AI-Powered Nutrition Analyzer For Fitness Enthusiast

IBM

PROJECT REPORT

Submitted by

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In partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

ARASU ENGINEERING COLLEGE,

KUMBAKONAM

INDEX

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.

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.).

1.2 Purpose

As the world is growing more fitness-conscious with time, there is an increasing demand for advanced technological solutions to cater to it. Lately, many applications worldwide are using predictive analytics artificial intelligence as well as natural language processing to help scores of fitness enthusiasts to monitor their nutrition and calorie intake. Artificial Intelligence and its subsets have been leveraged by these platforms to identify the calorie intake and then make food recommendations for a healthy diet.

LITERATURE SURVEY

[1] A New Deep Learning-based Food Recognition System for Dietary Assessment on An Edge Computing Service Infrastructure.

A deep learning-based visual food recognition algorithms to achieve the best-in-class recognition accuracy. A design of food recognition system employing edge computing-based service computing paradigm to overcome some inherent problems of traditional mobile cloud computing paradigm, such as unacceptable system latency and low battery life of mobile devices.

Algorithms Used:

- K-means clustering algorithms
- Convolutional Neural Network
- Deep learning

Challenges:

Using this simple cropping-based approach will not work well if the food is scattered on different parts of the image.

[2]AI in dietary assessment of nutritional system.

Mobile applications based on systems using AI are of significant importance in the field of nutritional prophylaxis. In 2008, Sun et al. proposed an electronic photographic approach and associated image processing algorithms to estimate food portion size. Lu et al., in a recent publication, offered go FOODTM as a dietary assessment system based on AI. It can estimate the calorie and macronutrient content of a meal, on the sole basis of food images captured by a smartphone.

Algorithm Used:
- Iterative closest point algorithm
- Clustering algorithm

Challenges:

Significant costs, time burden, technical complexity, and limited investment in dietary research infrastructure, including the necessary tools.

[1]Deep Food : Food Image Analysis and Dietary Assessment via Deep Model.

This system will analyze the nutritional ingredients based on the recognition results and generate a dietary assessment report by calculating the amount of calories, fat, carbohydrate and protein.

Algorithms Used:

• Region-based Convolutional Neural Network

• Convolutional Neural Network

• Non-maximum suppression

• Bounding Box Regression

• Deep learning

Challenges:

Three main challenges in real food image recognition and analysis are addressed as follows:

1. Region of Interest

2. The Delay of Food Recognition

3. Insufficient Information of Nutrition Content for dietary assessment

[4] Precision Nutrient Management Using Artificial Intelligence Based on Digital Data Collection Framework

Nutritional intake is fundamental to human growth and health, and the intake of different types of nutrients and micronutrients can affect health.The content of the diet affects the occurrence of disease, with the incidence of many

diseases increasing each year while the age group at which they occur is gradually decreasing.

Algorithm Used:
- Okapi BM25
- TF-IDF
- Levenshtein
- Jaccard
- Synonyms

Challenges:

This model has very little error and can significantly improve the efficiency of the analysis.

[5]Calculating Nutrition Facts with Computer Vision

People are becoming more health-conscious than before. However, there is a lack of knowledge about different fitness and wellness aspects of food. Thus, I come up with Foodify.ai — a deep learning-based application that detects food from the image and provides information of food such as protein, vitamins, calories, minerals, carbs, etc.

Algorithm Used:
- Deep learning
- Machine learning
- Image Processing

Challenges:

1. This is to collect images to create a huge dataset.

2. It is an extremely computationally expensive and time-consuming task to train the model again and again. This can be solved by using cloud-based services.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours 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. 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.

3.2 Ideation & 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 amount of creative solutions.

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

Step-2: Brainstorm, Idea Listing and Grouping

2

Brainstorm

Write down any ideas that come to mind
that address your problem statement.

⏱ 10 minutes

TIP

You can select a sticky note
and hit the pencil [switch to
sketch] icon to start drawing!

JAYASRI	DHARANIKA	GAYATHRI	KAMINIDEVI
Asks to enter the weight and height to calculate BMI	Tracking Food Consumption	Measuring the physical and chemical components in the food	Tracking health care plan of an individual
Calculate the nutrient content in their food by uploading images	Nutrition Facts	Check the quantity of food	Tracking calories in the food by uploading images
Assess nutrient rich foods based on their health conditions	Calories estimation	Indicates calories content of daily taken food	Suggests food based on their health conditions
Awards the user who takes balanced nutrient food on daily basis	FAQs	Maintain the daily food habits and menus	Suggests regular physical activities for good health

Step-3: Idea Prioritization

4

Prioritize

Your team should all be on the same page about what's important
moving forward. Place your ideas on this grid to determine which
ideas are important and which are feasible.

⏱ 20 minutes

→

After you collaborate

You can export the mural as an image or pdf
to share with members of your company who
might find it helpful.

