CHAPTER 1

INTRODUCTION

1.1 PROJECT DESCRIPTION

Fruit Recognition and ripen status is useful to the industrial purpose for recognising the fruit and checking the status of the fruit ripe. It is useful in fruit shop, market and malls to recognising the name of the fruit and categorise the fruit status like low, medium high. farming provides a living for more than 60% of the population. Nowadays, the growth of fruit productivity is usually influenced by quality. In the industrial field, quality is a major issue. Most fruits are low, medium and high ripe to classify the fruits and status of fruit with quality effected by the weather. This technique is used to determine the fruit status. To create a self-operating store the data to test the quality using the present system. This storage contains of information about fruit condition, recognition, and quality. The details of fruits and the status identified starting with the feature extraction are stored in the storage. The collection of data stores the details of the fruits and the status determined by feature extraction. The complete already stored data is compared to training images. As a result, the differences in the picture come with the stored data and the status of result in the fruits. The technique identifies quality of fruit by processing images and providing the necessary information. Fruit identification and fruit quality status are the two key applications of machine learning in fruit classification that have drawn a lot of interest. The database contains the details of fruit recognition, the input images undergo segmentation and then classification using Convolutional Neural Network (CNN) respectively.

1.2 APPLICATIONS

They frequently recognise certain traits of the fruits they eat, such as the touch, size, consistency, and, of course, flavour, when they are shopping in a market, fruit and vegetable store, or supermarket. All fruits and vegetables go through a quality control process to ensure that this experience is consistent and that the consumer's expectations will be successfully met. The applications are Agricultural Produce Market Committee (APMC) yard, Fruit markets, Malls, Fruit industries.

Smart farming has more obvious applications on the field, but the results of all the work also demand matching activities off the field. Additionally, support 9 efforts in the areas

of food sales, transportation, and inspection are required. This study examines the use of machine learning for sorting and grading, a task performed off the farm.

1.3 MOTIVATION

It's now possible to go further in the agriculture industry thanks to the notion of "modern agriculture," which is not only beneficial but also essential. In the current scenario 70% more fruit production is required to support the world population full filling only 70% of the world still 30% more quality fruit production is required to meet the demand. This requires further to cultivate more forms to produce more food and utilize more land for production. Therefore, it is important to practise more effective forming on studying the soil, type of crop, water facility, identifying fertility of soil available in forms. To develop strategies to get better yields.

1.4 OBJECTIVES

1. To identify the object using using the Machine learning Model.
2. To design the CNN model for Quality prediction.

1.5 REPORT ORGANIZATION

The material presented at the report is organized into 7 chapters, After the introductory chapter, chapter 2 describes the full overview of literature survey in detail, what technology and tools used in this project, hardware requirements and software requirements. Chapter 3 summarizes the problem statement and solution to the project. Chapter 4 provides system design of the present project. Chapter 5 presents the brief implementation of the code. Chapter 6 gives the experimental results and overall execution of the project are shown in the result. Finally, Chapter 7 provides the conclusion of the project.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING SYSTEM

In this section the similar research works are studied in detail and are summarized and compared with the proposed work.

H. Wang et al., (2020), The paper portrays a enhanced Masking on Reason-Based Convolution Neural Network mark identification system and uses bananas, apples, pears, and peaches as research objects. Add a top-down horizontal connecting path to the initial feature pyramid structure to enhance Masking on Reason-Based Convolution Neural Network or multi-scale feature fusion. This enhances the effect of multiscale attribute fusion and successfully addresses massive scale objective in the incorrect placement and Network detection precision is not the only ideal price of the lesion detection process. The test outcomes reveal that the algorithm's MAP value (Max worth) for detecting the outermost layers blemishes on the targeted fruit are over 94%, and that while using GPU, the 2.6 images per second is the accurate prediction rate.. Even though the article's suggested detection methodology has a high detection accuracy, the detection speed is a little slower.

V. Kulkreja et al., (2020), The automatic identification and catagories of citrus illnesses utilising process statistics augmentation and pre-processing has been offered as a DL methodology in this research. When there is a large collection of data, DL performs well. But the authors' initial little amount of data collection needs to be increased in order to produce a model that performs well. A single image can be used to generate many samples of data using the augmentation method, which enables the production of more images from a single image. In this study, 150 original photographs are used as the starting point, and 1200 additional images are added with nine attributes utilising data augmentation. Pre-processing enhances the qualities of the image while rescaling prevents computational lag.

P. Kantale et al., (2020), This essay provides a discussion of numerous methods for spotting plant disease. Researchers' efforts have significantly advanced the ability to detect and identify plant diseases, particularly those that affect pomegranates, including Bacterial leaf blight, Poison hemlock, Alternaria fruit rot, and Aspergillus fruit rot.

According to this critique findings, automated learning techniques produce the peak results for locating and identifying plant diseases.

N. Saranya et al., (2020), The most accurate method for identifying and categorising the illness in the banana plant is image processing. The MATLAB programme is used to develop the detection and classification of leaf and fruit diseases. This system substitutes the manual technique, which takes more time and has worse accuracy than the suggested system when it comes to recognising and classifying them based on symptoms. The suggested technique has a high accuracy rate and is very helpful for farmers in identifying diseases and practical strategies to prevent them from spreading to neighbouring plants. The various leaf and fruit diseases that affect banana plants and their symptoms are categorised in this essay. An important sin is played by the fuzzy cmeans, histogram-based equalisation, and the ANN. The histogram transforms the image in the proposed system without losing any of the information in the banana plant, and fuzzy c-means are utilised to split the image.

R. Ramya et al., (2020), The creation of a cloud-based programme to assist Indian farmers and agriculture aids in the better analysis of agricultural data, which reduces hoardings and aids in the building of a successful, secure, and tranquil farmer society in India. Using the K-Means algorithm and SVM approach, fruit picture classification and segmentation were carried out. Initially, the various attributes of a few fruits were retrieved and the corresponding photos were segmented. The various illness names are compared to feature values, and the best disease for the image is then determined. This disease is then displayed by an alert box and may be communicated as a message via a mobile application.

H. Patel et al., (2019), Explain the four aspects that this paper bases feature selection on: shape, size, colour, and texture. Making theory is utilised for merging features and combining colour and cluster-based approaches for actual part segmentation because it has been discovered that the SVM classification result changes when we vary the training/testing Ratio. For categorising orange fruit faults, our approach performs better. Future fruit industry output will be improved by using image processing to combine two or more classification systems.

S.D.M et al., (2019), After segmenting the images using grab crop segmentation, the suggested model incorporates the clever method for detecting edges to identify the fruit parts devasted by the disease. The damaged fruit area's edges are determined in terms of pixels after segmentation. The proportion of fruit infection is calculated using pixel counts, and remedies such as biological and chemical ones are offered depending on the disease that the fruit is affected with. Additionally, we intend to create a user-friendly programme that would make it simple for farmers to detect disease.

Hitanshu et al., (2019), This review paper emphasises how scholars combined their research and categorization efforts. It is an attempt to contrast several systems-applicable methodologies. These algorithms are used to categorise fruits and other items. The KNN algorithm, which locates the picture of a product that is similar to the one being classified, is the fundamental algorithm needed for such classification. Additionally, the product is sorted, which allows for the extraction of the right product. Fruits' basic characteristics include their forms, sizes, colours, and textures. Extraction of features, separation, categorisation, and pre-processing are fundamental techniques for detecting this. As a result, an effort is being made to determine how such technologies might be used to improve fruit freshness.

S.R.N.M. Ayyub et al., (2019), Our suggested solution, which is based on image processing, has been tested and found to be effective. The three categories of apple disease—Blotch, Rot, and Scab—were used to categorise the photographs of infected and healthy fruit. The results of our experiments demonstrate that the proposed approach can considerably support the automatic detection and categorization of illnesses in apple and fruit. We have established a more accurate classification of apple fruit disease as a result of our investigations. To improve the results of the suggested method, additional study takes into account the combination of several features.

S.M. Jaisakthi et al., (2019), This article, suggest a ML based automated mechanism for recognising leaves can detect illnesses in grape leaves. The suggested system separates the leaf component by utilising grab cutting separation as from backdrop techniques, and then uses two different algorithms to identify the diseased region on the segmented leaves. While the second method makes use of semi-supervised learning, the first method employs global thresholding.

