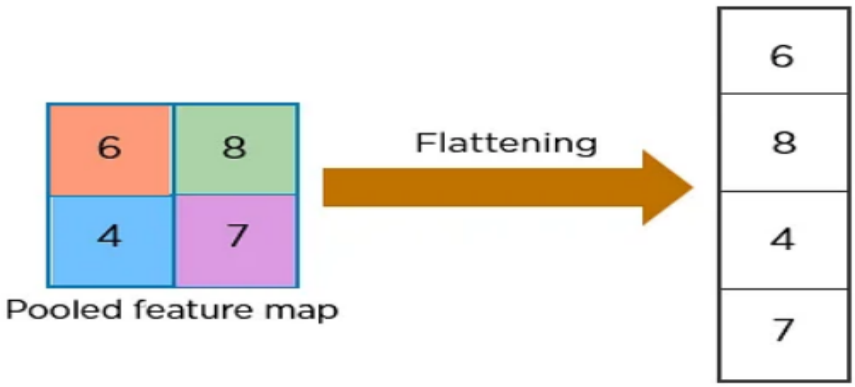


Fig.7 Flattening

Connected Layers form the last few layers in the network. The input to the connected layer is the output from the final Pooling or Convolution Layer, which is flattened and then fed into the fully connected layer. A representation of image data processing is shown in fig.8.

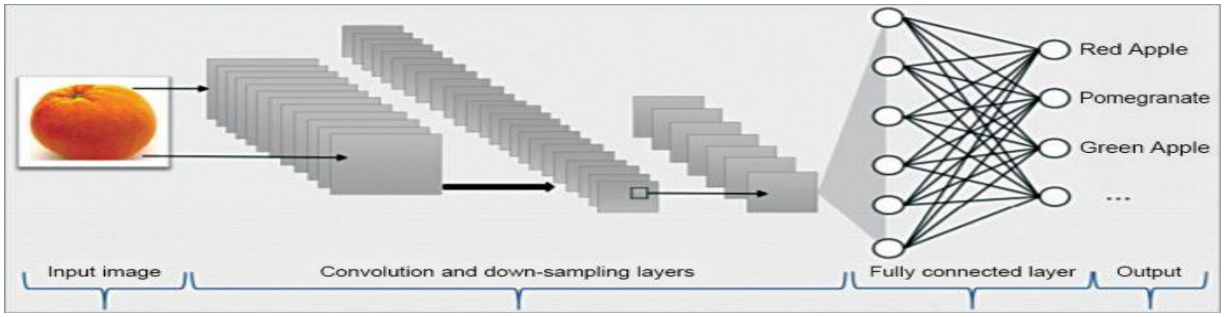


Fig.8 Connected layers

Further the image will be classified to their fruit category based upon which nutrition level for fruit will be estimated. The flow chart in fig.9 clearly shows how the application works.

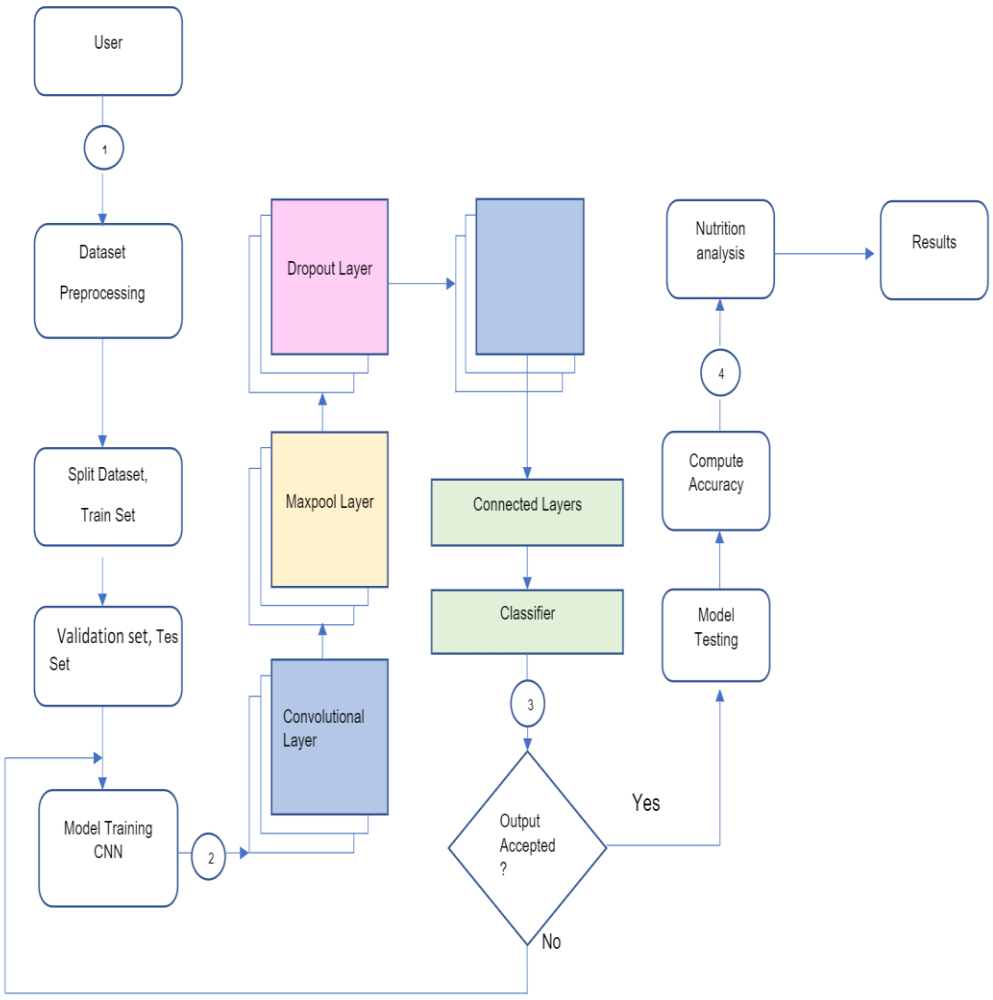


Fig.9 Data flow diagram

6.3. WORKFLOW DIAGRAM

A workflow diagram provides a graphic overview of the business process. Using standardized symbols and shapes, the workflow shows step by step how your work is completed from start to finish. The steps are shown sequentially in fig.10.

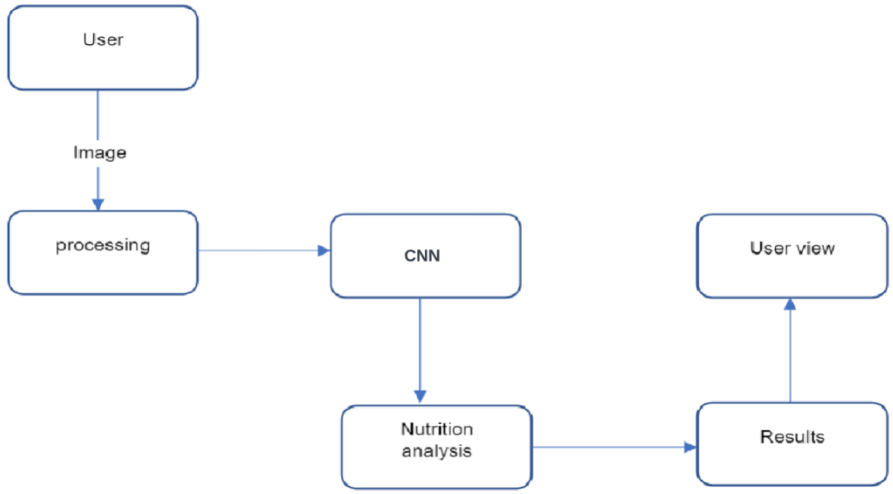


Fig.10 Workflow diagram

Initially when the user captures the image to find out the nutrition level, the image will be preprocessed to get a clear pixel range for further estimation and with help of convolution neural network (CNN) algorithm the image is classified and nutrition value is predicted and given as a result which is displayed to user.

6.4. USER JOURNEY

Creating a user journey is a quick way to help you and the team gain a deeper understanding of who you're designing for, aka the stakeholder in your project. The information you add here should be representative of the observations and research you've done about your users. Fig.11 depicts how the users will have the overall experience.

Fig.11 User Journey

6.5. DESCRIPTION OF MODULES

There are five modules used in this system

- Input acquisition module
- Image pre-processing module
- Segmentation and features extraction module
- Dataset training module
- Nutrition level estimation

6.6. EXPLANATION OF MODULES

1. **Input acquisition module: -**

In this module the camera will capture the photo and the multiple frames can be converted into a single frame image and sent to the next block for further processing as shown in fig.12.

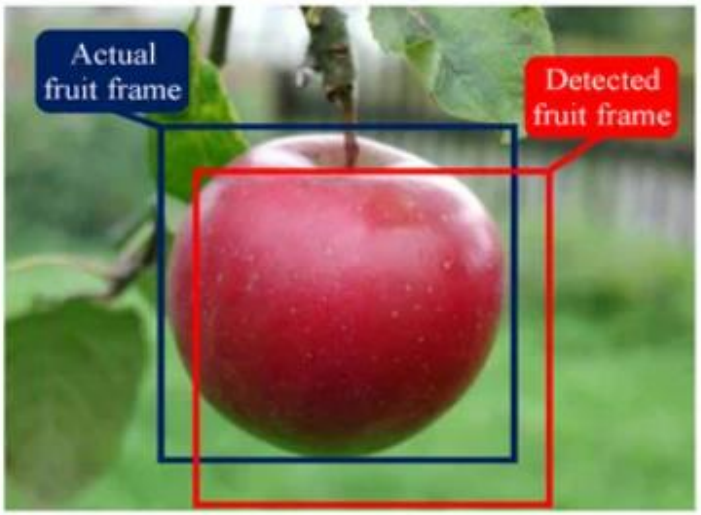


Fig.12 Input Image

2. Image preprocessing and segmentation module: -

The Segmentation process will take place and the input image will be segmented for the purpose of detection which is necessary to identify the region of interest in the image. This module will convert the processed and segmented images by performing a region-based segmentation process as depicted in fig.13. It uses key factors in the image like hue saturation value, descriptor points in order to analyze the complete content of the image.