Quick add-ons

A **Share the mural**
Share a view link to the mural with stakeholders to keep
them in the loop about the outcomes of the session.

B **Export the mural**
Export a copy of the mural as a PNG or PDF to attach to
emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or
strategy.
Open the template →

Customer experience journey map
Understand customer needs, motivations, and
obstacles for an experience.
Open the template →

Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities,
and threats (SWOT) to develop a plan.
Open the template →

Share template feedback

♡ **Importance**
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

Yellow notes on grid: Calculate the nutrient content in their food by uploading images; Calories estimation; Asks to enter the weight and height to calculate BMI; Maintain the daily food habits and menus; Estimate the nutrition level; FAQs; Suggests food based on their health conditions; Tracking health care plan of an individual; Check the quantity of food

TIP
Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can control the zoom by using the laser pointer holding the M key on the keyboard.

3.3 Proposed Solution

S.NO	PARAMETER	DESCRIPTION
1.	Problem statement(problem to be solved)	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.
2.	Idea / solution description	The idea of the project is to building a model which is used for classifying the fruit depends on the different characteristics like color, shape, texture etc.
3.	Novelty / uniqueness	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.).

4.	Social impact / customer satisfaction	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. This project is very helpful to People. Everyone Maintaining their own diet, to manage the time.
5.	Business model	By using this system, the users can predict and analyze the picture of the fruits and foods. In which it results to the visualizing the description of the foods taken as input.
6.	Scalability of the solution	By implementing this system, the people can efficiently and effectively to gain knowledge about the fitness .They want and they wish to use at anytime. This system can also be integrated with the future technologies

3.4 Problem Solution fit
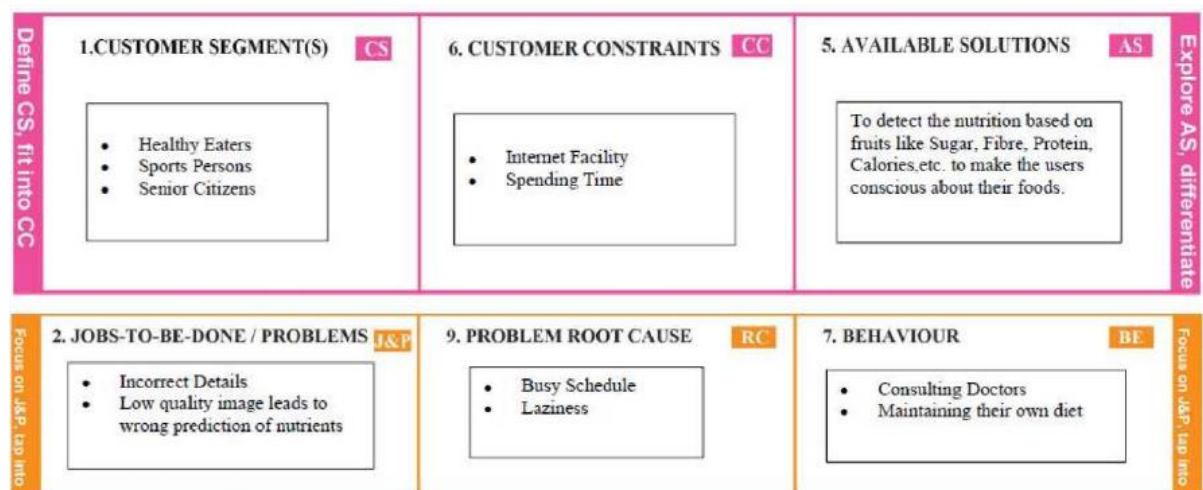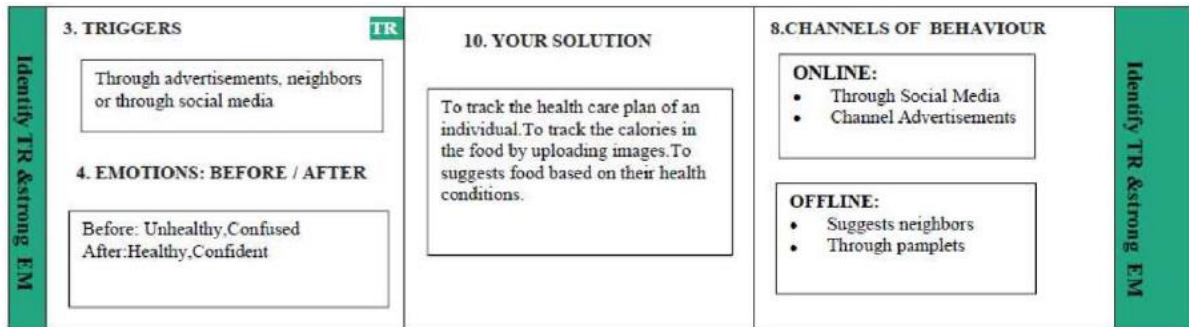
4. REQUIREMENT ANALYSIS