Table 2.1: Merits and Demerits of present system

Paper	**Methodology**	**Merits**	**Demerits**
[1].	The CNN algorithm is used.	This improved the outcome of several scale fusions and productively solving the big scale target in checking the process.	This masking Region-based convolutional neural network fail to find the objects.
[2].	In this paper the CNN Algorithm is used.	Deep learning is well when there was a white collection of data used CNN algorithm in citrous fruits	The failure was associates in the year relates to the analysing, failed chart of the design with augmented data and pre-processing.
[3].	This paper using the k-means clustering.	ML was provided the good result in the detecting and identifying of plant disease.	This was simply to loss in two local optimums in big dimension space.
[4].	The ANN algorithm is used.	Most thresholds value is remain the big accuracy of histogram results in leaves and fruits.	This provides more bulk of data to performed good than the a few technologies.
[5].	In this paper K-means algorithm and SVM used.	This detect data in the plants area was determine by the processing images.	It cannot maintain the noises from the data
[6].	The SVM technique is used.	This system is best for orange classifications.	This is a less accreted compare to SVM.
[7].	In this paper local Binary pattern feature extraction and feed FNN method is used.	The infection is identifying with prominent perfection.	The binary data makes by them are careful to noises.
[8].	In this paper SVM techniques and ANN is used.	SVM works better when the partition between the class and memory efficient.	The processing of fruits required a big data set and is difficult to handle the big task.
[9].	K-mean clustering algorithm used.	The benefits is which given the great accuracy compare to others.	The disadvantage is big dimension matrices and big connection.
[10].	SVM techniques is used.	SVM performed best when data is high is non-linear.	This system provided the late executions.

2.2 LIMITATIONS OF THE EXISTING SYSTEM

The development of a technique for the object identification model to identify when a fruit is bad was one of the main objectives of this thesis. All of my fruit samples lacked sufficient data in the form of numerous high-quality images, so I pre-processed my information instead by just using an image histogram to illustrate individual fruit. Fruit marked with colour would't be chosen in this way.

Some companies who use systems similar to the one I am developing for fruit recognition and status checking have direct exposure to significant amounts of data and are still today training their models on substantial amounts of graded fruit samples. The breadth of my inquiry is constrained by my inability to access these resources.

2.3 TOOLS AND TECHNOLOGIES USED

In the proposed system explained about the tools and technologies are:

Python is an object-oriented, high-level, interpreted coding languages that is simple to learn and quick construct applications with. It is accessible on a variety of platforms. With a little number of codes, complicated reasoning is implemented. Since it uses dynamic coding, dynamic binding, and high bandwidth structures, it is particularly advantageous for quick proposal to in addition to coding or a language of bridge to join already existent components. Python has been created too very readable.

Computer Vision: It is a method for using computers to understand digitized images and videos. It seeks to streamline processes that human eyesight can carry out. In order to create information, this entails techniques for collecting, handling, analysing, and understanding digital images and also for obtaining information from the actual surroundings. It also features sub-domains including its practical features alike object recognition, visual tracking, and motion detection. for routing, object modelling, and other fields.

Simply put, computer vision uses a camera-equipped equipment to take still images or moving photos, then does analysis. Understanding the content of digital photos and videos is the objective of computer vision. Additionally, utilise these photos and movies to draw something valuable and significant that will help you address a variety of issues. Examples include devices that can monitor the condition of decorative plants' health,

mechanisms that can determine whether food is present in the refrigerator, and intricate procedures like disaster recovery operations.

Computer recognition includes item identification, detection, and recognition.

Finding and recognising items in a digital picture or video is the goal of object recognition.

Machine Learning Technology

A subfield of computer sciences is deep learning, which simulates human learning by using data and algorithms to improve its predictions over time.

Data science is a fast-expanding area, and automation is a major aspect. Algorithms are trained to produce classifiers or projections using statistical techniques in data mining activities. Ideally, the choices taken as a result of these insights affect important growth metrics in applications and businesses. As big data evolves and expands, data scientists will be increasingly in demand since they will be required to assist in recognizing the maximum crucial commercial task and then the information to address them.

Machine learning comes in two different flavours. Supervised and unsupervised are the categories of machine learning. Our project makes advantage of supervised learning.

Supervised Learning-An important component of supervised learning, often known as machine learning approaches, the use of labelled datasets to train programs that reliably categorise data or predict events.

Unsupervised learning-It evaluates the unlabelled dataset with ML techniques. With no aid from a person, these algorithms find secret patterns or data clusters.

Convolutional Neural Network

In this article, we will identify the fruit, and using its image, a convolutional neural network will forecast the fruit's name. We will train the network in a supervised manner, with the input being photos of the fruits and the output being labels for the fruits. The CNN model will be able to properly anticipate the fruit's label after a successful training session.

The libraries used are:

1 NumPy: The most popular open-source Python module is called NumPy. It features built-in mathematical operations for simple computation and enables big matrix and multidimensional data. "Numerical Python" is defined by the term "NumPy." It may function as per multi-dimension container for general information and be utilised in algebra, randomly generated group, etc. A row-and-column n-dimension array is well-defined by the python, numpy, array and object.

2 Pandas: A BSD-licensed open-source library is the panda. In the field of data science, the library is heavily utilised. The majority of their applications include the analysis, modification, and cleansing of data. Panda enables the simple modelling and data processing activities without a need to convert to another programming language like R.

3 Matplotlib: This library is used for analysis of information and for visualising statistical values. Graphs, pie charts, scatterplots, histograms, and other elevated figures are published using this open-source toolkit.

4 SK Learn: Scikit Learn is an easy-to-use machine learning package for Python. It is written in C, C++, and Python. However, Python is used to create the majority of it. A free machine learning library, that is. This adaptable Python package can coexist peacefully with other Python libraries and packages like numpy and scipy

5 SciPy:The scientific computations, data computation, and high-performance calculation, SciPy is an open-source Python library. The library contains a huge number of approachable routines for simple computing. The package is constructed using the NumPy extension, which enables high-level instructions to be made available for data processing and visualisation. For mathematical computing, SciPy is utilised with NumPy. While the numerical code is kept in SciPy, NumPy provides sorting and indexing of array data.

6 Flask: Python is used to create the Flask microweb application framework. With Flask, developers can create programmes more quickly and intelligently. Despite the lack of a significant release, it’s worth is demonstrated by the widespread adoption of it by professionals. Flask, a comparatively new structure, is learnt after others that came before and has shown to be excellent for smaller applications while retaining the potential to expand.

7 Open CV: OpenCV was a Python image processing collection that is part of the Open-source Computer Vision project. It keeps an eye on all processes related to immediate machine vision. Many developers claim that OpenCV is one of the most difficult libraries to learn, despite the fact that it lacks comprehensive documentation. It does, however, offer a variety of built-in features that make it simple to master computer vision.

8 TensorFlow: It is an open-source collection for high-performances arithmetical computing is called TensorFlow. Deep learning algorithms and machine learning techniques both use it. It was created by the google brain team under the google Artificial Intelligence company, and it is currently extensively utilised by mathematics, physics and ML investigators for challenging scientific computations. MacOS and later, Windows 7 and later, Ubuntu 16.4 and later, and raspbian 9.0 and later all support TensorFlow.

2.4 HARDWARE AND SOFTWARE REQUIREMENTS

Hardware Requirement:

The minimum hardware requirements for the proposed system are listed as follows

Pentium 4 Processor

2GB RAM

80 HDD

Software Requirement:

The software requirement for the proposed system is listed as follows

Python 3.5

OpenCV 4.0,

Tensor flow 2.0

CHAPTER 3

PROBLEM STATEMENT AND SOLUTION STRATEGY

In this chapter problem statement and solution strategies are elaborately discussed.

3.1 PROBLEM STATEMENT

To design a system which automatically detect the quality of fruit using a machine learning model.

