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Rotten Fruit Disease Detection and Treatment Using Recommended Pesticides

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Abstract - India's largest industry is the fruit industry. The fruit disease causes large losses in productivity, quality, and quantity due to lack of care and improper human inspection. The manual examination is a time-consuming and arduous operation. Using multiple color, texture, and shape feature combinations, an image processing strategy is given for apple fruit disease identification and categorization. Image segmentation, feature extraction (color, texture, and shape), feature combining, and finally, Fruit Disease Detection using Conventional Neural Network (CNN) where Fruits are classified into diseased or normal classes, are the basic steps of the suggested approach. Fruit diseases pose a server threat to agriculture industry production and economic loss. The presence of Illness in the fruit might cause a fruit's quality and yield to decline too much. Monitoring fruit health and identifying diseases that are present is essential. In agricultural applications, such as disease detection, categorization, and grading, advanced computational approaches have been applied to assist farmers in routine Farm activities with more precision, efficiency, productivity, and cost savings, the classification of disease that improves defect segmentation and fuses color, texture, and shape- based information.

***Key Words*:** CNN, Pesticides, Neural.

1.INTRODUCTION

Fruit diseases seriously jeopardize the agricultural industry's output and financial ability. It is possible for a fruit's quality and yield to drastically fall if it has diseases. It's crucial to keep an eye on fruit's health and spot any infections that might be present. Advanced computational methodologies have been used in agricultural applications, such as disease detection, categorization, and grading, to support farmers in normal farm chores with more precision, efficiency, productivity, and cost savings. The illness categorization integrates color, texture, and shape-based information and enhances defect segmentation. Rotten fruit disease is a common problem in agriculture, particularly in the production of fruits. This disease is caused by fungi that infect the fruits, causing them to rot and become unsuitable for consumption or sale. It can have a significant impact on farmers' yields and profits. The early detection and treatment of rotten fruit disease are critical to prevent its spread and minimize its impact on the crop. One effective method for detection is through visual inspection of the fruits, which can identify any signs of discoloration, mold growth, or other indications of rot. Once detected, the use of recommended pesticides is a common method for treating the disease. These pesticides can kill the fungi that cause the disease and prevent its spread to other fruits. It is important to use only recommend pesticides to ensure the safety of the fruit for consumption and minimize any harm to the environment. it is essential to educate farmers on the proper use of pesticides and their potential impacts on the crop, environment, and human health. the early detection and treatment of rotten fruit disease using recommended pesticides can help ensure the production of high-quality, safe fruits while also minimizing the impact of the disease on farmers' yields and profits. Apple blotch is a fungal disease and appears on the surface of the fruit as dark, irregular, or lobed edges. Visual inspection of apples is already automated in the industry by machine vision with respect to size and color. However, the detection of defects is still problematic due to the nature al variability of skin

color in different types of fruits, the high variance of defect types, and the presence of stem/calyx. The studies of fruit can be determined by apparent patterns of specific fruit and it is critical to monitor health and detect disease within a fruit. Through proper management action such as pesticides, fungicides, and chemical applications one can promote control of diseases which interns improve quality. Varieties of fruits are being exported all over the world with the development of cold storage facilities and transportation. It becomes necessary of maintaining the highest- level export quality which is mainly carried out by visual checking by experts. This is expensive and time-consuming due to the distant location of farms. Precision Agriculture helps the farmers to provide sufficient and economical information and control technology due to the development and disclosure in various fields. The objectives are agricultural input systemization, profit hike, e, and environmental damage reduction. So, in this work, a solution for the detection and classification of fruit diseases is proposed and experimentally validated. This system takes input as image e of a fruit and identifies it as infected or noninfected. The technique helps the farmers to identify diseases using this proposed work.

2. PROBLEM STATEMENT

Fruit diseases are a major problem in economic losses and production in the agricultural industry worldwide. an image processing approach is proposed for identifying passion fruit diseases.

3. OBJECTIVE OF THE PROJECT

The objective of this project is to develop a system that helps the food industry to classify fruits based on specific quality features. Our system will give best performance when used to sort some brand of fruits. The fruit industry plays a vital role in a country's economic growth. They account for a fraction of the agricultural output produced by a country. It forms a part of the food processing industry. Fruits are a major source of energy, vitamins, minerals, fiber and other nutrients. They contribute to an essential part of our diet. Fruits come in varying shapes, colors, and sizes. Some of them are exported, thereby yielding profit to the industry

4. MOTIVATION

India is well known for its agricultural production. Farmers have variety of options to cultivate fruit in the field. Still, the cultivating this fruit for best harvest and top quality of production is done in a technical way. So, the yield can be increased and quality can be improved by the use oftechnology.