4.1 Functional Requirements:
Following are the functional requirements of the proposed solution.

FR.No	Functional Requirement	Sub Requirement(Story / Task)
FR-1	User Requirement	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Capturing Image	Capture the image of the fruit and check the parameter of the captured image.
FR-4	Image Processing	Upload the image for the Identification of the nutrition in the Fruit.
FR-5	Nutrition Identification	Identify the fruit and analyse the nutrition level
FR-6	Image Description	Suggested the best nutrition food

4.2 Non-Functional requirements

Fr No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The users should be able to use the application without any difficulties. The interface should be easy to use and understand. The image capture process should be smooth and not tedious.
NFR-2	**Security**	Details of the users and their personal calories calendar should not be disclosed or shared to other users. Privacy of data should be ensured.
NFR-3	**Reliability**	This application should correctly identify fruits from the captured image and fetch its nutritional value the count and calculate the calories should be done accurately

|		
NFR-4	**Performance**	The application should be built on a highly efficient prediction model such that the results are accurate. It should keep in mind time and space complexity.
NFR-5	**Availability**	The application should be available to its users at all times and should work efficiently. It should not suffer from issues such as application crashes.

5. PROJECT DESIGN

5.1 Data Flow Diagram
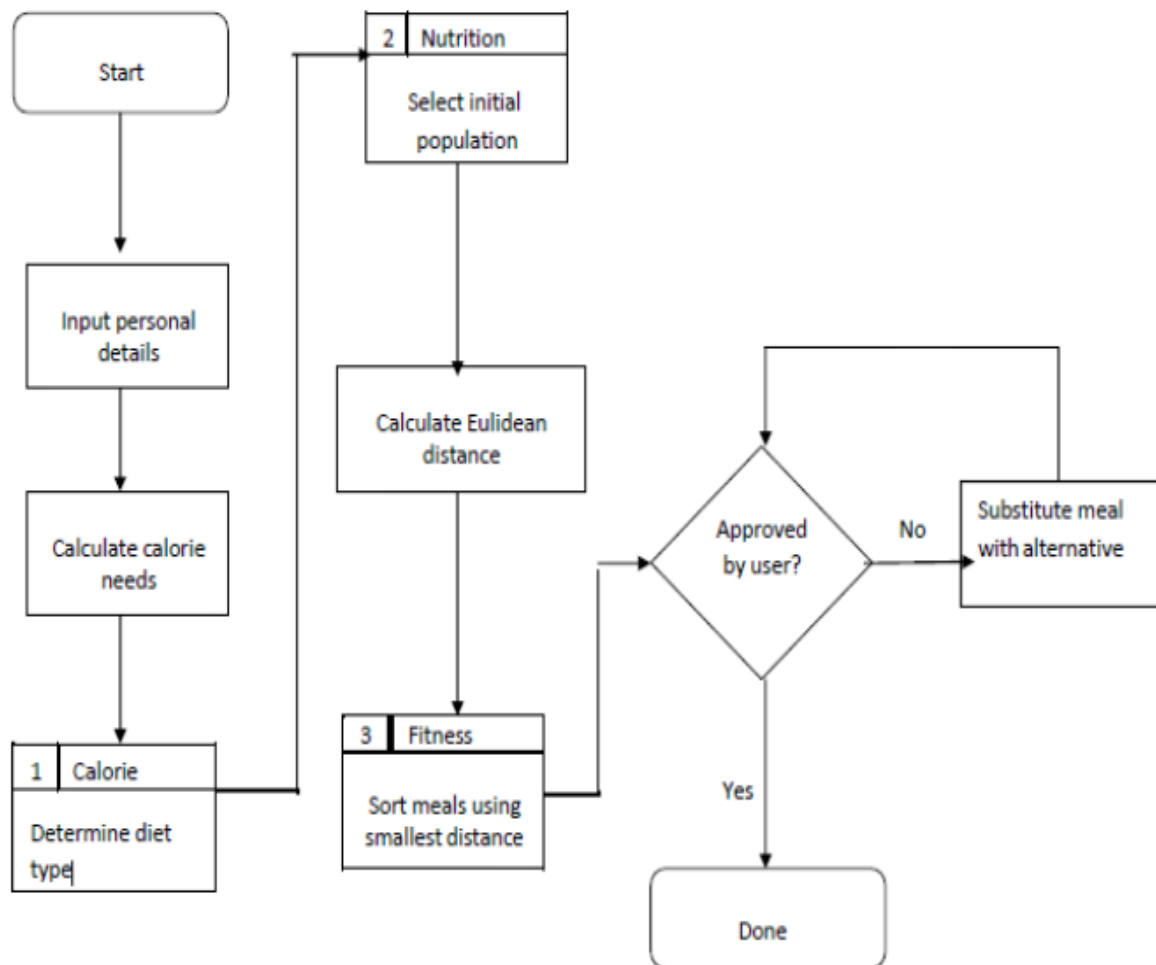
5.2 Solution & Technical Architecture
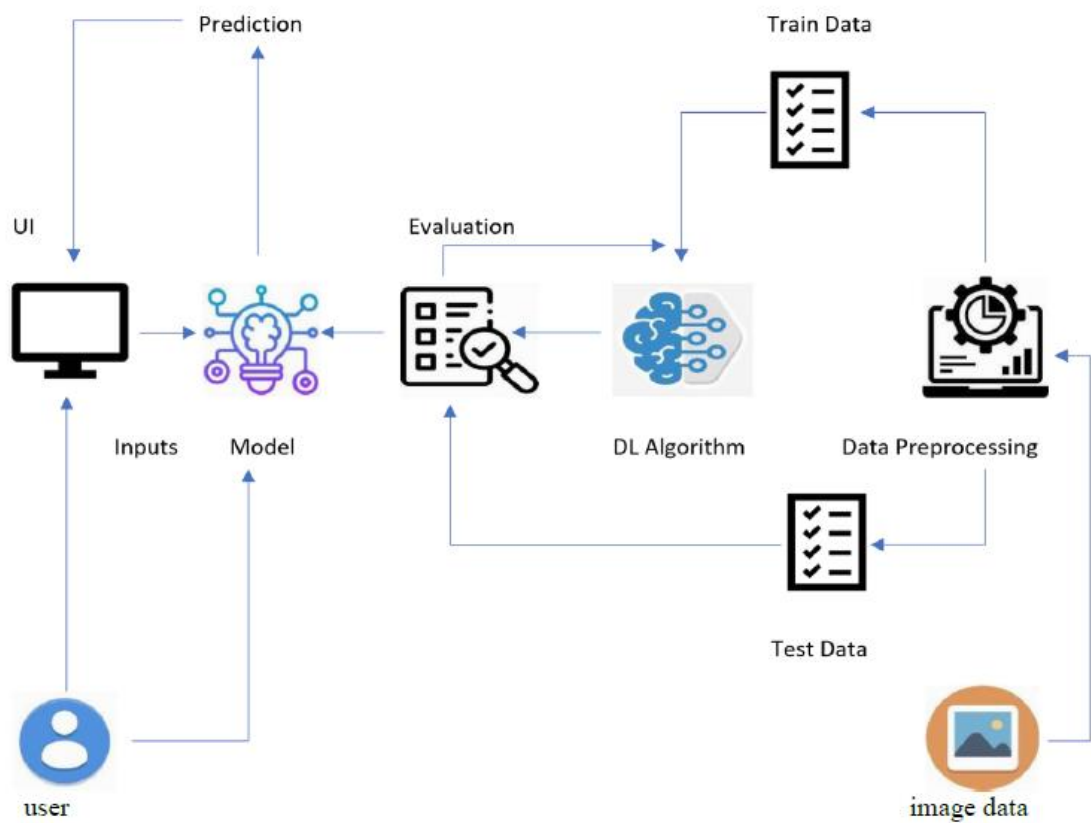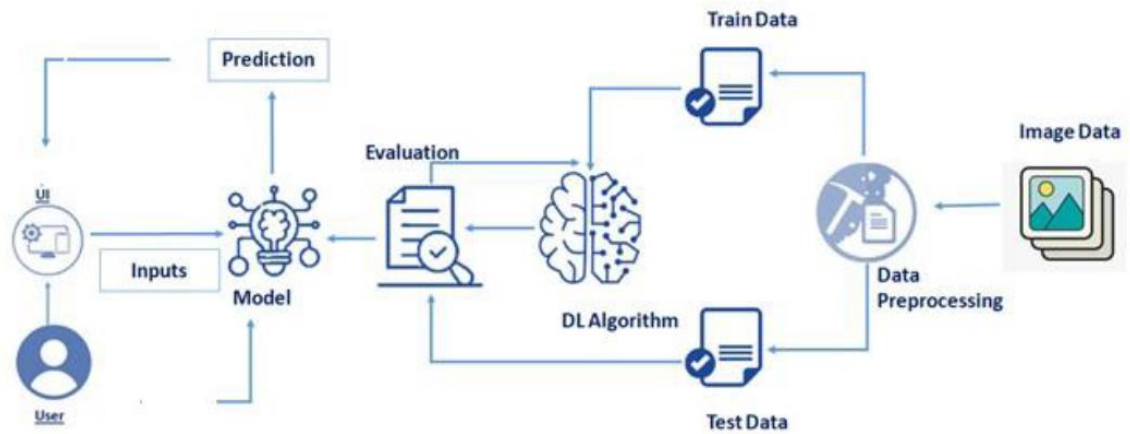
6. PROJECT PLANNING & SCHEDULING