The first consideration in making a purchase of a fruit or vegetable is how it appears. The typical human would not be able to follow a fruit's species and genetic characteristics to determine whether or not it is ripe. However, to a large part, these inferences made from the customer's fundamental examination of the fruits might really reveal the fruit's quality, which means that the suppliers or merchants must ensure that the fruits they put on sale look appetising in order to increase sales. Because of this, supermarkets and other retail outlets spend a lot of time and effort inspecting and grading fruits. Certified inspectors also grade and examine fruits in order to ensure quality and as a safety precaution. Variations in their reporting, however, can potentially result in significant waste or poor purchasing. Every erroneous finding resulted in a poor buy, and every erroneous finding resulted in waste. Additionally, fruit sheets reduce the necessity for direct contact with a lot of the agricultural product across the distribution network and enhance the efficiency in consumption of time and effort required for sorting fruits at stores. Automating the needless and Inadequate agricultural product management by amateurs might help allay worries about food poisoning and other health issues brought on by novel virus and pathogenic bacteria.

3.2 SOLUTION STRATEGY

The present solution used the Convolutional neural network and Histogram graph, the system will classify the fruit recognition and status of the ripe fruit type like low, medium and high ripen status in the fruits.

My project offers a solution to purchase fruits of high quality in order to resolve all these problems. The proposed work of a solution provides a precise forecast of the fruits that will be available. In order to meet client expectations, the equipment will precisely measure the quality, such as low, medium, and high ripe.

Most manufacturers needed specified qualities in order to produce the fruits' auxiliary goods.

CHAPTER 4

SYSTEM DESIGN

Each stage of the suggested technique, including pre-processing, feature extraction, and categorization, is covered in length in this chapter along with an example of the process's code.

4.1 PROPOSED METHOD

In this below diagram explained about the working flow of diagram is labelling, acquisition of image, pre-processing images, extracting the features, classified result

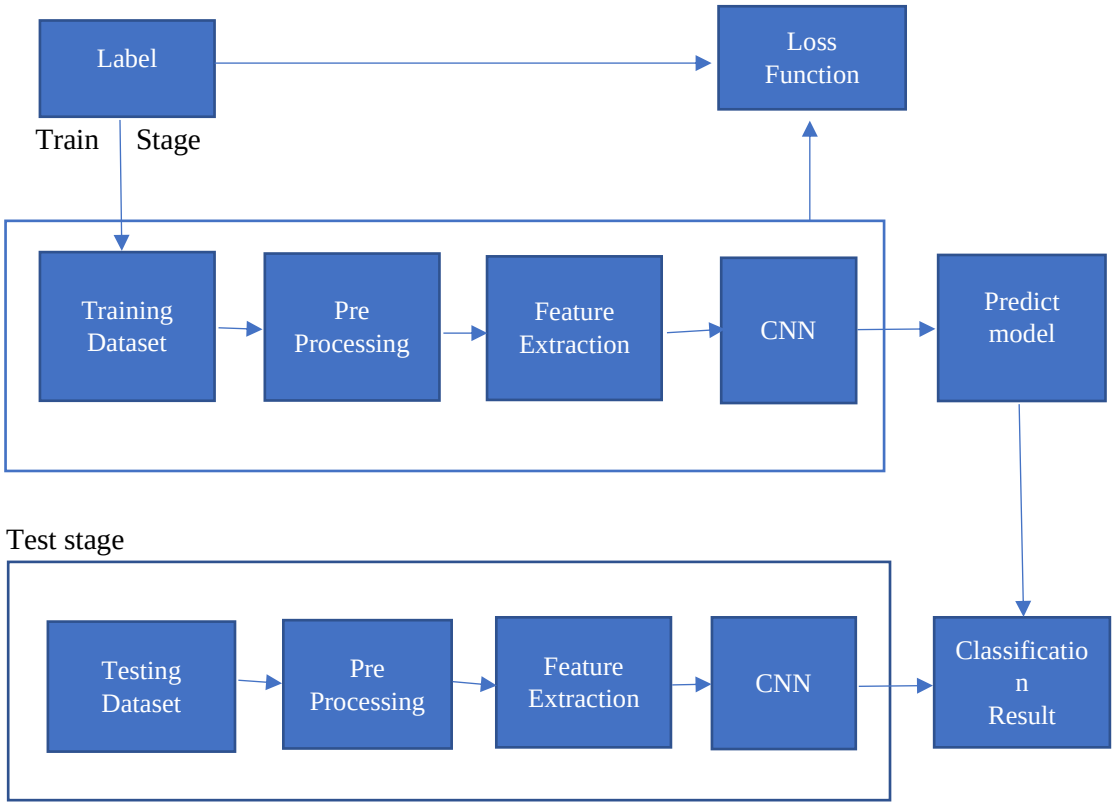

Fig 4.1: Flow of the diagram

Firstly, we labelling the different fruits. The categorization of fruit based on the fruit type on the different folders.

CLASS_MAP={

“Apple”: 0,

“Banana”: 1,

“Grape”: 2,

“Orange”: 3

}

After the label. The training dataset we read the image using the get data set and after this list the map importing the class as intake. To create model into RGB colour.

Layer (type)	Output shape	Param
Convolutional 2Dimension	(Null, 109, 109, 65)	1793
Max pooling 2 Dimensional	(Null, 111, 111, 64)	0
Convolutional 2Dimension-1	(Null, 109, 109, 64)	36928
Max Pooling 2 Dimensional -1	(Null, 56, 56, 64)	0
Convolutional 2Dimension-2	(Null, 52, 52, 128)	73856
Max pooling 2 Dimensional -2	(Null, 26, 26, 128)	0
Convolutional 2Dimension-3	(Null, 24, 24, 128)	147584
Max pooling 2 Dimensional -3	(Null, 12, 2, 128)	0
Convolutional 2Dimension-4	(Null, 12, 128)	147584
Max pooling 2 Dimensional -4	(Null, 6, 6, 128)	0
flatten	(Null, 3200)	0
dropout	(Null, 3200)	0
dense	(Null, 512)	1638912
dense-1	(Null, 3)	1529

Table 4.1: Training the data set using Convolutional 2D layer

Acquisition of image

The image acquisition for obtaining an image starting with computer or coming out of a storage of fruits data set is referred to as image acquisition. The picture was taken in the web cam or a regular picture from the already stored data.

- Apple
- Banana
- Grape
- Orange

The images are capturing using the webcam and images are stored in the training data set. In the below figure shows the capturing images.

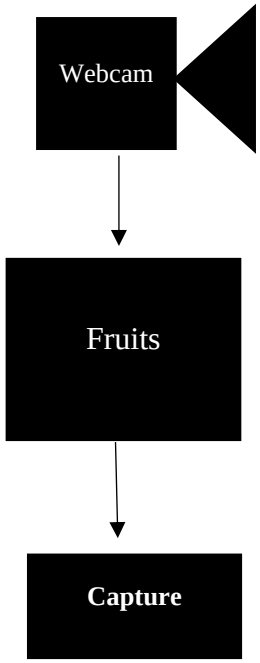

Fig 4.2: Capturing images using webcam

In the pre-processing pictures are collected, It is upgrading the input image, which includes noise removal and size clarifying to improve the picture. In our project used the im_read, im_shape, im_resize, color_bgr2gray.In the below figure explained about the pre-processing process firstly, The images are taken as input and applying the filter. After the filtering. Its converts the colour image to grey scale conversion and removing the noise. To detect the edge and given the pre-processed output.

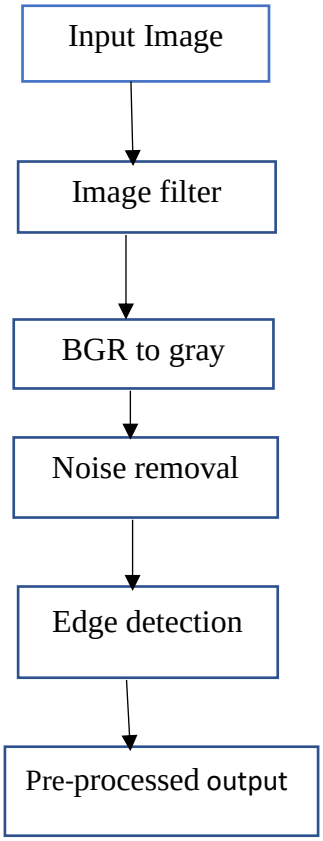

Fig 4.3: Pre processing

The next stage is extracting the feature. In process of enhancing snaps to better depict visually appealing elements is known as feature extraction. The input photos are examined for properties like spots, colour, form, and area, among others. We plan to leverage colour features including standard deviation, distribution of frequency, distort, collection of prominence, and collection of shade since colour may distinguish one disease from another. It is primarily done to reduce the difficulty of processing the photos. The quality is recognised placed on the color and shapein the behaviours that specify the bug in the fruit photos.