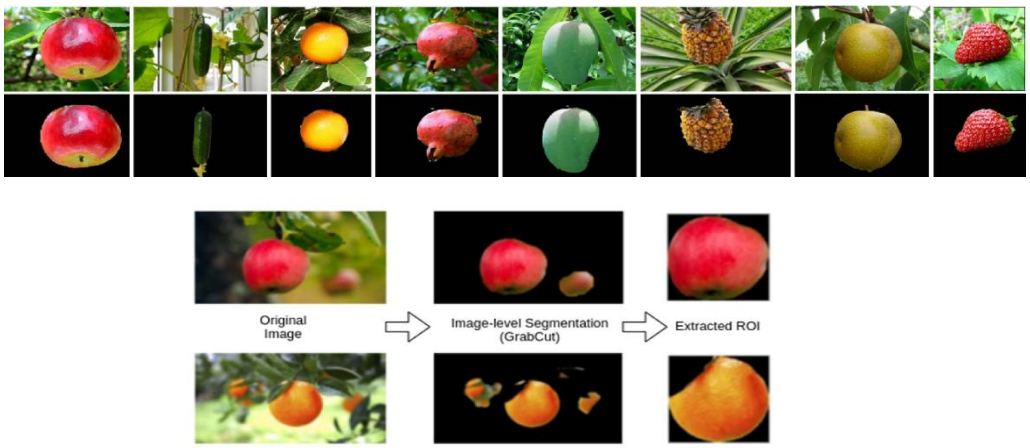


Fig.13 Image preprocessing and segmentation

3. **Feature extraction module: -**

In this feature extraction module, the features like color, size and shape can be extracted from the input food image as shown in fig.14.

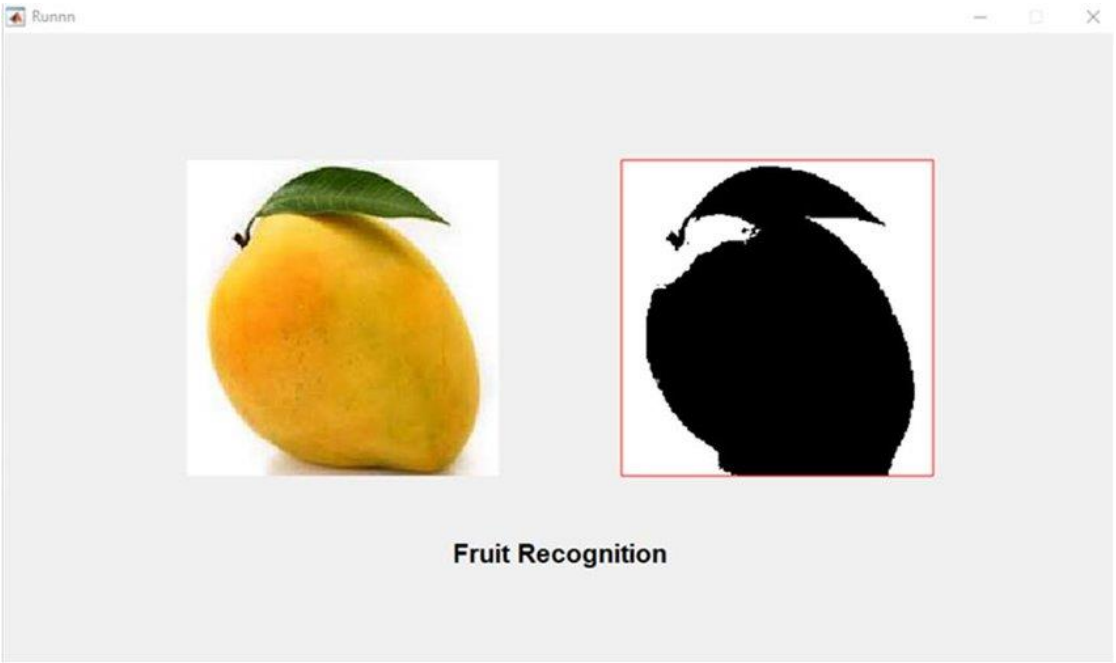


Fig.14 Feature extracted from image

4. **Dataset training module: -**

The CNN model will be trained with a fruit dataset. In the fruit dataset we will have five classes of fruit like apple, orange, banana, watermelon, pineapple. In fig.15 it shows how an input is classified using a neural network.

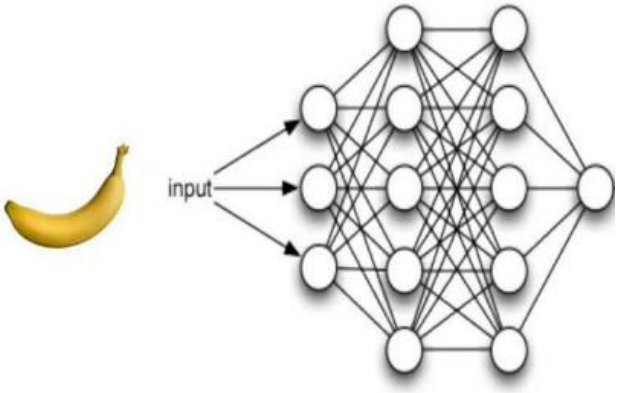


Fig.15 Dataset training

5. **Nutrition level estimation:** -

In rapid API we use one of the API called CalorieNinjas to predict the nutrition level in fruit. The API estimates the nutrition based on the given query as shown in fig.16.

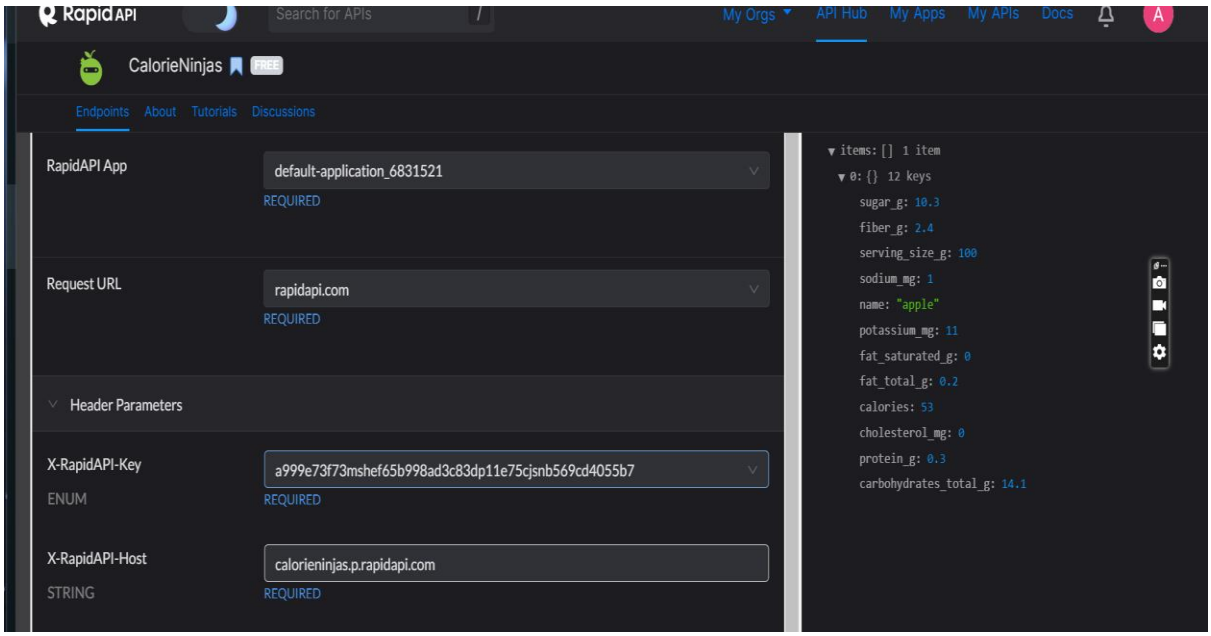


Fig.16 Nutrition level estimation

6.7. Algorithms/Techniques

Deep Learning, which has emerged as an effective tool for analyzing big data, uses complex algorithms and artificial neural networks to train machines/computers so that they can learn from experience, classify and recognize data/images just like a human brain does.

Within Deep Learning, a Convolution 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.

Deep Learning has various applications like image processing, natural language processing, etc. It is also used in Medical Science, Media & Entertainment, Autonomous Cars, etc.

CNN

A convolution neural network (CNN) is a subset of machine learning. It is one of the various types of artificial neural networks which are used for different applications and data types.

A CNN is a kind of network architecture for deep learning algorithms and is specifically used for image recognition, object detection, segmentation and tasks that involve the processing of pixel data. These algorithms are currently the best algorithms we have for the automated processing of images.