6.1 sprint planning and estimation

Sprint	Functional requirement	User story number	User story / task	Story points	priority	Team members
Sprint 1	Registration	USN-1	As a user, First I have to register for IBM cloud	2	High	Jayasri Kaminidevi Dharanika gayathri
Sprint 1	Collection of datasets	USN-2	As a user, I have to collect and download the datasets	2	High	Jayasri Kaminidevi Dharanika Gayathri
Sprint 1	Image preprocessing	USN-3	After collecting the datasets,Image Preprocessing has to be done	2	Medium	Dharanika Gayathri
Sprint 1	Model building	USN-4	After image preprocessing, user has to build the model	2	High	Jayasri Kaminidevi Dharanika Gayathri
Sprint 2	-	USN-5	As a user, I have to develop a code for this model building and I have to build a model	2	High	Jayasri Kaminidevi Dharanika

						Gayathri
Sprint 2	Application building	USN-6	After model building,I have to create an application for the end users	2	High	Jayasri Kaminidevi Dharanika gayathri
Sprint 3	-	USN-7	As a user, I have to Create a folder which contains all the necessary html, css,js and python coding files	2	Medium	Dharanika Gayathri Kaminidevi
Sprint 3	-	USN-8	I have to create a folder name flask,where I have to paste all the above mentioned coding files in that folder	1	High	Jayasri Kaminidevi Dharanika Gayathri
Sprint 4	Outputs	USN-9	Link the flask file with html files and I have to share the screenshots of the output webpage	2	High	Jayasri Kaminidevi Dharanika Gayathri
Sprint 4		USN-10	As a user, I have to deploy the model on IBM	2	High	Jayasri Kaminidevi Dharanika Gayathri

6.2 Sprint Delivery Schedule

The delivery plan of project deliverables is a strategic element for every project manager. The goal of every project is in fact to produce a result that serves a specific purpose. With the word "purpose ", we can mean the most disparate goals, a software program, a chair, a building, translation, etc.

In project sprint Delivery Planning is one of the processes of completing the project and Showcasing the timeline of the project planning. This delivery plan helps to understand the process and workflow of the project working by the team mates. Every single module are assigned to the teammates to showcase their work and contribution of developing the Project.

Delivery Plan

Spirit Model Planning

Spirit One
- The team should conduct a proof of concept.
- The team should start by outlining the milestones.
- The team should monitor the process efficiency.

Spirit Two
- The team make any final adjustments to the process.
- The team should make the prototype for their project.
- The team should start by analysis the project Specification.

Spirit Three
- The team mates should understand the project Flow
- The team should monitor the process of work
- The team should follow the project Management System

Spirit Four
- The team will show the Demo process to team mentor.
- The team mates will updating the project modules in cloud
- The team make to deploy the final Model for the Testing Process

6.3 Reports from JIRA

JIRA has categorized reports in four levels, which are

1.Agile

2.detection of items

3.deatails generation

4.others

VELOCITY: SPRINT - 1

Sprint duration = 5 days
Velocity of team = 20 points

$$\text{Average Velocity (AV)} = \frac{\text{Velocity}}{\text{Sprint duration}}$$

$AV = 20/5 = 4$

> **_Average Velocity = 4_**

VELOCITY: Sprint 1 - 4

Sprint duration = 20 days
Velocity of team = 80 points

$$\text{Average Velocity (AV)} = \frac{\text{Velocity}}{\text{Sprint duration}}$$

$AV = 80/20 = 4$

> **_Total Average Velocity = 4_**

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

7.1 Feature 1

```
In [73]:  import numpy as np
          import tensorflow
          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
          from keras.preprocessing.image import ImageDataGenerator
```

DATA AUGMENTATION

TESTING AND TRAINING

```
In [74]:  import os, types
          import pandas as pd
          from botocore.client import Config
          import ibm_boto3

          def __iter__(self): return 0

          # @hidden_cell
          # The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
          # You might want to remove those credentials before you share the notebook.
          cos_client = ibm_boto3.client(service_name='s3',
              ibm_api_key_id='5Lj0HGwwDuTqeL545tX4VeIBqI9_mpPA6hiunt9ltdjb',
              ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
              config=Config(signature_version='oauth'),
              endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')

          bucket = 'imageclassification-donotdelete-pr-2slksiubpgncif'
          object_key = 'Dataset.zip'

          streaming_body_2 = cos_client.get_object(Bucket=bucket, Key=object_key)['Body']
```

```
In [75]:  from io import BytesIO
          import zipfile
In [76]:  pwd
```

Out[76]: '/home/wsuser/work'

```
In [77]:  import os
          filesnames = os.listdir("/home/wsuser/work/Dataset/TRAIN_SET")
```

```
In [78]:  train_datagen = ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
          test_datagen=ImageDataGenerator(rescale=1./255)
```

```
In [79]:  x_train = train_datagen.flow_from_directory(
              r'/home/wsuser/work/Dataset/TRAIN_SET',
              target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
          x_test = test_datagen.flow_from_directory(
              r'/home/wsuser/work/Dataset/TEST_SET',
              target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')

          Found 2626 images belonging to 5 classes.
          Found 1055 images belonging to 5 classes.
```

```
In [80]:  print(x_train.class_indices)

          {'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}
```

```
In [81]:    print(x_test.class_indices)

            {'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}

In [82]:    from collections import Counter as c
            c(x_train .labels)

Out[82]:   Counter({0: 606, 1: 445, 2: 479, 3: 621, 4: 475})
```