Agriculture is one of the major contributors to economy in India. The decline in production of agriculture will not only lead to loss of farmers but also leads to an increase in regular prices of agriproducts produced by farmers across India. The decrease in fruit yield might be due to several reasons. But one of the main reasons is due to diseases with which the fruits are infected. The identification of type of disease the fruit is suffering from can't be predicted accurately and it may be error prone. So, there is a immediate need of a new methods and strategy for easy and accurate classification of diseases with which the fruits might get infected. The failure in early detection of fruit disease might lead to significant decrease in fruit yield. The manual inspection of fruits by farmers and asking for pesticide recommendation to the village officials of agriculture lead to incorrect diagnosis of fruit and may cause more negative adverse effects in the plants or lead to decline in production of fruit yield. The manual inspection is also a time consuming and tedious process in the fields of agriculture. Thus, the new way of detecting the type of fruit disease and suggesting pesticide by the method of image preprocessing and machine learning algorithms reduces time and also provides better output results.

5. IMPLEMENTATION

- **Modules**

- **Admin:**

In this module, the admin has to log in by using a valid username and password. After the login is successful, he can do some operations, such as View All Users and Authorize, View All E- Commerce Websites and Authorize, View All Products and Reviews, View All Products Early Reviews, View All Keyword Search Details, View All Products Search Ratio, View All Keyword Search Results, View All Product Review Rank Results.

- **View and Authorize Users:**

In this module, the admin can view the list of users who are all registered. In this, the admin can View the user's details such as user name, email, address, and admin authorize the users.

- **View Charts Results:**

View All Products Search Ratios, View All Keyword Search Results, and View All Product Review Rank Results.

- **E-commerce User:**

In this module, there are n numbers of users present. Users should register before doing any operations. Once user registers, their details will be stored in the database. After registration is successful, he has to log in by using an authorized username and password Once the Login is successful user will do some operations like Add Products, View All Products with Reviews, View All Early Product Reviews, and View All Purchased Transactions.

- **End User:**

In this module, there are n numbers of users present. Users should register before doing any operations. Once user registers, their details will best or to the database. After registration is successful, he has to log in by using an authorized username and password. Once Login is successful user will do some operations like Manage Account, Search Products by keyword and Purchase, View Your Search Transactions, and View.

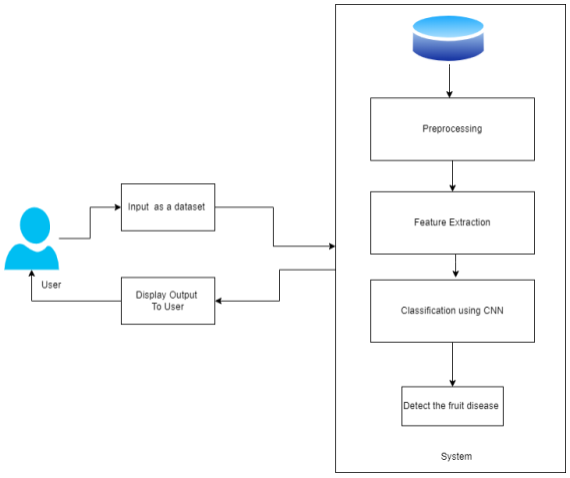


Fig. 1 System Architecture

In Data Flow Diagram, we Show the flow of data in our system in DFD0 we show that base DFD in which the rectangle presents input as well as output and the circle shows our system, In DFD1 we show the actual input and actual output of the system input of our system is text or image and output is rumor detected likewise in DFD 2 we present operation of the user as well as admin.