After the extracting**,** CNN based networks (CNNs) are currently a more general class of models for classifying and recognising images, according to CNN categorization. The main benefit of CNN is that, in comparison to other classifying algorithms, it requires much less pre-processing time. It processes the incoming data, trains the model, and then quickly prepares the crucial data to improve the sorting process. A CNN algorithm's main goal is to information downloading in a successful arrangement

with avoiding loss in crucial structures while taking the facts into account. Due to the vast amount of information, it is suited for use at work. CNN is made up mostly of three levels. The number of layers varies according to how complicated the challenging domain is. Such coatings are used in greater amount in complex applications. The image is coated in the following order are convolutional first layer, max pooling second layer, and relu connected third layer. The output is then produced after that.

In this, the natural image is managed by layer filters. It takes structures out of the depiction. The convolution layer holds the popular of the user-specified limitations, such as the number of fruits and the size of the fruit. Max Pooling layers are used to execute average or extreme pooling. The major pool method is used in most pooling coats. They are frequently used to make networks lesser. The last coatings of the network are entirely combined layers. This layer's input is the outcome of the earlier pool or convolution layer. The softmax activation purpose splits the input image into different, termed class.

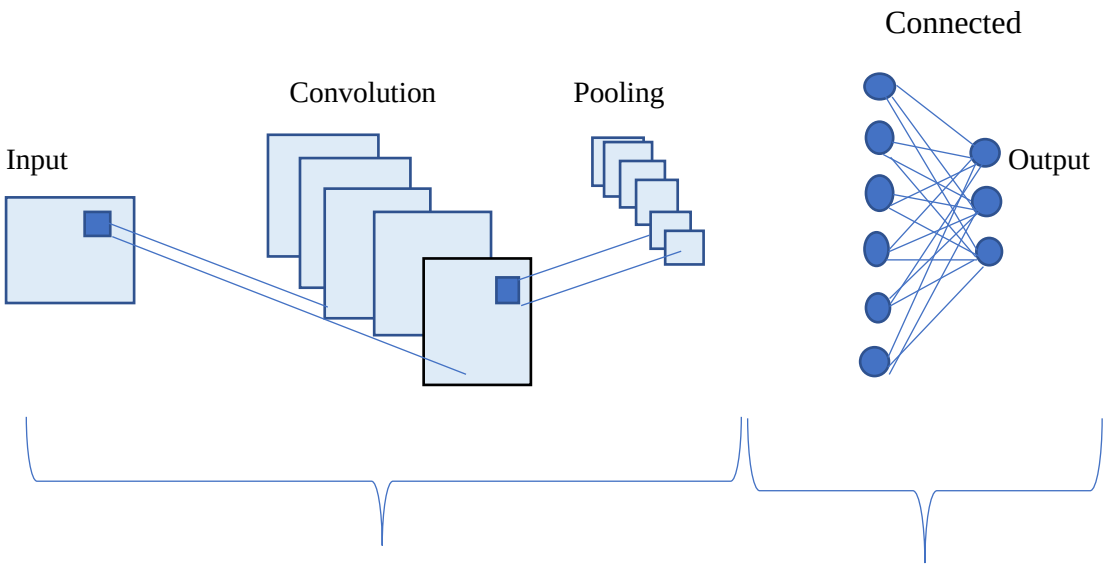

Fig 4.4: CNN Structure for classification

CNN Algorithm

Step1: Fruits Image are stored in the different folders.

Step2: The labelled folder is subjected for CNN model creation.

Step3: By 6 layers of relu layer to develop CNN model.

Step4: Convolutional 2 dimension and max pooling, white spreading and flattening are carried out to make model strong.

Step5: By giving input image to already existed model we can able to forecast the class of the predicted image.

Existing CNN Model

The current work suggests a CNN model for determining low, medium, and high levels of fruit ripeness that is deep learning-based. The following layers make up this model: six convolution layers, five max pooling layers, two fully connected layers and the output layers of the softmax classifier are all included. The input picture size for the fruit dataset is 225 x 225. The beginning function of the Rectified linear unit is contained in the first convolution operation (Convolution 1). (ReLU). It helps the model operate better and learn more quickly. Max pool layer and convolution are combined from convolution layer 1 to convolution layer 5. A max-pooling layers with a size of 2 x 2 and a stride of two is applied after each convolution layer. Table 1 lists the number of filters employed and the kernel size at each stage. 512 filters are used in convolution layer 6.

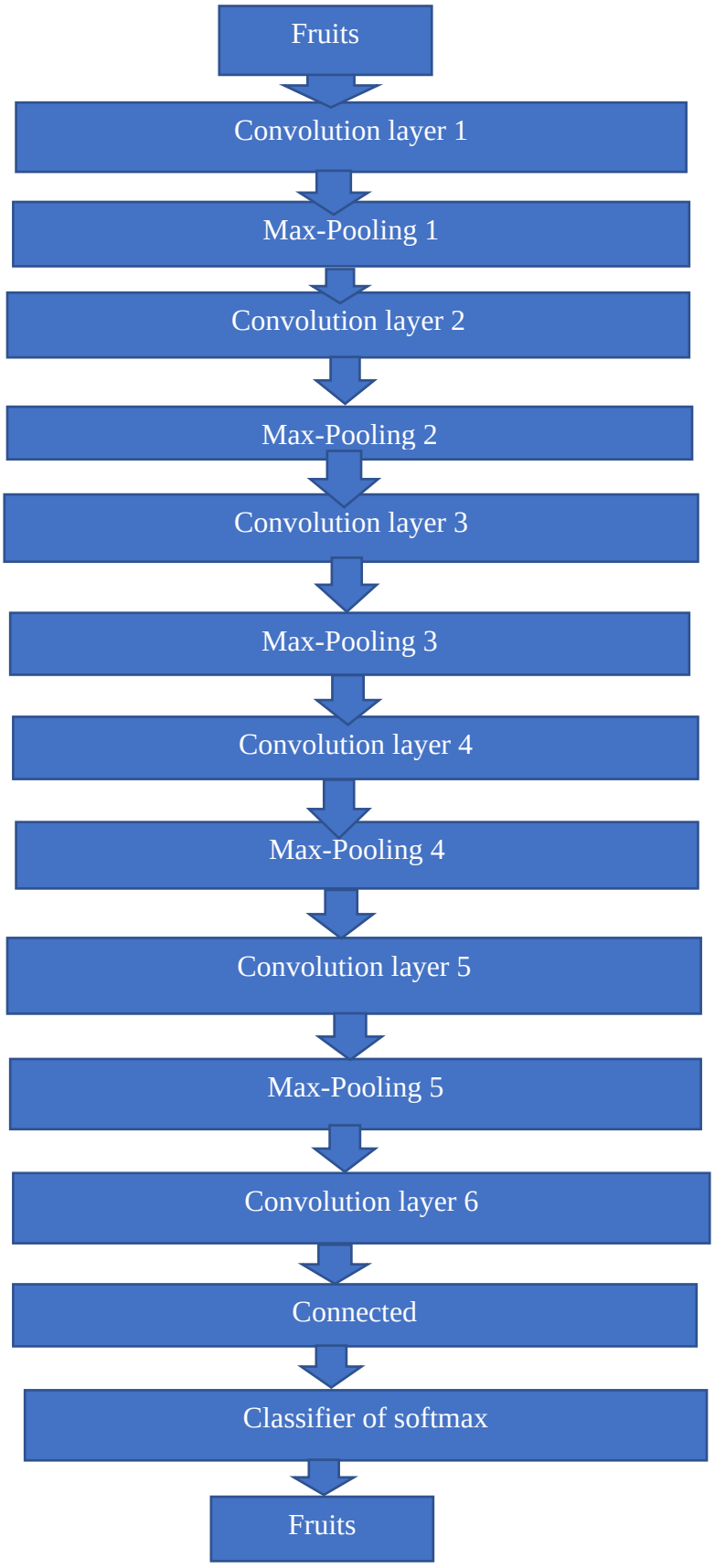

Fig 4.5: Basic CNN Model

CHAPTER 5

RESULT AND ANALYSIS

5.1 RESULTS

In this chapter result obtained each phase of the proposed work like acquisition the images, pre-processing, classification is presented along with the implementation.