Images contain data of RGB combination. Matplotlib can be used to import an image into memory from a file. The computer doesn’t see an image, all it sees is an array of numbers. Color images are stored in 3-dimensional arrays. The first

two dimensions correspond to the height and width of the image (the number of pixels). The last dimension corresponds to the red, green, and blue colors present in each pixel.

Layers of CNN

There are three types of layers in Convolution Neural Networks:

1) Convolution Layer:

In a typical neural network, each input neuron is connected to the next hidden layer. In CNN, only a small region of the input layer neurons connects to the neuron hidden layer.

2) Pooling Layer:

The pooling layer is used to reduce the dimensionality of the feature map. There will be multiple activation & pooling layers inside the hidden layer of the CNN.

3) Fully-Connected layer:

This layer forms the last few layers in the network. The input to the fully connected layer is the output from the final Pooling or Convolutional Layer, which is flattened and then fed into the fully connected layer.

CHAPTER 7

PROJECT PLANNING

AND SCHEDULING

7.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration and login	USN-1	As a user, I can register for the application by entering a unique user id, password, and confirm my password.	8	High	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-1	Main page, AboutPage	USN-2	Home page, About page. Navigate through the application easily (easy user experience and interface).	7	High	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-1	Logout	USN-3	As a user, I can logout from the application	5	High	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-2	Prediction	USN-4	As a user, I can upload pictures from the camera and also from the device.	6	High	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-2	Anonymous Usage	USN-5	As a user, I can access the application without signing in.	3	High	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D

						IMTHIYAS F
Sprint-2	Searching fruits data manually	USN-6	As a user, I can access information (nutritional Content).	4	Medium	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-2	Motivational quotes suggestion	USN-7	As a user, I get daily motivational quotes.	3	High	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-2	Searching	USN-8	As a user, I can get suggestion of fruits based on season and health condition	5	High	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-2	Dashboard	USN-9	As a User I can view the nutritional content of food taken for a day	3	Low	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-2	Report page	USN-10	As a User I can report any issues through report page	2	High	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-2	Dashboard	USN-11	As a User I can View the issues and reports done by common users and the administrator	8	High	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-3	Monitoring	USN-12	As a user, I can monitor my daily water intake as per my body weight,	2	Medium	AKSHAYA R ASIF M S HARIKARASUDHAN K

			and get periodic reminders.			HARINI T D IMTHIYAS F
Sprint-3	Health details management	USN-13	As a user, I can manage my health condition details.	2	Medium	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-3	Installable PWA	USN-14	PWA for mobile users	2	Medium	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-3	Dashboard	USN-15	As an Administrator I can view and manage users, contents	2	Medium	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-3	Feedback page	USN-16	As a User I can give Feedback.		Medium	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-3	BMI update page	USN-17	As a User I can update and view my BMI		Medium	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-3	Storing Data	USN-18	As a user, I can store the data which are used to predict the health conditions		Medium	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F
Sprint-4	Security Check	USN-19	As an administrator I need to confirm that the users' data are in secure		Medium	AKSHAYA R ASIF M S HARIKARASUDHAN K

			format			HARINI T D IMTHIYAS F
Sprint-4	Grouping Users	USN-120	As a user, I can join or enroll in a group to get specialized content		Low	AKSHAYA R ASIF M S HARIKARASUDHAN K HARINI T D IMTHIYAS F

Sprint-01:

Usn-01 - As a user, I can register for the application byentering a unique user id, password, and confirm my password.

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-02 - Home page, About page. Navigate through theapplication easily (easy user experience and interface).

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-03 - As a user, I can logout from the application

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Sprint-02:

Usn-04 - As a user, I can upload pictures from the camera and also from the device.

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-05 - As a user, I can access the application without signing in.

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-06 - As a user, I can access information (nutritional Content).

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-07 - As a user, I get daily motivational quotes.

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-08 - As a user, I can get suggestion of fruits based on season and health condition

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-09 - As a User I can view the nutritional content of food taken for a day

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-10 - As a User I can report any issues through report page

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-11 - As a User I can View the issues and reports done by common users and the administrator

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Sprint-03:

Usn-12 - As a user, I can monitor my daily water intake as per my body weight, and get periodic reminders.

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-13 - As a user, I can manage my health condition details.

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-14 - PWA for mobile users

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D

- IMTHIYAS F

Usn-15 - As an Administrator I can view and manage users, contents.

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-16 - As a User I can give Feedback.

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-17 - As a User I can update and view my BMI

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-18 - As a user, I can store the data which are used to predict the health

conditions.

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Sprint-01:

Usn-19 - As an administrator I need to confirm that the users' data are in secure format

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

Usn-20 - As a user, I can join or enroll in a group to get specialized content

Team members

- AKSHAYA R
- ASIF M S
- HARIKARASUDHAN K
- HARINI T D
- IMTHIYAS F

7.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	5	6 Days	24 Oct 2022	29 Oct 2022	5	29 Oct 2022
Sprint-2	5	6 Days	31 Oct 2022	05 Nov 2022	5	05 Nov 2022
Sprint-3	6	6 Days	07 Nov 2022	12 Nov 2022	6	12 Nov 2022
Sprint-4	8	6 Days	14 Nov 2022	19 Nov 2022	8	19 Nov 2022

Sprint-1

- **Total Story Points -** 20
- **Duration -** 6 Days
- **Sprint Start Date** - 24 Oct 2022
- **Sprint End Date (Planned) -** 29 Oct 2022
- **Story Points Completed (as on Planned End Date) -** 5
- **Sprint Release Date (Actual) -** 29 Oct 2022

Sprint-2

- **Total Story Points -** 5
- **Duration -** 6 Days
- **Sprint Start Date -** 31 Oct 2022

- **Sprint End Date (Planned) -** 05 Nov 2022
- **Story Points Completed (as on Planned End Date)** - 5
- **Sprint Release Date (Actual) -** 05 Nov 2022

Sprint-3

- **Total Story Points** - 6
- **Duration** - 6 Days
- **Sprint Start Date** - 07 Nov 2022
- **Sprint End Date (Planned) -** 12 Nov 2022
- **Story Points Completed (as on Planned End Date)** - 6
- **Sprint Release Date (Actual) -** 12 Nov 2022

Sprint-4

- **Total Story Points** - 8
- **Duration** - 6 Days
- **Sprint Start Date** - 14 Nov 2022
- **Sprint End Date (Planned) -** 19 Nov 2022
- **Story Points Completed (as on Planned End Date)** - 8
- **Sprint Release Date (Actual) -** 19 Nov 2022

7.3 REPORTS FROM JIRA

Burndown Chart Report:

A burndown chart is a graphical representation of work left to do versus time and completed work. It is often used in agile software development methodologies such as scrum, Jira. However, burndown charts can apply to any project containing measurable time.

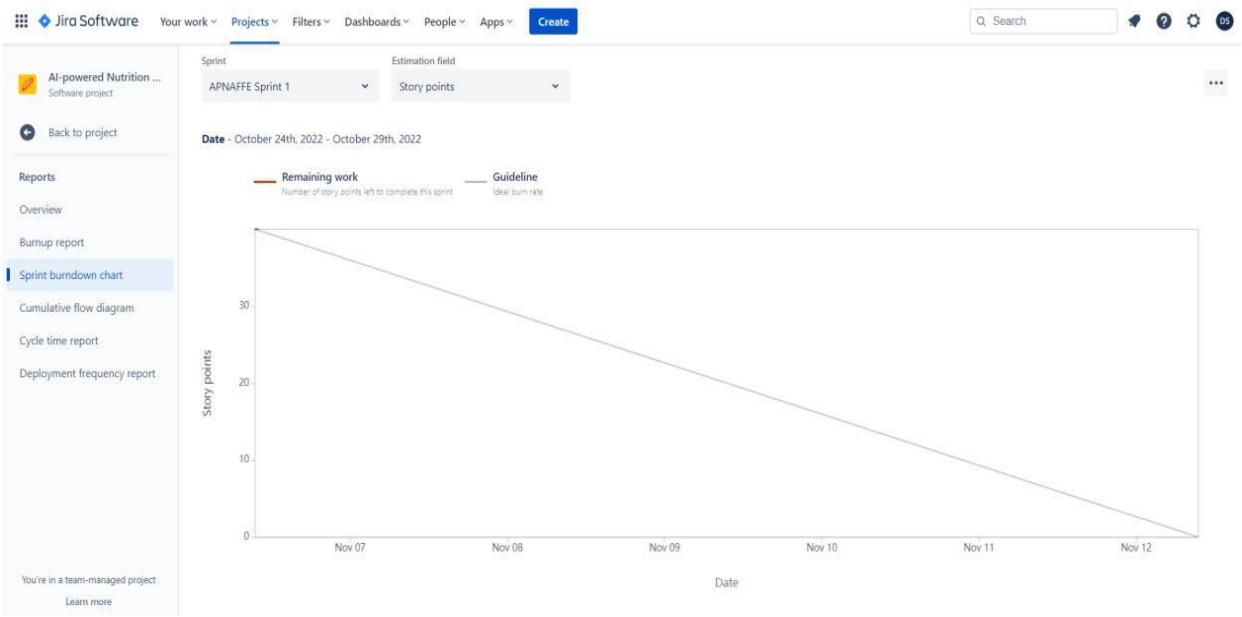


Fig.17 Burndown Chart

Roadmap Report:

It provides the details about the project completion status, the work yet to be completed in four ways like days, months, weeks, quarters.