INITIALIZATION OF CNN

PERFORMING THE FOLLOWING:

1. Adding the convolution layer
2. Adding maxpooling layer
3. Second Maxpooling snf convolution layers
4. Flattening of layers
5. Adding Dense layer

```
In [83]:    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())
            classifier.add(Dense(units=128, activation='relu'))
            classifier.add(Dense(units=5, activation='softmax'))
```

```
In [84]:    classifier.summary()

            Model: "sequential_1"
            _____
            Layer (type)                 Output Shape              Param #
            =================================================================
            conv2d_2 (Conv2D)            (None, 62, 62, 32)        896

            max_pooling2d_2 (MaxPooling  (None, 31, 31, 32)        0
            2D)

            conv2d_3 (Conv2D)            (None, 29, 29, 32)        9248

            max_pooling2d_3 (MaxPooling  (None, 14, 14, 32)        0
            2D)
```

Requirement already satisfied: botocore<1.22.0,>=1.21.21 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning
-client) (1.21.41)
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from botocore<1.22.0,>=1.21.21->b
oto3->watson-machine-learning-client) (2.8.2)
Requirement already satisfied: six>=1.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from python-dateutil<3.0.0,>=2.1->botocore<1.22.0,>=
1.21.21->boto3->watson-machine-learning-client) (1.15.0)
Requirement already satisfied: ibm-cos-sdk-core==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-lea
rning-client) (2.11.0)
Requirement already satisfied: ibm-cos-sdk-s3transfer==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machi
ne-learning-client) (2.11.0)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->watson-machine-learning-client)
(3.3)
Requirement already satisfied: charset-normalizer~=2.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->watson-machine-learn
ing-client) (2.0.4)
Requirement already satisfied: pytz>=2017.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client) (20
21.3)
Requirement already satisfied: numpy>=1.17.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client)
(1.20.3)

```
In [35]:    from ibm_watson_machine_learning import APIClient
            wml_credentials= {"url":"https://us-south.ml.cloud.ibm.com","apikey":"sFYJM2RQbIt39atcqI8BbnhEEJsBl9nBHWLeyeKC0vdq"}
            client=APIClient(wml_credentials)

In [36]:    def guid_from_space_name(client,space_name):
                space=client.spaces.get_details()
                return(next(item for item in space['resources']if item['entity']["name"]==space_name)['metadata']['id'])

In [50]:    space_uid=guid_from_space_name(client,'imageclassification')
            print("Space UID = "+ space_uid)

            Space UID = c69b5cda-6240-47d0-9324-3f683ca61ce2

In [51]:    client.set.default_space(space_uid)

Out[51]:   'SUCCESS'
```

```
pytorch-onnx_1.1-py3.6-edt    32983cea-3f32-4400-8965-dde874a8d67e  base
spark-mllib_3.0-py37          36507ebe-8770-55ba-ab2a-eafe787600e9  base
spark-mllib_2.4               390d21f8-e58b-4fac-9c55-d7ceda621326  base
autoai-ts_rt22.2-py3.10       396b2e83-0953-5b86-9a55-7ce1628a406f  base
xgboost_0.82-py3.6            39e31acd-5f30-41dc-ae44-60233c80306e  base
pytorch-onnx_1.2-py3.6-edt    40589d0e-7019-4e28-8daa-fb03b6f4fe12  base
pytorch-onnx_rt22.2-py3.10    40e73f55-783a-5535-b3fa-0c8b94291431  base
default_r36py38               41c247d3-45f8-5a71-b065-8580229facf0  base
autoai-ts_rt22.1-py3.9        4269d2Ge-07ba-5d40-8f66-2d495b0c71f7  base
autoai-obm_3.0                42b92e18-d9ab-567f-988a-4240ba1ed5f7  base
pmml-3.0_4.3                  493bcb95-16f1-5bc5-bee8-81b8af80e9c7  base
spark-mllib_2.4-r_3.6         49403dff-92e9-4c87-a3d7-a42d0021c095  base
xgboost_0.90-py3.6            4ff8d6c2-1343-4c18-85e1-689c965304d3  base
pytorch-onnx_1.1-py3.6        50f95b2a-bc16-43bb-bc94-b0bed208c60b  base
autoai-ts_3.9-py3.8           52c57136-80fa-572e-8728-a5e7cbb42cde  base
spark-mllib_2.4-scala_2.11    55a70f99-7320-4be5-9fb9-9edb5a443af5  base
spark-mllib_3.0               5c1b0ca2-4977-5c2e-9439-ffd44ea8ffe9  base
autoai-obm_2.0                5c2e37fa-80b8-5e77-840f-d912469614ee  base
spss-modeler_18.1             5c3cad7e-507f-4b2a-a9a3-ab53a21dee8b  base
cuda-py3.8                    5d3232bf-c86b-5df4-a2cd-7bb870a1cd4e  base
runtime-22.2-py3.10-xc        5e8cddff-db4a-5a6a-b8aa-2d4af9864dab  base
autoai-kb_3.1-py3.7           632d4b22-10aa-5180-88f0-f52dfb6444d7  base
---------------------------   -----------------------------------   ----
Note: Only first 50 records were displayed. To display more use 'limit' parameter.
```

```
[53]:   software_spec_uid=client.software_specifications.get_uid_by_name("tensorflow_1.15-py3.6")
        software_spec_uid

t[53]:  '2b73a275-7cbf-420b-a912-eae7f436e0bc'

[54]:   software_spec_uid = client.software_specifications.get_uid_by_name("tensorflow_rt22.1-py3.9")
        software_spec_uid

t[54]:  'acd9c798-6974-5d2f-a657-ce0Ge986df4d'
```