1.Labelling:

In this below code explained about the labelling of the fruits.

```
import os

import cv2

import numpy as np

import tensorflow as tf

from tensorflow import keras

TRAINING_DATA_DIR = "training_data"

class_map = {

"other": 0,

"apple": 1,

"BANANA": 2

}

def mapper(value):

return CLASS_MAP[value]
```

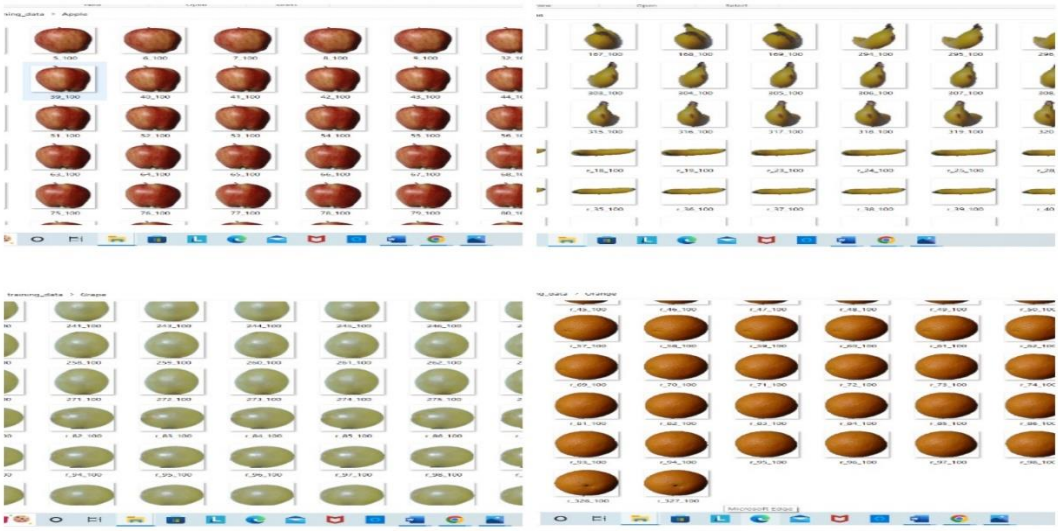

Fig 5.1: Fruit images

In the above code is used to label the fruit names it is helpful to recognize the different fruits by name. After the labelling the test and train the data are done by the labelling. The output shows the labelling images like apple, banana, grape, orange are labelled. When the labelling is used it is easy to categorized the different fruit.

2.Pre processing

In the below code explained about the pre-processing steps used in the project.

```
for label_dir in os.listdir(TRAINING_DATA_DIR):
# iterating each item in the training data directory
path = os.path.join(TRAINING_DATA_DIR, label_dir)
if not os.path.isdir(path):
continued
for image_file in os.listdir(path):
img = cv2.imread(os.path.join(path, image_file))
img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
img = cv2.resize(img, img_shape)
dataset.append([img, label_dir])
return zip(*dataset)
```

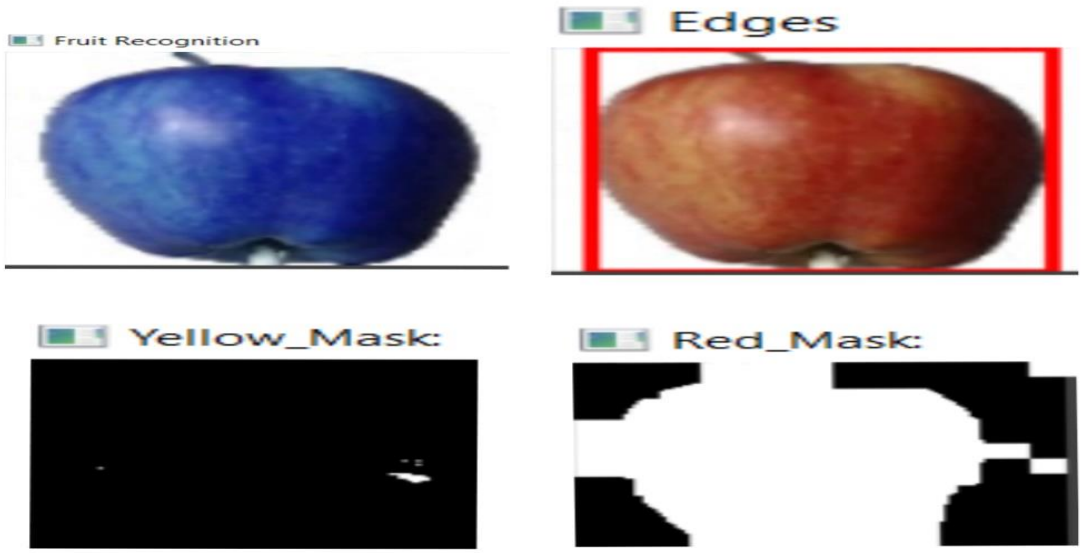

Fig 5.2: Fruit recognition, Detect the edge, Yellow masking and Red masking

In the above figure explained about the pre-processing. Using the pre-processing identify the fruit name, detect the edges, yellow masking and red masking of the fruits. The based on the colour and shape predicting the fruit is low, medium and high ripen.

3.Feature Extraction

In the below code is elaborates the extracting the features.

```
def get_dataset(img_shape):
## load images from the training data directory
dataset = []
for label_dir in os.listdir(TRAINING_DATA_DIR):
## iterating each item in the training data directory
path = os.path.join(TRAINING_DATA_DIR, label_dir)
if not os.path.isdir(path):
continue
# iterating threw each file in the sub directory
for image_file in os.listdir(path):
# loading each image
```

```
img = cv2.imread(os.path.join(path, image_file))

img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)

img = cv2.resize(img, img_shape)

# adding them to the dataset

dataset.append([img, label_dir])

return zip(*dataset)
```

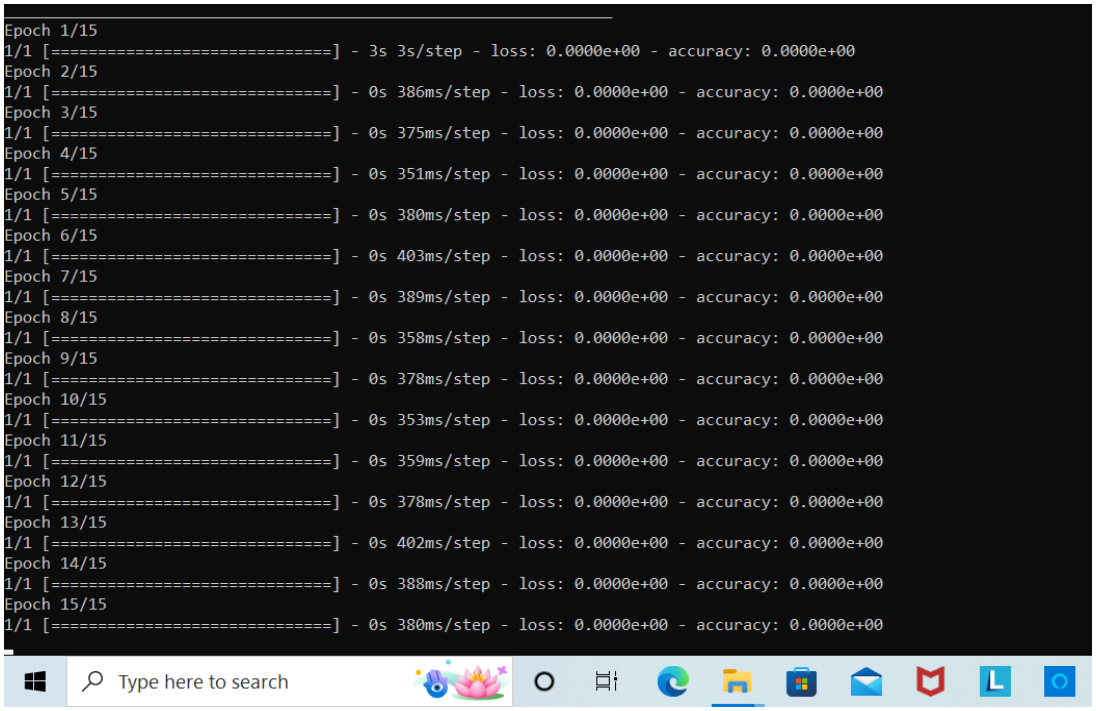

Fig 5.3: Output of extraction

The technique of turning raw data into numerical features that can be handled while keeping the content of the original set of data is known as feature extraction. Extracting the features is done by the load the model.