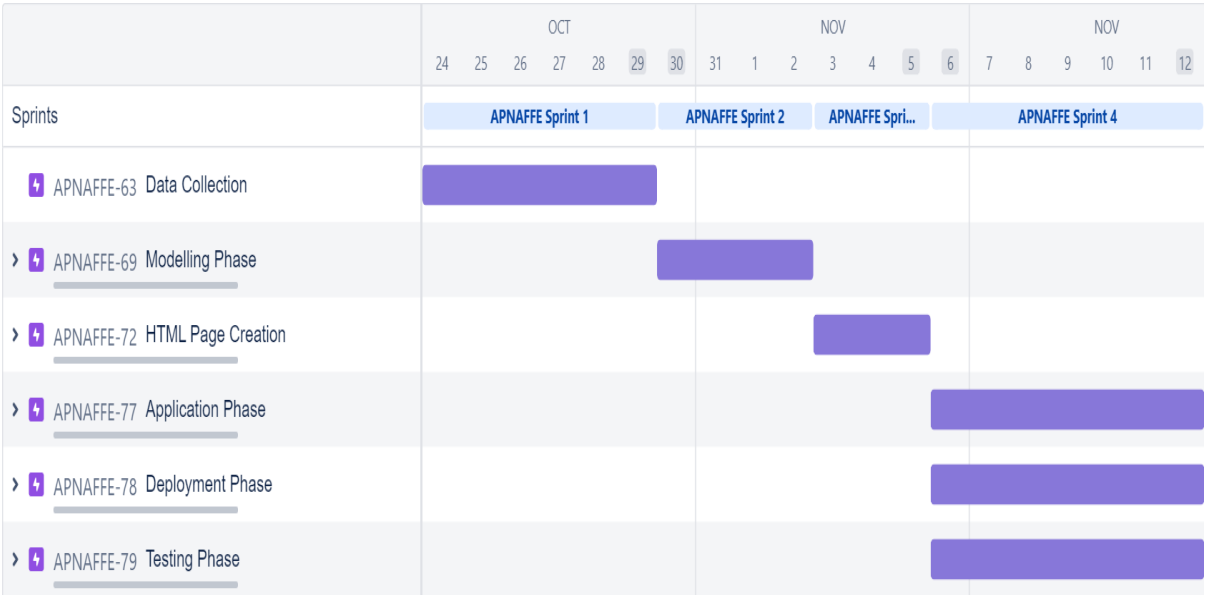


Fig.18 Roadmap

CHAPTER 8

CODING AND SOLUTIONING

8.1. Hardware Requirements:

- Windows 10
- RAM: 4GB
- Hard Disk: 100GB
- Processor: Intel i5

8.2. Software Requirements:

1. TensorFlow
2. Python IDE
3. Anaconda Navigator
4. Spyder
5. IBM Cloud
6. IBM Watson

TensorFlow

TensorFlow is an end-to-end open-source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries, and community resources that lets researchers push the state-of-the-art in ML, and gives developers the ability to easily build and deploy ML-powered applications.

TensorFlow provides a collection of workflows with intuitive, high-level APIs for both beginners and experts to create machine learning models in numerous languages. Developers have the option to deploy models on a number of platforms such as on servers, in the cloud, on mobile and edge devices, in browsers, and on many other JavaScript platforms. This enables developers to go from model building and training to deployment much more easily.

Anaconda Navigator

Anaconda Navigator is a desktop graphical user interface included in Anaconda that allows you to launch applications and easily manage conda packages, environments and channels without the need to use command line commands.

Python IDE

An IDE (or Integrated Development Environment) is a program dedicated to software development. As the name implies, IDEs integrate several tools specifically designed for software development. These tools usually include:

• An editor designed to handle code (with, for example, syntax highlighting and auto-completion)

• Build, execution, and debugging tools

Most IDEs support many different programming languages and contain many more features. They can, therefore, be large and take time to download and install. You may also need advanced knowledge to use them properly. In contrast, a dedicated code editor can be as simple as a text editor with syntax highlighting and code formatting capabilities. Most good code editors can execute code and control a debugger. The very best ones interact with source control systems as well. Compared to an IDE, a good dedicated code editor is usually smaller and quicker, but often less feature rich.

Spyder

Spyder is a free and open-source scientific environment written in Python, for Python, and designed by and for scientists, engineers and data analysts. It features a unique combination of the advanced editing, analysis, debugging, and profiling functionality of a comprehensive development tool with the data exploration, interactive execution, deep inspection, and beautiful visualization capabilities of a scientific package.

IBM Cloud

The IBM Cloud platform combines platform as a service (PaaS) with infrastructure as a service (IaaS) to provide an integrated experience. The platform scales and supports both small development teams and organizations, and large enterprise businesses. Globally deployed across data centers around the world, the solution you build on IBM Cloud spins up fast and performs reliably in a tested and supported environment you can trust.

IBM Cloud provides solutions that enable higher levels of compliance, security, and management, with proven architecture patterns and methods for rapid delivery for running mission-critical workloads. Available in data centers worldwide, with multi zone regions in North and South America, Europe, Asia, and Australia, you are enabled to deploy locally with global scalability.

IBM Cloud offers the most open and secure public cloud for business with a next-generation hybrid cloud platform, advanced data and AI capabilities, and deep enterprise expertise across 20 industries.

IBM Watson

Powered by the latest innovations in machine learning, Watson lets you learn more with less data. You can integrate AI into your most important business processes, informed by IBM’s rich industry expertise. You can build models from scratch, or leverage our APIs and pre-trained business solutions. No matter how you use Watson, your data and insights belong to you − and only you.

Only Watson gives you complete control of what's important to you. With Watson on the IBM Cloud, you maintain ownership of your data, insights, training, and IP.

Your business processes get smarter with Watson. From healthcare and education to finance, transportation, and energy, Watson is trained by leading experts in your field, so you can quickly embed into your existing workflows. Watson understands the language of your industry and taps into deep domain knowledge to help you make more informed decisions faster.

8.3. ALGORITHMIC IMPLEMENTATIONS

STEP 1:

A CNN model is developed and trained in the Google Colab platform.

STEP 2:

Initially the required packages such as Flask, NumPy, TensorFlow, keras are imported. Fig.19 shows the packages that are imported from the python library files.

```
1  from flask import Flask,render_template,request
2  # Flask-It is our framework which we are going to use to run/serve our application.
3  #request-for accessing file which was uploaded by the user on our application.
4  import os
5  import numpy as np #used for numerical analysis
6  from tensorflow.keras.models import load_model#to load our trained model
7  from tensorflow.keras.preprocessing import image
8  import requests
9
```

Fig.19 Importing libraries

Flask

Flask is a micro web framework written in Python. It is classified as a micro-framework because it does not require particular tools or libraries. It has no

database abstraction layer, form validation, or any other components where preexisting third-party libraries provide common functions.

NumPy

NumPy is the fundamental package for scientific computing in Python. It is a Python library that provides a multidimensional array object, various derived objects and an assortment of routines for fast operations on arrays, including mathematical, logical, shape manipulation, sorting, selecting, I/O, discrete Fourier transforms, basic linear algebra, basic statistical operations, random simulation and much more.

TensorFlow

TensorFlow is a free and open-source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks.

Keras

Keras is an open-source software library that provides a Python interface for artificial neural networks. Keras acts as an interface for the TensorFlow library. Up until version 2.3, Keras supported multiple back-ends, including TensorFlow, Microsoft Cognitive Toolkit, Theano, and PlaidML.

STEP 3: The dataset is imported by mounting the drive to colab using drive.mount() method.

STEP 4: Preprocessing the image.

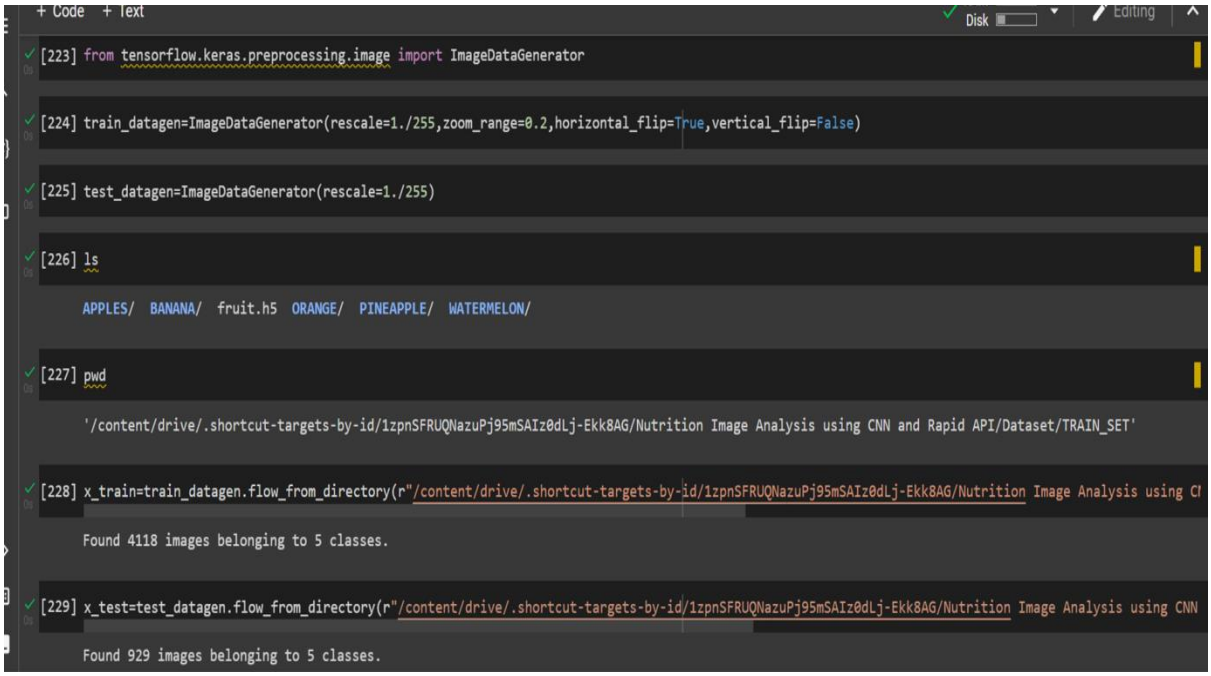


Fig.20 Image Preprocessing

Since images exist in different formats, i.e., natural, fake, grayscale, etc., we need to take into consideration and standardize them before feeding them into a neural network.