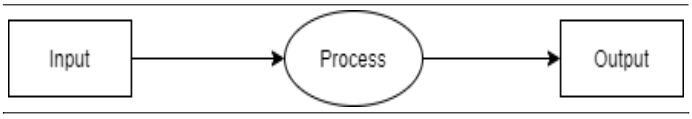


Fig. 2 Data Flow-0 Diagram

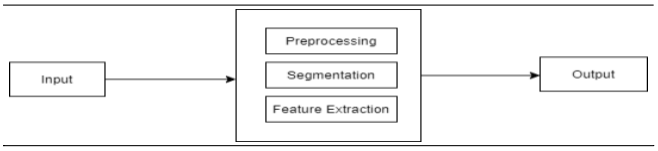


Fig. 3 Data Flow-1 Diagram

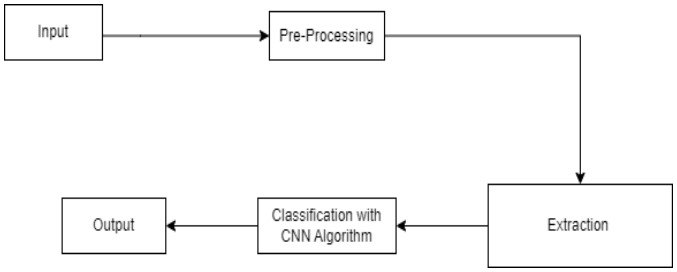


Fig. 4 Data Flow-2 Diagram

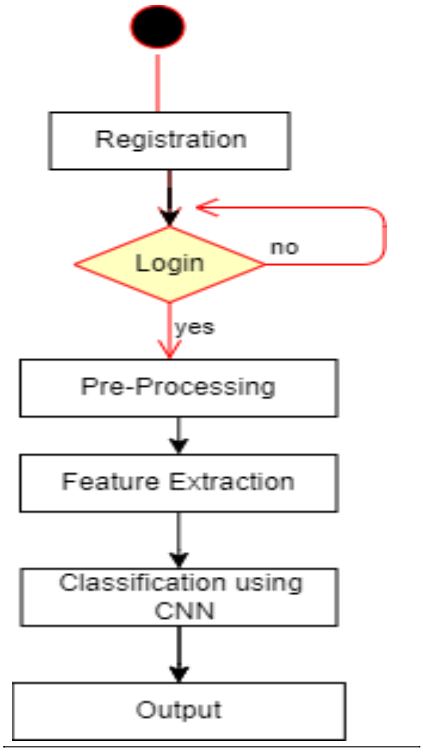


Fig. 6 Activity Diagram

- **UML Diagrams**

Unified Modeling Language is a standard language for writing software blueprints. The UML may be used to visualize, specify, construct, and document the artifacts of a software-intensive system that is process independent, although optimally it should be used in a process that is use case driven, architecture-centric, iterative, and incremental. The Number of UML diagrams are available.

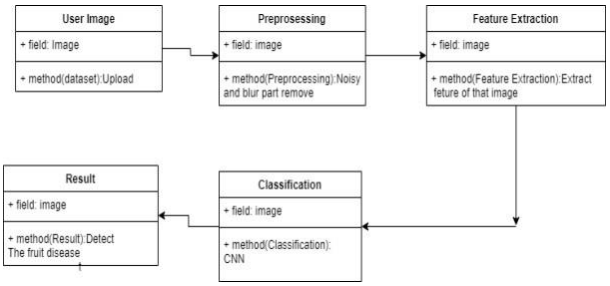


Fig. 7 Class Diagram

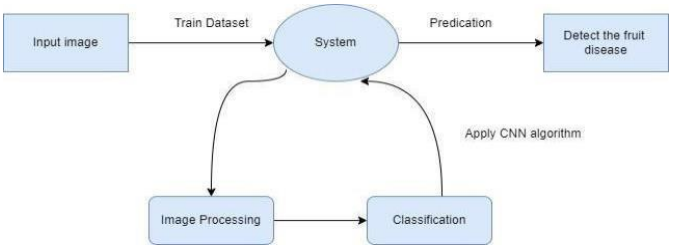


Fig. 5 Use Case Diagram

6. Methodology

- Detection of Rotten Fruit

Fruit Detection Using Image Processing, this is how we can find rottenness in fruits through Artificial Intelligence (AI), Computer Vision (CV), and Convolutional Neural Networks. Nowadays, Artificial Intelligence (AI) is an emerging technology; it is not only part of computing sciences, but it is becoming the basic need of the living population. The vast majority of us know the sentiment of purchasing natural fruits, just to discover that they are effectively ruined. The primary grounds of this project are to bring asystem that can easily detect the rottenness of fruits and evaluate the accuracy of the rottenness of fruits through the camera and classify whether the fruit is rotten or fresh according to the accuracy of their rottenness/freshness.