4 Classification

In this step explained about the classification using the Convolutional neural network.

```
keras.layers.Conv2D(64, (3,3), activation='relu', input_shape=input_shape),

keras.layers.MaxPooling2D(2, 2),

keras.layers.Conv2D(64, (3,3), activation='relu'),

keras.layers.MaxPooling2D(2,2),
```

keras.layers.Conv2D(128, (3,3), activation='relu'),

keras.layers.MaxPooling2D(2,2),

keras.layers.Conv2D(128, (3,3), activation='relu'),

keras.layers.MaxPooling2D(2,2),

keras.layers.Conv2D(128, (3,3), activation='relu'),

keras.layers.MaxPooling2D(2,2),

keras.layers.Flatten(),

keras.layers.Dropout(0.5),

keras.layers.Dense(512, a

ctivation='relu'),

keras.layers.Dense(num_classes, activation='softmax')

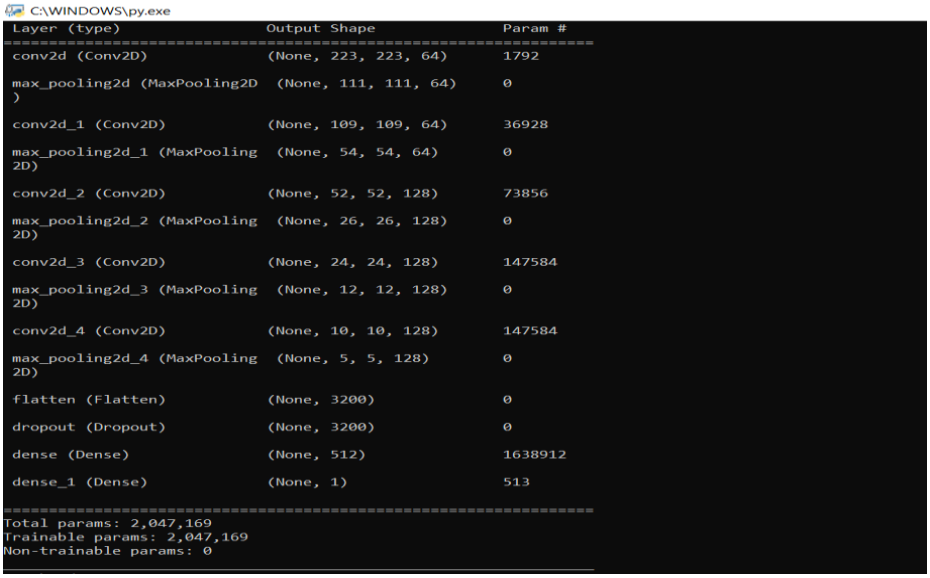

Fig 5.4: Output of classification using CNN

Sort the layers first by category. Following are the 6 convolutional layers and 5 max pooling that make up this model. uses thick, flat, dropout layers to categorise the outcome six layers of convolution The two fully layer, Softmax classifier output layer are coupled by five max pooling layers. A 225 by 225 input picture is used to start the fruit dataset. The Rectified linear units activation function is contained in the first convolution layer (Convolution 1). (Relu). It enables the model to pick things up more quickly and perform better. Convolution and max pool layers are combined from

convolution layer 1 to convolution layer 5. Later each convolution layers, a max-pooling layers with dimensions of 2 x 2 and a stride of two is deployed.

5.2 ANALYSIS

Based on the parameters the performance analysis of the CNN model is done.

1 Histogram

```
def histogramImage(file_name,image_height,image_width,DPI):
img = cv2.imread(file_name)
base = os.path.basename(file_name)
name = os.path.splitext(base)[0]
ext = os.path.splitext(base)[1]
histb = cv2.calcHist([img],[0],None,[256],[0,256])
histg = cv2.calcHist([img],[1],None,[256],[0,256])
histr = cv2.calcHist([img],[2],None,[256],[0,256])
f, (ax1, ax2, ax3) = plt.subplots(3, sharex=True, sharey=True)
plt.xlabel('Pixel intensity')
plt.ylabel('Number of pixels',horizontalalignment='left',position=(1,1))
figure = plt.gcf() # get current figure
ax1.fill(histr,'r');
ax2.fill(histg,'g');
ax3.fill(histb,'b');
figure.set_size_inches(image_width, image_height)#in inches
# when saving, specify the DPI
new_file_name = "histogram_"+name+ext
print "\nThe filename is: "+new_file_name
plt.savefig(new_file_name, dpi = DPI, bbox_inches='tight')
plt.setp([a.get_xticklabels() for a in f.axes[:-5]], visible=True)
```

plt.show()

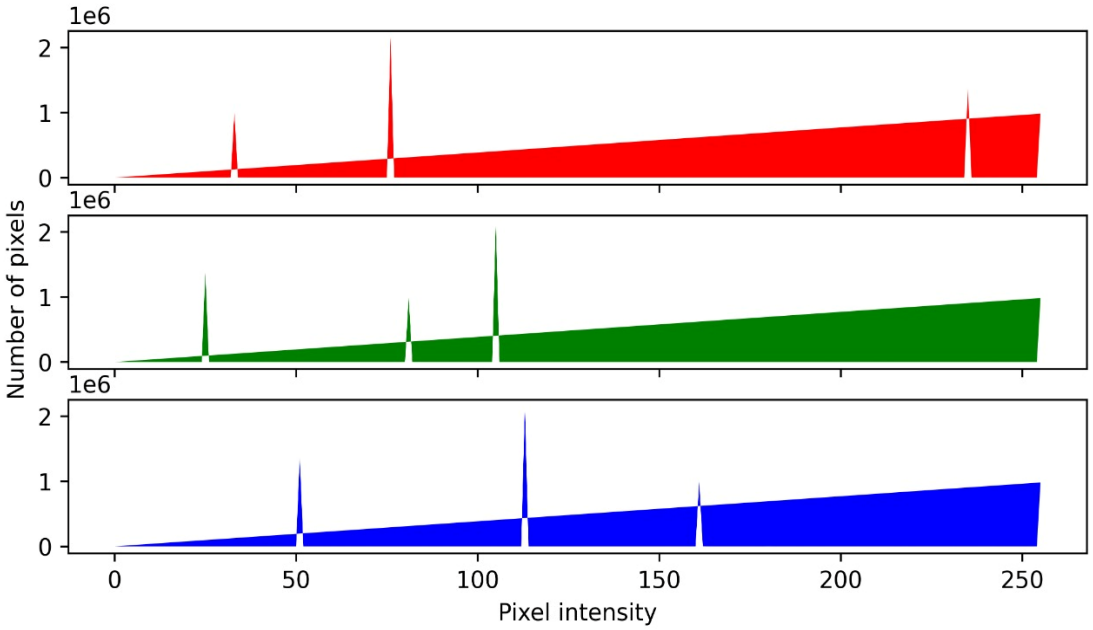

Fig 5.5: Colour distribution graph

The analysis is performed the histogram which represents the colour distribution which is used to classify the quality of low, medium and high.

Comparison table

Explanation about the comparative findings in the list following. The second row displays a test error rate using solely Convolutional-Neural-Network of 0.61 percent. The following row reveals that the overall test error rate is 0.92 percent. The mistake rate is greater in the third row than the second. Since some of the extracted regions only include a small portion of a full fruit or are distorted when they are enlarged, using all of the areas might result in a significant mistake rate.

Methods	Error rate
Convolutional-Neural-Network	0.61
Selective search+ Convolutional-Neural-Network	0.92

Table 5.1: Fruit grading with error rate

Methods	Recognition rate
Colour and shape feature + MDC	86.00487
FSCABC	89.2
Convolutional-Neural-Network	99.3
Selective search + Convolutional-Neural-Network + vote	99.67

Table 5.2: Fruit grading with recognition rate

CNN has a greater recognition effect comparison to the other two techniques in Table. Both are significantly more accurate when compared to the latter two approaches. Additionally, CNN and selective search yield a higher identification rate of up to 89.76 percent. As a result, the recognition rate may be significantly boosted using the suggested strategy. And it can fulfil the required specifications.