Using the keras library in python the image preprocessing is done and further the image data is generated using ImageDataGenerator method.

Fig.20 shows how using the keras library in python the image preprocessing is done and further the image data is generated using ImageDataGenerator() method.

STEP 5: Segmentation and feature extraction.

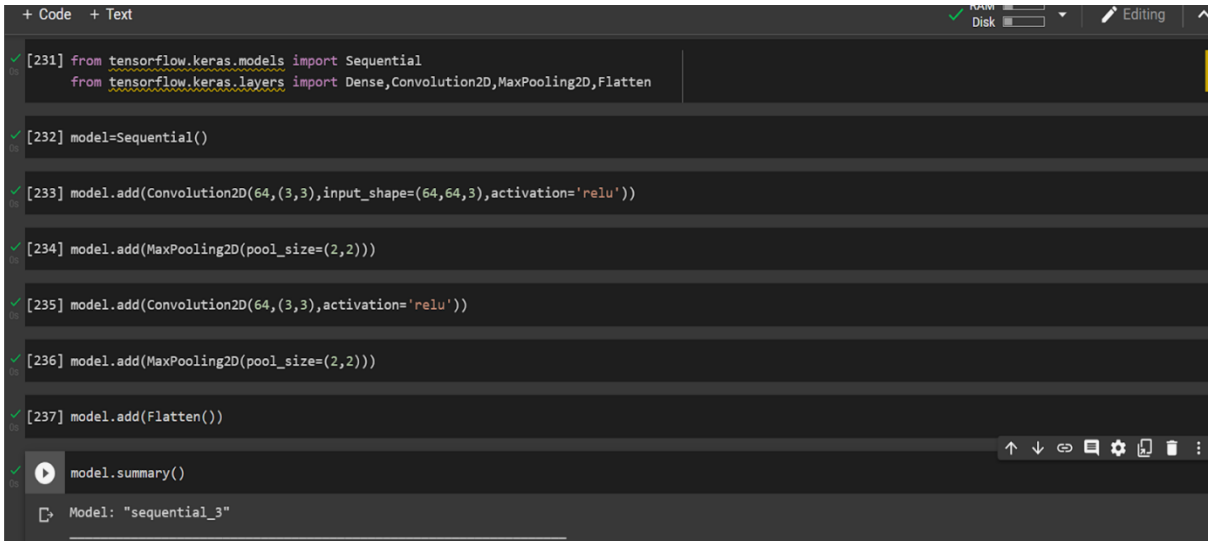


Fig.21 Segmentation and Feature Extraction

Image segmentation involves converting an image into a collection of regions of pixels that are represented by a mask or a labeled image. By dividing an image into segments, you can process only the important segments of the image instead of processing the entire image. Fig.21 shows the layers and methods used in the model for the segmentation and feature extraction. The layers are attached to the model using model.add() method.

By the generated segments the features are extracted using convolution layer, max pooling layer and the flatten layer after which the features are fed into the neural network for classification.

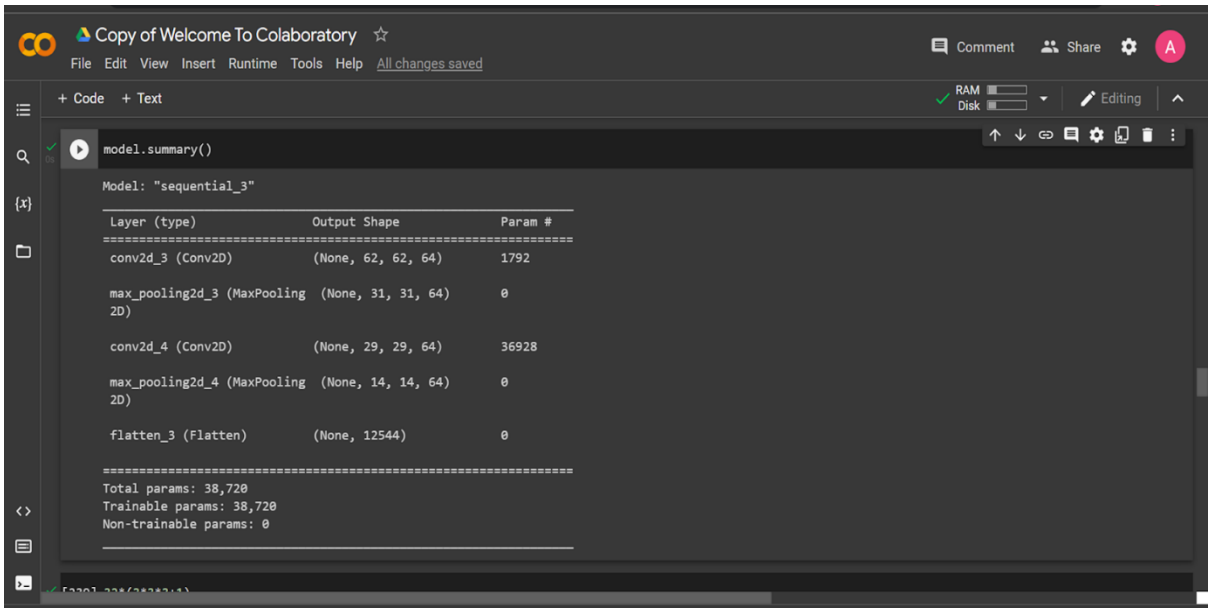


Fig.22 Output Summary

In the above output, the layer information is listed on the left side in the order of first to last. The first layer is at the top and the last layer is at the bottom. Fig.22 shows the output summary of the sequential() model.

STEP 6: Training the model.

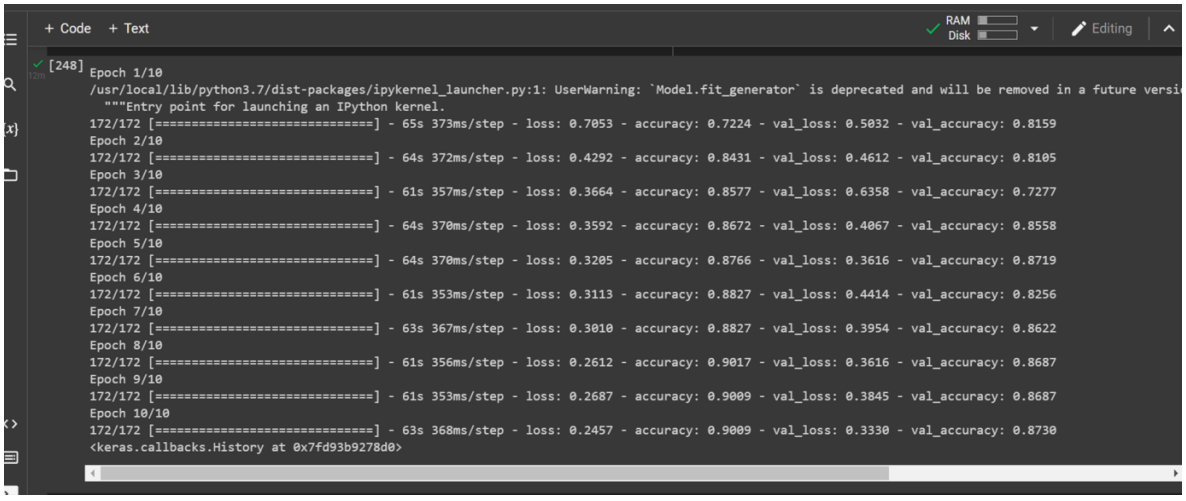


Fig.23 CNN Model Training

In fig.23 the model is trained using the imported dataset. A parameter called epoch is used to train the model.

An epoch consists of passing a dataset through the algorithm completely. Each Epoch consists of many weights update steps. To optimize the learning process, gradient descent is used, which is an iterative process. It improves the internal model parameters over many steps and not at once.

Hence the dataset is passed through the algorithm multiple times so that it can update the weights over the different steps to optimize learning using model.fit_generator () method.

STEP 7: Testing the model.