8.TESTING

Test Case ID	Purpose	Test Cases	Result
TC 1	Validation	Image in PDF format	Image should be in JPG, JPEG or PNG
TC 2	Validation	Image in DOCX format	Image should be in JPG, JPEG or PNG
TC 3	Validation	Image in BMP format	Image should be in JPG, JPEG or PNG

9.RESULTS

9.1 Performance Metrics

- Tracking nutrients intake: Monitoring the diet plan and tracking all the nutrients intake.

- Validating outcome: Capture and find the nutrients present in the given data sample.

- Reports: The tracking app generates and sends reports to give a detailed insight about the diet plan,amount of calorie intake and nutritional value of the given sample.

10.ADVANTAGES

- The new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits

- It help in exploring the nutrition patterns in their daily routines and this is very useful for people to maintain a healthy diet balances.

- The nutritional analysis is used to determine the nutritional content of food.

- This application eliminates the travelling cost in visiting a dietician.

- The usage of this application greatly reduces the time required to get the best diet plan.

- Achieve your fitness goals with a tailored web app that perfectly fits your diet.

- Deliver an outstanding user experience through additional control over the app.

- Control the security of your user data.

- Increase efficiency and user satisfaction with an app aligned to their needs.

DISADVANTAGES

- The android mobile user will not be able to insert or view details if the server goes down.
- Thus there is disadvantage of single point failure.
- Some nutritional software packages are of poor quality, and the technical support provided to users is sometimes inadequate.
- This review examines some of the sources of error associated with the use of nutritional analysis software.

11.CONCLUSION

This work provided an overview of existing AI nutrition recommender systems, a field that has experienced substantial growth in the last few years. A categorization of such systems into task specific components was presented, along with approaches concerned with each component and relevant data-sets. An assessment of the feasibility of implementing an ideal AI nutrition recommender system using current methods was also provided, with the general conclusion being that some of the required components have not reached a mature state yet.

12. FUTURE SCOPE

The application is unable to maintain the backup of data once it is uninstalled.

This application does not provide higher decision capability.

To further enhance the capability of this application, we recommend the following features to be incorporated into the system:

- Multiple language interfaces.

- Provide backup and recovery of data.

- Provide a better user interface for users.

- Mobile apps advantage.

13.APPENDIX
Source code:

Index.html

```html
<html lang="en">

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>Nutrition Analyzer</title>
    <link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
rel="stylesheet">
    <script
src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
    <script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
    <script
src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
    <link href="{{ url_for('static', filename='css/main.css') }}"
rel="stylesheet">
    <style>
        #result {
            color: #000000;
        }

        body {
            background-color: #a0e4cb;
            background-image:
url("https://www.transparenttextures.com/patterns/mirrored-squares.png");
            /* This is mostly intended for prototyping; please download the
pattern and re-host for productionenvironments. Thank you! */
        }
    </style>
</head>

<body>
    <nav class="navbar navbar-dark bg-dark">
```

```html
        <div class="container">
            <a class="navbar-brand" href="#">AI-Powered Nutrition Analyzer for
Fitness Enthusiasts</a>
        </div>
    </nav>
    <div class="container">
        <div id="content" style="margin-top:2em">
            <div class="container">
                <div class="row" style="height:60%">
                    <div class="col-sm-6 bd">
                        <h3>NUTRITION ANALYZER: </h3>
                        <br>
                        <p>Nutritional analysis is the process of determining
the nutritional content of food. It is a
                            vitalpart of analytical chemistry that provides
information about the chemical composition,
                            processing, quality controland contamination
                            of food.Nutritional Analysis ensures that the food
has optimal requirement of vitamins
                            andminerals wherein the examining of nutrition in
food helps in understanding about the fat
                            proportion,
                            carbohydrates dilution, proteins,
                            fiber, sugar, etc.</p>
                    </div>
                    <div class="col-sm-6">
                        <img style="height: 70%"
src="https://www.mlchc.org/sites/default/files/styles/max_650x650/public/2022-
03/nutrition_image2.jpg?itok=fUi0J40D" height="20%",width="5%">
                    </div>
                </div>
                <div style="display: flex;justify-content:center;">
                    <div>
                        <h4>Upload Image Here</h4>
                        <form method="post" action="/"
enctype="multipart/form-data">
                            <label for="imageUpload" class="upload-label">
                                Choose
                            </label>
                            <!--<input type="file" name="image"
id="imageUpload">-->
                            <input type="file" name="file" autocomplete="off"
required>
                            <!--<button type="submit"  id="btn-
predict">Analyze!</button>-->
                            <input type="submit" value="Analyze!">

                        <!-- <div class="image-section" style="display:none;">
```

```html
                            <div class="img-preview">
                                <div id="imagePreview">
                                </div>
                            </div>
                            <div style="border: 5px solid red;">
                                <button type="submit"  id="btn-
predict">Analyze!</button>
                            </div>
                        </div> -->
                        <!-- <div class="loader" style="display:none;"></div>
-->
                        <h3>
                            <span id="result"> {{ message }}</span>
                        </h3>

                    </form>
                    </div>
                </div>
            </div>
        </div>

</body>
<footer>
    <script src="{{ url_for('static', filename='js/main.js') }}"
type="text/javascript"></script>
</footer>

</html>
```

Python code :

```python
import os
from app import app
import urllib.request
from flask import Flask, flash, request, redirect, url_for, render_template
from werkzeug.utils import secure_filename

# ALLOWED_EXTENSIONS = set("png", "jpg", 'jpeg', 'gif')


def allowed_extensions():
    return {'png', 'jpg', 'jpeg', 'gif'}


def allowed_file(filename):
```

```python
    return '.' in filename and filename.rsplit('.', 1)[1].lower() in
allowed_extensions()


@app.route('/')
def upload_form():
    return render_template('index.html')


@app.route('/', methods=['POST'])
def upload_image():
    if 'file' not in request.files:
        flash('No file part')
        return redirect(request.url)
    file = request.files['file']
    if file.filename == '':
        message = """No image selected for uploading"""
        return redirect(request.url)
    if file and allowed_file(file.filename):
        filename = secure_filename(file.filename)
        message = None
        file.save(os.path.join(app.config['UPLOAD_FOLDER'], filename))
        # print('upload_image filename: ' + filename)
        if filename.split('.')[0].lower() == """apple""":
            # flash('Image successfully uploaded and displayed below')
            message = """APPLE ===>
            *Calories 96
            *Protein - 0.59g
            *Carbohydrate 25g
            *Fats -0.39g
            *Dietary Fiber 4.4g
            *Sugar 14 g
            *Sodium 18mg
            *Potassium 194.7mg"""
        elif filename.split('.')[0].lower() == """banana""":
            message = """BANANA  ===>
            *Calories 105
            *Protein 1.39 g
            *carbohydrate 279g
            *Fats 0.49g
            *Dietary fibre 6.14g
            *Sodium 1.2 mg
            *Potassium 422 mg"""
        elif filename.split('.')[0].lower() == """orange""":
            message = """ORANGE  ===>
            *Calories 105
            *Protein 0.9g
            *Fats 0.1g
            *Carbohydrate 18g
```

```python
            *Dietary fiber 2.39
            *Sugar 9g
            *Sodium 0mg
            *Potassium 173.8mg"""
        elif filename.split('.')[0].lower() == """pineapple""":
            message = """PINEAPPLE  ===>
            *Calories 452"
            *Protein-4.99g
            *Fats 11g
            *Carbohydrates -199g
            *Dietary Fiber 139g
            *Sugar 89g
            *Sodium 9.1 mg
            *Potassium 986.5mg"""
        elif filename.split('.')[0].lower() == """watermelon""":
            message = """WATERMELON  ===>
            *Calories 1371
            *Protein 26g
            *Fats-7g
            *Carbohydrate 341g
            *Dietary Fiber 18g
            *Sugar 280g
            *Sodium 45.2 mg
            *Potassium 5060.2 mg"""
        else:
            message = "Sorry!, I don't have any information of this
Fruit/Vegetable."
        return render_template('index.html', filename=filename,
message=message)
    else:
        flash('Allowed image types are -> png, jpg, jpeg, gif')
        return redirect(request.url)


@app.route('/display/<filename>')
def display_image(filename):
    # print('display_image filename: ' + filename)
    return redirect(url_for('static', filename='uploads/' + filename),
code=301)


if __name__ == "__main__":
    app.run(port=5001)
```