After the completion of analysis to run the application go to command prompt type app.py or we can directly run the program for double tap the app.py file.

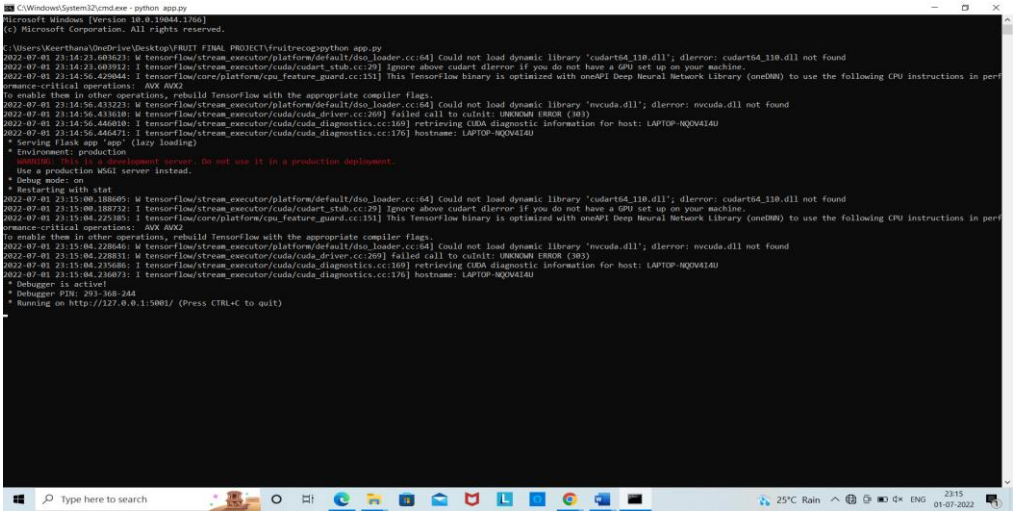

Fig 5.6: Run the application

After running the application we are using the image input window for classifying the fruits rippenness. In this window we are going to give the input for our project.

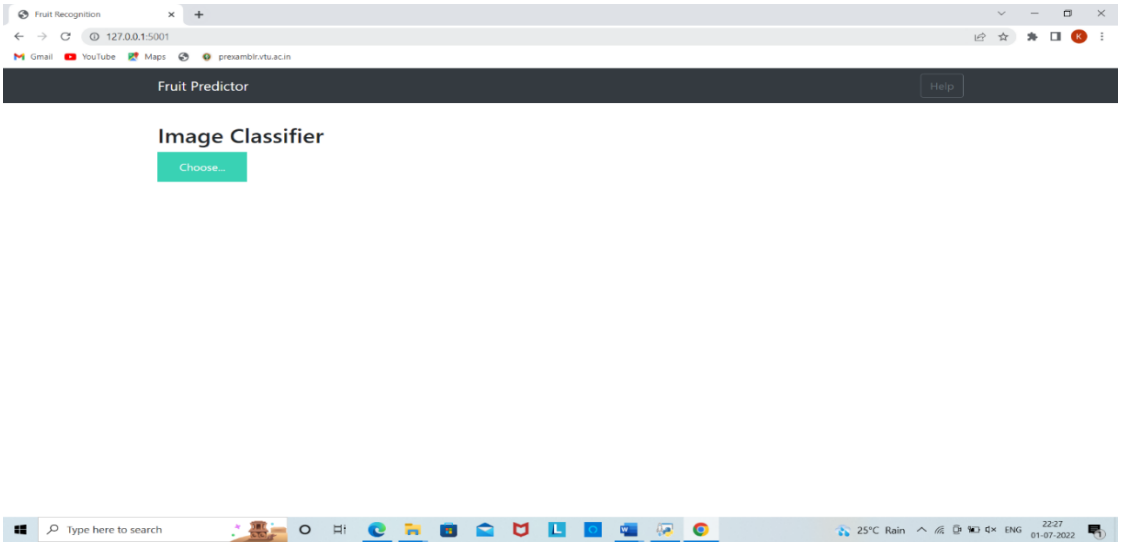

Fig 5.7: Image classifier page

After that completion we have to give the fruit images as input. click on the image browser button when we click the button it will shows the fruit image. Next click the predict image to know the result of the given image.