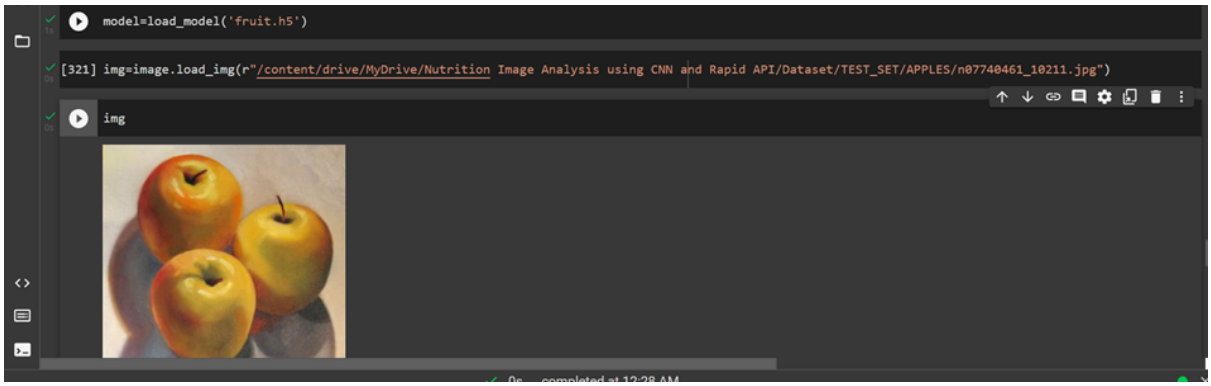


Fig.24 CNN Model Testing

The trained model is tested using our own image data. Initially to test the model first the saved model needs to be loaded using load_model() as shown in fig.24.

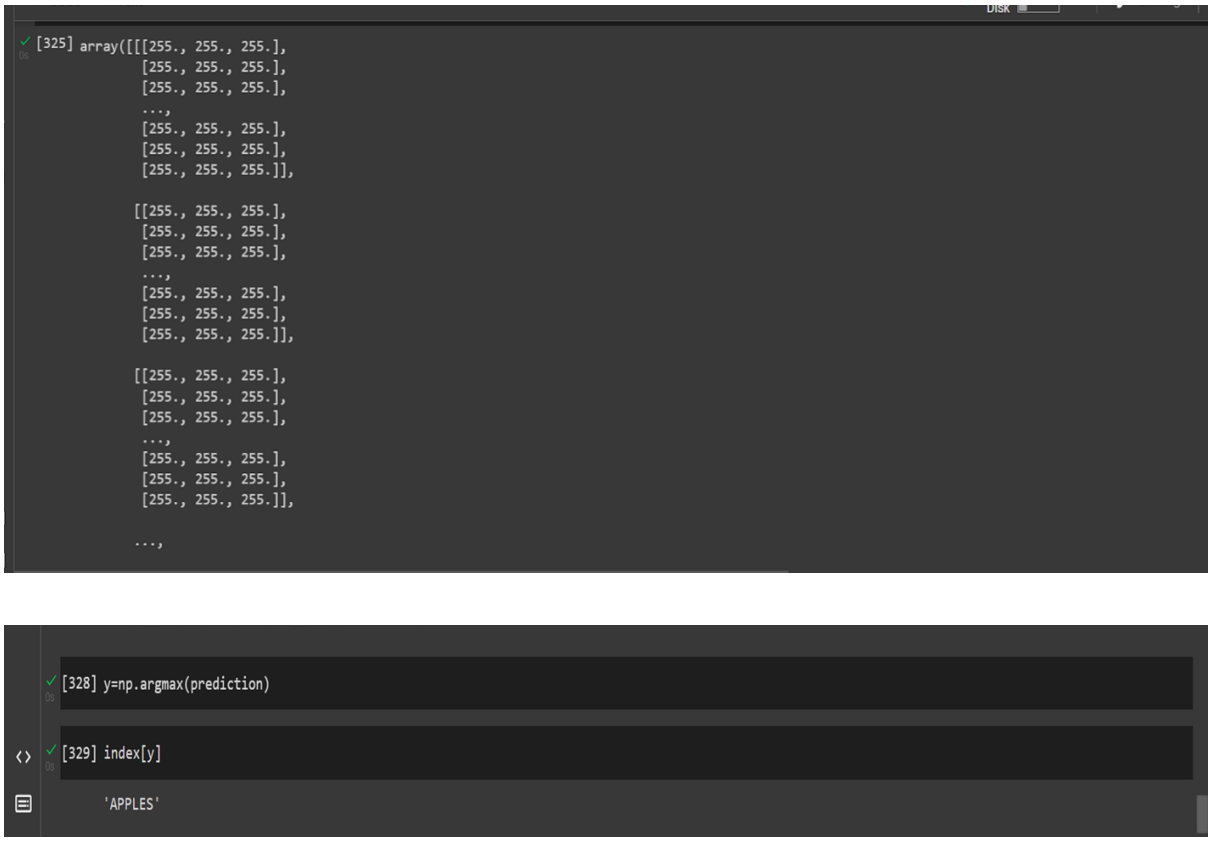


Fig.25 Image classification

Eventually after filtering the features of the loaded image using the convolution layers as in fig.25 , the classification of the image is done and the class that the image belongs to is displayed.

CHAPTER 9

TESTING

9.1. TEST CASES

- Verify user is able to see the home page or not
- Verify the UI elements in home page
- Verify user is able to select the dropdown value or not
- Verify user is able to upload the image or not
- Verify user is able to preview the image or not
- Verify whether the image is predicted correctly or no

9.2. USER ACCEPTANCE TESTING

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the Fertilizers Recommendation System for Disease Prediction project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	0	0	1	0	1
Duplicate	1	3	2	2	8
External	2	3	0	0	5
Fixed	4	4	4	4	16
Not Reproduced	0	0	0	1	1
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	7	10	7	7	31

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	1	0	0	1
Client Application	1	0	0	1
Security	1	0	0	1
Outsource Shipping	1	0	0	1
Exception Reporting	1	0	0	1
Final Report Output	1	0	0	1
Version Control	1	0	0	1

CHAPTER 10

RESULTS

10.1. PERFORMANCE METRICS

Fruits.h5

Model Summary:

```
model.summary()

Model: "sequential_3"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_3 (Conv2D)           (None, 62, 62, 64)        1792

 max_pooling2d_3 (MaxPooling  (None, 31, 31, 64)       0
 2D)

 conv2d_4 (Conv2D)           (None, 29, 29, 64)        36928

 max_pooling2d_4 (MaxPooling  (None, 14, 14, 64)       0
 2D)

 flatten_3 (Flatten)         (None, 12544)             0

=================================================================
Total params: 38,720
Trainable params: 38,720
Non-trainable params: 0
```

Accuracy:

```
[ ] Epoch 1/10
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a futu
  """Entry point for launching an IPython kernel.
172/172 [==============================] - 65s 373ms/step - loss: 0.7053 - accuracy: 0.7224 - val_loss: 0.5032 - val_accuracy: 0.8159
Epoch 2/10
172/172 [==============================] - 64s 372ms/step - loss: 0.4292 - accuracy: 0.8431 - val_loss: 0.4612 - val_accuracy: 0.8105
Epoch 3/10
172/172 [==============================] - 61s 357ms/step - loss: 0.3664 - accuracy: 0.8577 - val_loss: 0.6358 - val_accuracy: 0.7277
Epoch 4/10
172/172 [==============================] - 64s 370ms/step - loss: 0.3592 - accuracy: 0.8672 - val_loss: 0.4067 - val_accuracy: 0.8558
Epoch 5/10
172/172 [==============================] - 64s 370ms/step - loss: 0.3205 - accuracy: 0.8766 - val_loss: 0.3616 - val_accuracy: 0.8719
Epoch 6/10
172/172 [==============================] - 61s 353ms/step - loss: 0.3113 - accuracy: 0.8827 - val_loss: 0.4414 - val_accuracy: 0.8256
Epoch 7/10
172/172 [==============================] - 63s 367ms/step - loss: 0.3010 - accuracy: 0.8827 - val_loss: 0.3954 - val_accuracy: 0.8622
Epoch 8/10
172/172 [==============================] - 61s 356ms/step - loss: 0.2612 - accuracy: 0.9017 - val_loss: 0.3616 - val_accuracy: 0.8687
Epoch 9/10
172/172 [==============================] - 61s 353ms/step - loss: 0.2687 - accuracy: 0.9009 - val_loss: 0.3845 - val_accuracy: 0.8687
Epoch 10/10
172/172 [==============================] - 63s 368ms/step - loss: 0.2457 - accuracy: 0.9009 - val_loss: 0.3330 - val_accuracy: 0.8730
<keras.callbacks.History at 0x7fd93b9278d0>
```

CHAPTER 11

CONCLUSION AND FUTURE ENHANCEMENTS

11.1 ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- Accurate identification of fruit.
- Effective nutrition estimation.

DISADVANTAGES:

- The system can predict the nutrition only for the trained set of fruit dataset and it will not predict the nutrition for the non-trained set of fruit dataset.

11.2. CONCLUSION:

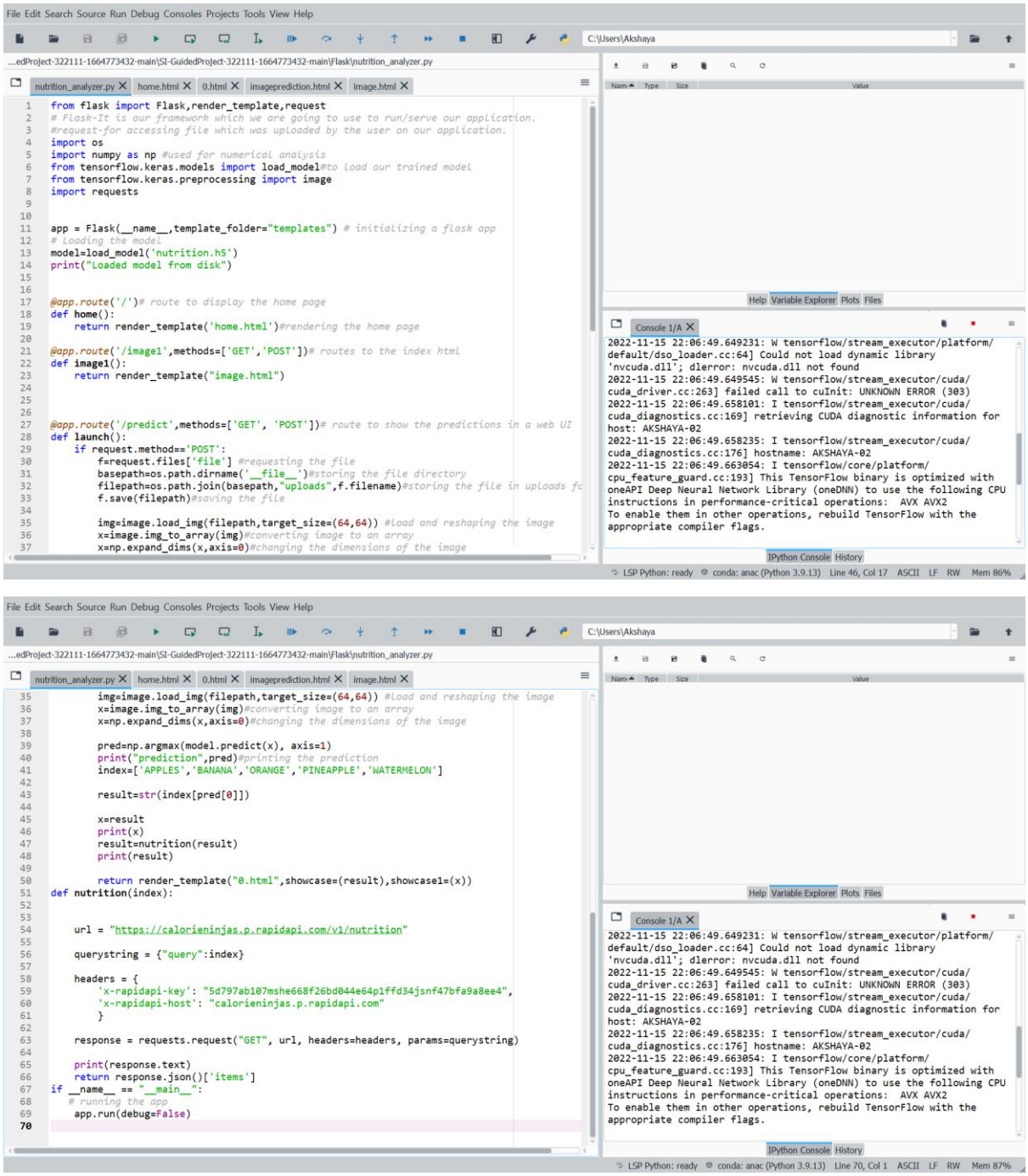
The convolution-based model is trained over a large number of fruit images, which enhances your model's ability to detect the required features quickly. In the analysis of the results, the accuracy of the training database of the obtained images is about 87%. We can create a large database that combines different fruit images to get the best result. The need to have a daily diet plan for the people who follow the fruitarian diet is important because of insufficient knowledge in taking the proper amount of fruit according to nutritional needs to maintain a healthy diet. Therefore, we have proposed a method of estimating the number of calories, proteins, fibre etc., from different fruit images by measuring factors such as the color, size, shape.

11.3. FUTURE ENHANCEMENT:

Further it can be developed by having specific diet patterns for different fitness enthusiasts who want to follow only vegan diet or paleo diet or low carbohydrates diet.

APPENDIX A

CODING SNIPPETS



```
from flask import Flask,render_template,request
# Flask-It is our framework which we are going to use to run/serve our application.
#request-for accessing file which was uploaded by the user on our application.
import os
import numpy as np #used for numerical analysis
from tensorflow.keras.models import load_model#to load our trained model
from tensorflow.keras.preprocessing import image
import requests


app = Flask(__name__,template_folder="templates") # initializing a flask app
# Loading the model
model=load_model('nutrition.h5')
print("Loaded model from disk")


@app.route('/')# route to display the home page
def home():
    return render_template('home.html')#rendering the home page

@app.route('/image1',methods=['GET','POST'])# routes to the index html
def image1():
    return render_template("image.html")



@app.route('/predict',methods=['GET', 'POST'])# route to show the predictions in a web UI
def launch():
    if request.method=='POST':
        f=request.files['file'] #requesting the file
        basepath=os.path.dirname('__file__')#storing the file directory
        filepath=os.path.join(basepath,"uploads",f.filename)#storing the file in uploads fo
        f.save(filepath)#saving the file

        img=image.load_img(filepath,target_size=(64,64)) #Load and reshaping the image
        x=image.img_to_array(img)#converting image to an array
        x=np.expand_dims(x,axis=0)#changing the dimensions of the image
```

```
        img=image.load_img(filepath,target_size=(64,64)) #Load and reshaping the image
        x=image.img_to_array(img)#converting image to an array
        x=np.expand_dims(x,axis=0)#changing the dimensions of the image

        pred=np.argmax(model.predict(x), axis=1)
        print("prediction",pred)#printing the prediction
        index=['APPLES','BANANA','ORANGE','PINEAPPLE','WATERMELON']

        result=str(index[pred[0]])

        x=result
        print(x)
        result=nutrition(result)
        print(result)

        return render_template("0.html",showcase=(result),showcase1=(x))
def nutrition(index):


    url = "https://calorieninjas.p.rapidapi.com/v1/nutrition"

    querystring = {"query":index}

    headers = {
        'x-rapidapi-key': "5d797ab107mshe668f26bd044e64p1ffd34jsnf47bfa9a8ee4",
        'x-rapidapi-host': "calorieninjas.p.rapidapi.com"
        }

    response = requests.request("GET", url, headers=headers, params=querystring)

    print(response.text)
    return response.json()['items']
if __name__ == "__main__":
    # running the app
    app.run(debug=False)
```