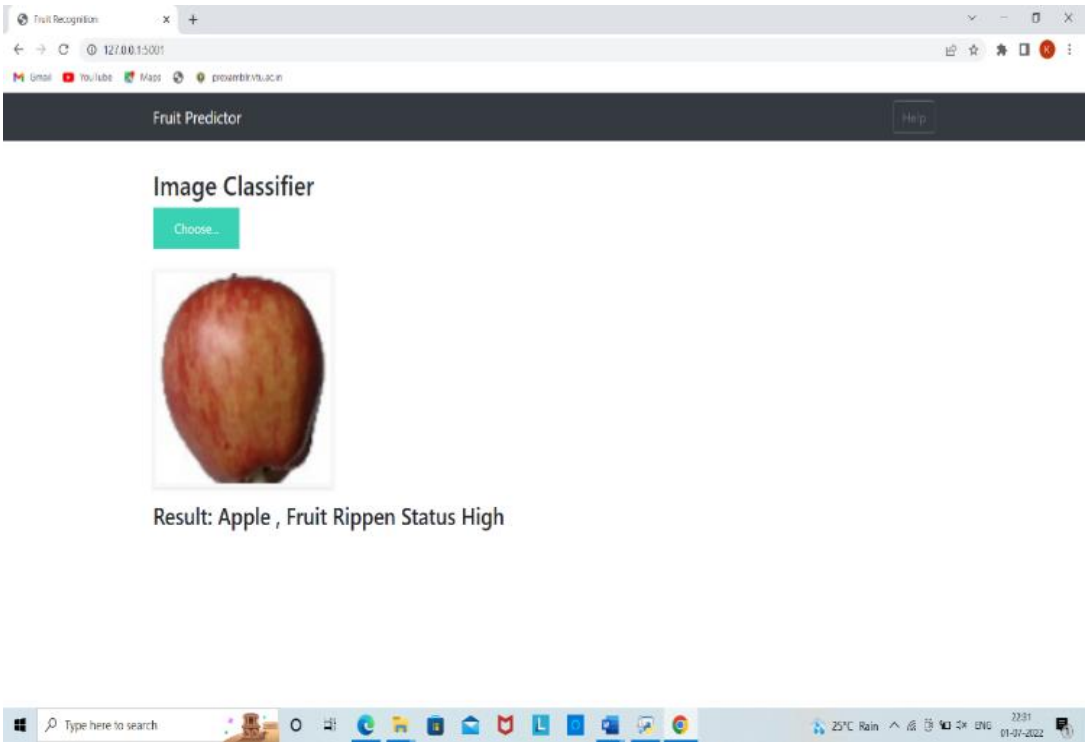

Fig 5.8 : Fruit recognition and status of apple

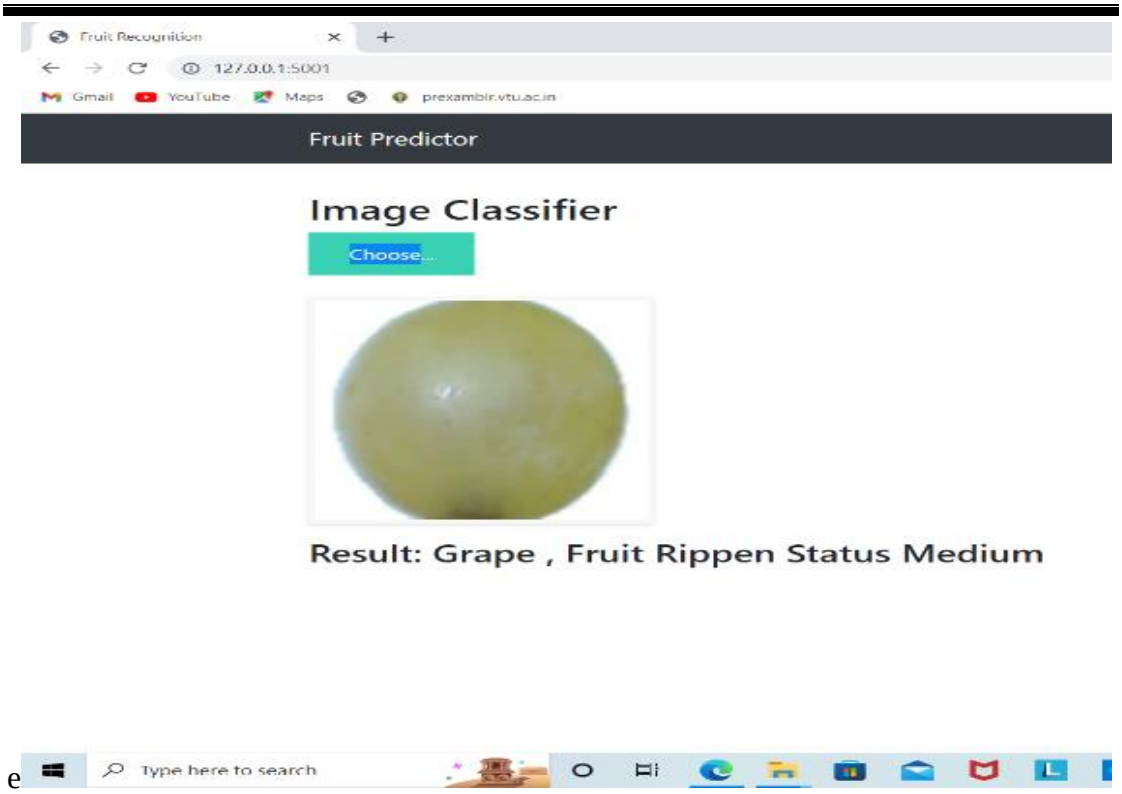

Fig 5.9: Fruit recognition and status of grape

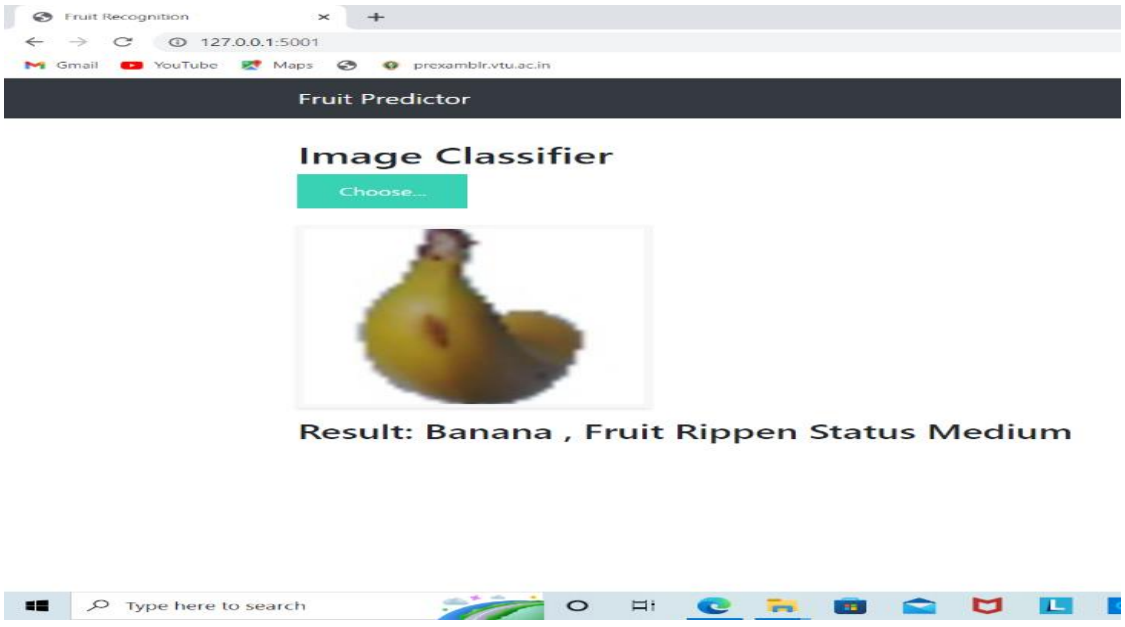

Fig 5.10: Fruit recognition and status of banana.

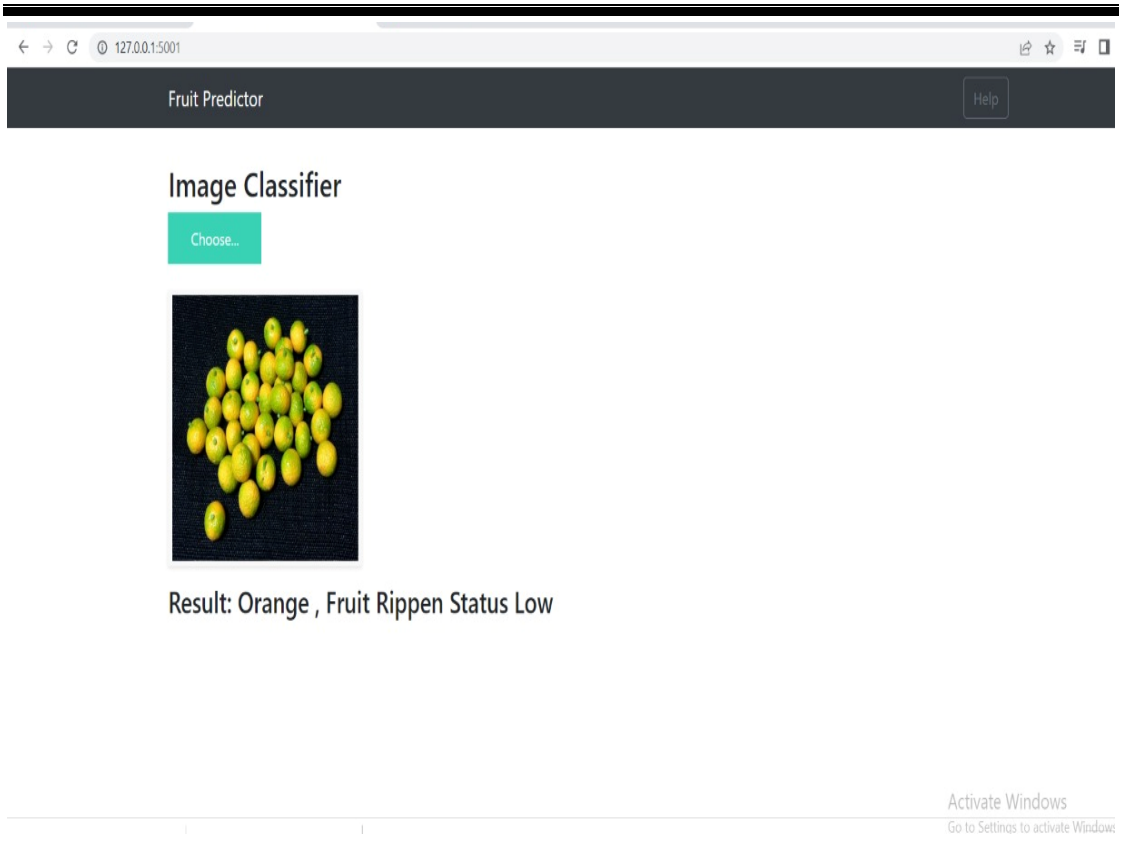

Fig 5.11: Fruit recognition and status of orange.

CHAPTER 6

CONCLUSION

The creation of a fruit recognition and status system for the benefit of market, mall, wholesale fruit shop and industries for the better predicting the of quality details, which helps for eliminating the collecting as well as encourage the development of a prosperous, secure, and tranquil farmer society in India. The CNN technique was used to classify and segment fruit image data. Initially, the various attributes of a few fruits were retrieved and the corresponding photos were segmented. The various quality names are compared to feature values after which the best quality for the image is determined. This quality is then highlighted by an alert box. The result is displayed together with the overall sample count, low, middle, and high locations. The overall paper shows the fruit recognition, status, ripe and quality of the fruit

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List of publication

Sl No.	Author	Title of the paper	Publisher	Issue	Vol	page	Publish Year
1	Keerthana S N	Predicting the quality of fruit using machine learning	International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)	1	2	5	2022