Fig.27 Implementation

APPENDIX B

Result Page Screenshots

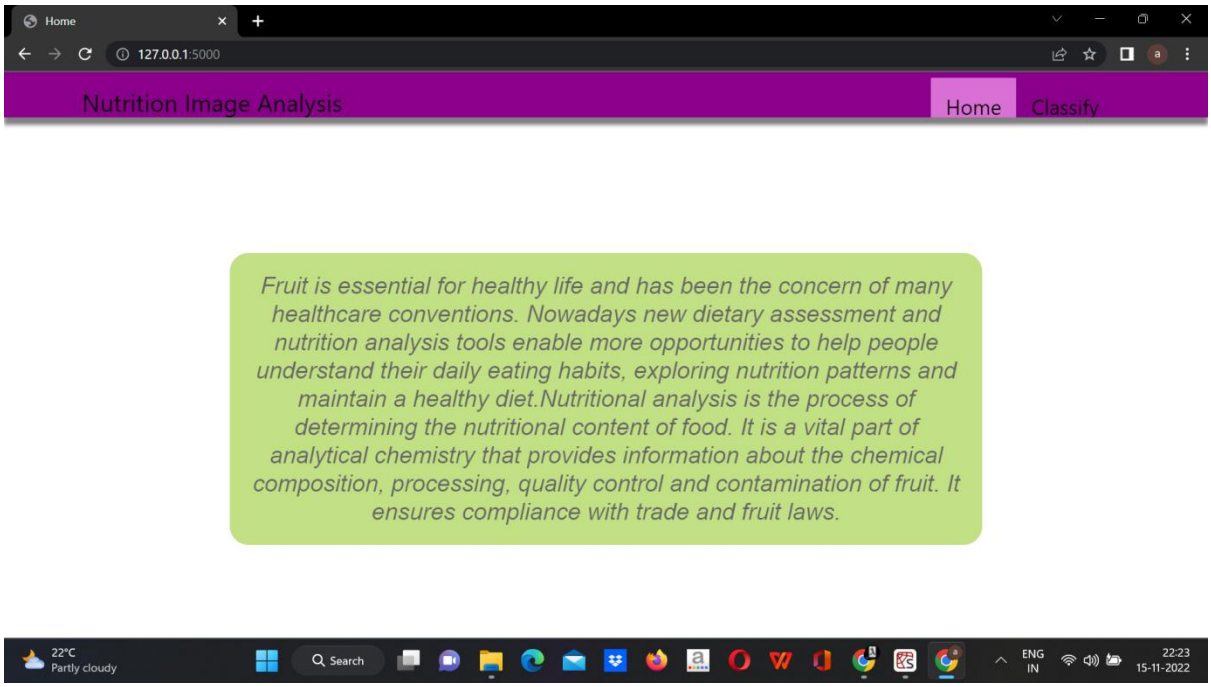


Fig.28 a) Home Page

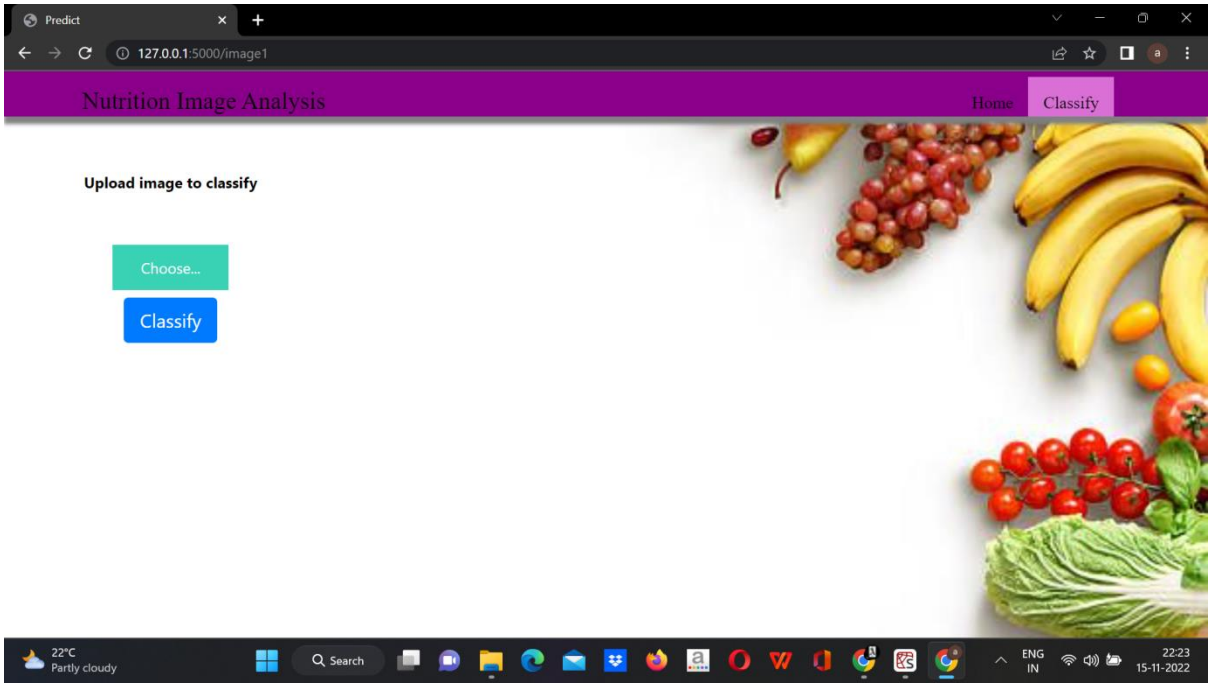


Fig.28 b) User interface

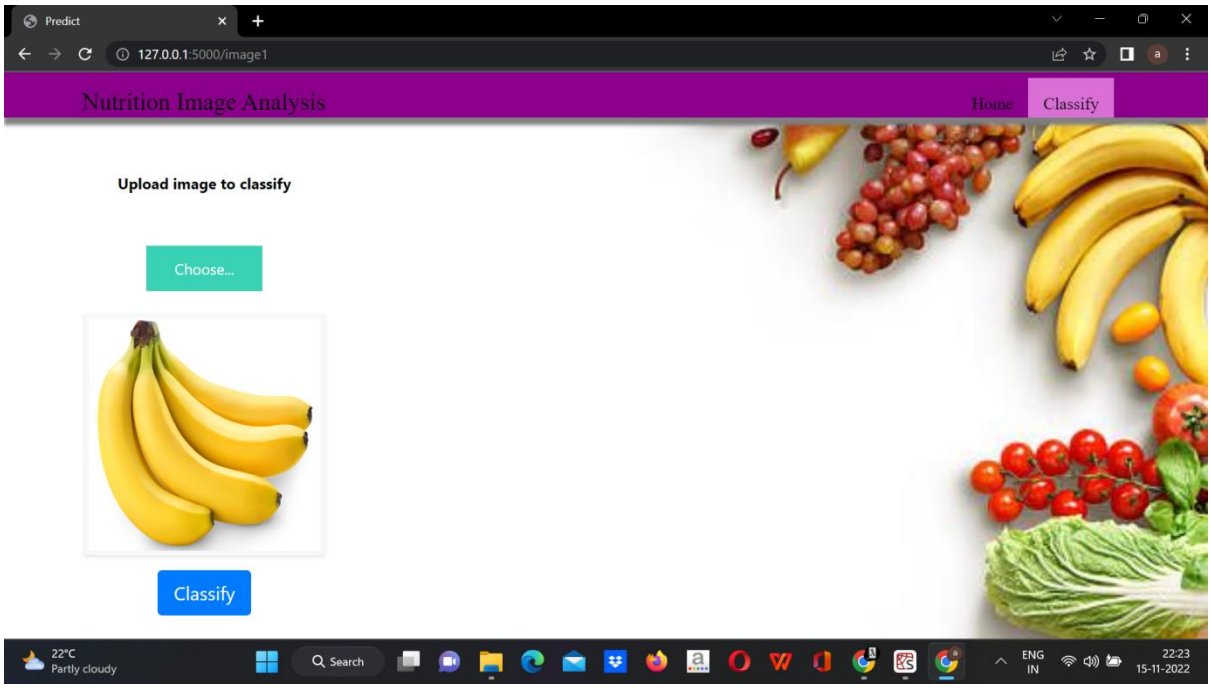


Fig.28 c) User Image Input

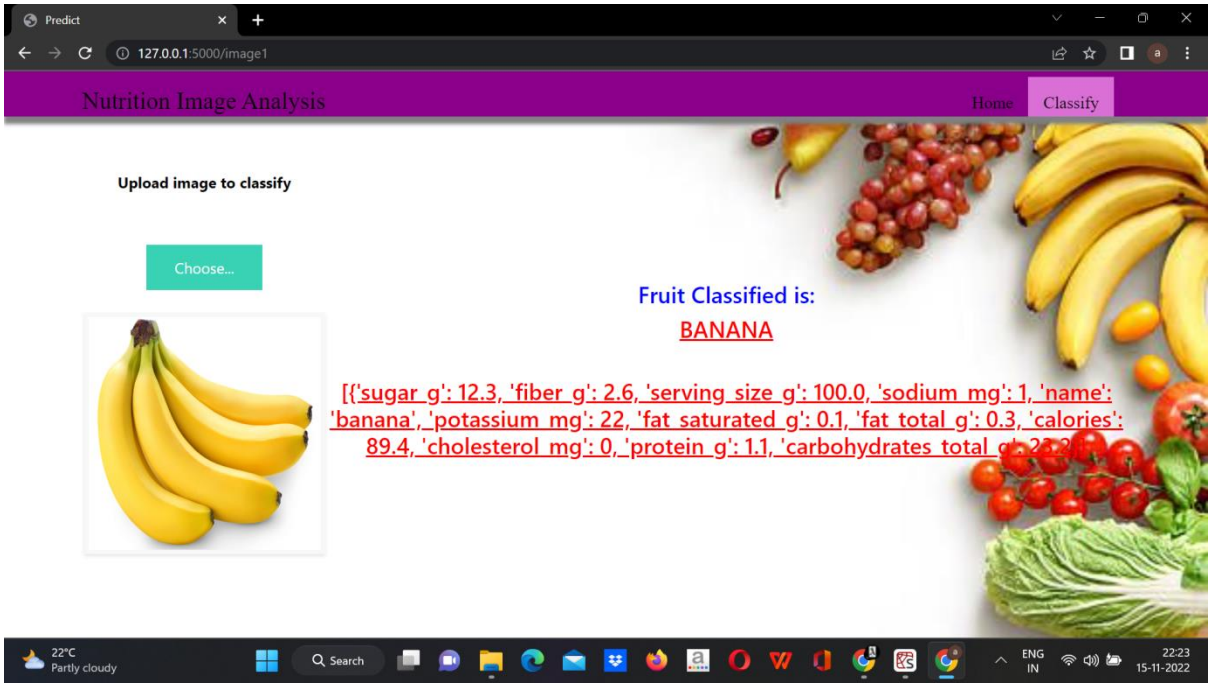


Fig.28 d) Nutrition prediction

APPENDIX C

GITHUB LINK

https://github.com/IBM-EPBL/IBM-Project-9961-1659085477

PROJECT DEMO LINK

https://drive.google.com/file/d/1zw7zarux11BOYjQ0unpc7-4evcOj3BDk/view?usp=share_link

REFERENCES

● Rajayogi, J.R., Manjunath, G. and Shobha, G., 2019, December. Indian Food Image Classification with
Transfer Learning. In 2019 4th International Conference on Computational Systems and Information
Technology for Sustainable Solution (CSITSS) (Vol. 4, pp. 1-4). IEEE.

● Reddy, V.H., Kumari, S., Muralidharan, V., Gigoo, K. and Thakare, B.S., 2019, May. Food Recognition and
Calorie Measurement using Image Processing and Convolutional Neural Network. In 2019 4th International Conference on Recent Trends on Electronics, Information, Communication & Technology (RTEICT) (pp. 109-115). IEEE.

●Subhi, M.A. and Ali, S.M., 2018, December. A deep convolutional neural network for food detection and
recognition. In 2018 IEEE-EMBS conference on biomedical engineering and sciences (IECBES) (pp. 284-
287). IEEE.

●Burugapalli, V.C. and Patil, P.C., TRANSFER LEARNING: INCEPTION-V3 BASED CUSTOM CLASSIFICATION APPROACH FOR FOOD IMAGES.

●Fruit Recognition and its Calorie Measurement: An Image Processing Approach Manpreet kaur Basant singh
Sardar1, Dr. Sayyad D. Ajij2 (2016)