Everyone is interested to get fresh and quality fruits. As fruits are going to be rotten after the passing of time. Hence, fruit quality has substantial economic consequences. It is estimated that roughly one- third of the fruits are rotten causing huge financial loss. Furthermore, the sale of fruits will be impacted because consumers believe that spoiled fruits are harmful to their health. Classification of fresh and rotten fruits is usually carried out by people, which is ineffective for fruit farmers, sellers as well as fruitprocessing industries.

In the recent era, computer vision techniques are very promising in performing such types of classification and detection tasks.

With a view to developing computer vision-based algorithms, an extensive fruit dataset is presented containing sixteen types of fruit classes, namely fresh apple, rotten apple, fresh banana, rotten banana, fresh orange, rotten orange, fresh grape, rotten grape, fresh guava, rotten guava, fresh jujube, rotten jujube, fresh pomegranate, rotten pomegranate, fresh strawberry, and rotten strawberry. Fresh and rottenclassifications are done with the help of a domain expert from an agricultural institute.

A total of 3200 images of fresh and rotten fruits are collected from different fruit shops and real fields. Then from these original images, a total of 12335 augmented images are produced by using rotation, flipping, zooming, and shearing techniques to increase the data number. Freshness provides one of the essential characteristics for consumers. Consumers prefer fresh fruits rather than rotten ones when it comes to hygiene. An efficient fruit detection system is required to facilitate humans. So, for the easiness of people, this desktop application is proposed, named “Detection of Rotten Fruits (DRF)” by using Artificial Intelligence and Computer Vision. DRF is a desktop application for detecting rottennessin fruits that can be used to indicate the fruits according to their rottenness. Evaluation of fruits relies on the availability of fruit images which are stored in a trained model. This report describes how; through Convolutional Neural Network (CNN) we can find rottenness in fruits. This document will also describehow the system will take input as an image and provide output in the form of accuracy through CNN. This concept will solve the issue of rottenness without using any sensors or extra machines.

Convolution Neural Network

CNN is widely used in computer vision and has become the state of the art for many visual applications such as image classification, and has also found success in natural language processing for textclassification. CNN is very good at picking up on patterns in the input image, such as lines, gradients, circles, or even eyes and faces. Convolutional neural networks can operate directly on a raw image anddo not need any preprocessing. CNN is a feed-forward neural network. CNN contains up to 20-30 layers.The convolutional layer is specific which makes CNN more powerful. The key building block in a convolutional neural network is the convolutional layer. We can visualize a convolutional layer as many small square templates, called convolutional kernels, which slide over the image and look for patterns. Where that

part of the image matches the kernel's pattern, the kernel returns a large positive value, andwhen there is no match, the kernel returns zero or a smaller value. CNN has three main types of layers. They are:

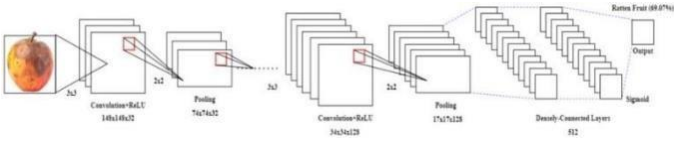
- Convolutional layer
- Pooling layer
- Fully-connected layer

Convolutional Layer: The key building block in a convolutional neural network is the convolutional layer. The Input image is a fruit, which is made up of a matrix of pixels in 2D. It means the image contains dimensions' height, width, and depth. We also have a feature detector it moves across the respective fields of the image, checking the feature is present. The pooling layer is used for dimensionality reduction and for reducing the number of parameters in the input image. This layer filtersacross the entire input. the input fruit image is filtered to get accurate results.

There are three types of pooling:

Max pooling

Average pooling Fully-Connected Layer: The name of the full-connected layer aptly describes itself.The pixel values of the input image are not directly connected to the output layer in partially connected layers. However, in the fully-connected layer, each node in the output layer connects directly to a node in the previous layer. This layer performs the task of classification based on the features extracted through the previous layers and their different filters.



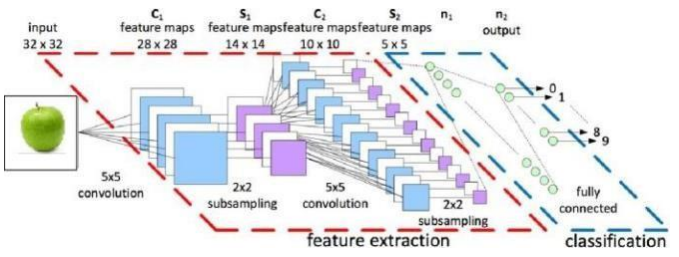


Fig. 8 Convolutional Neural Network

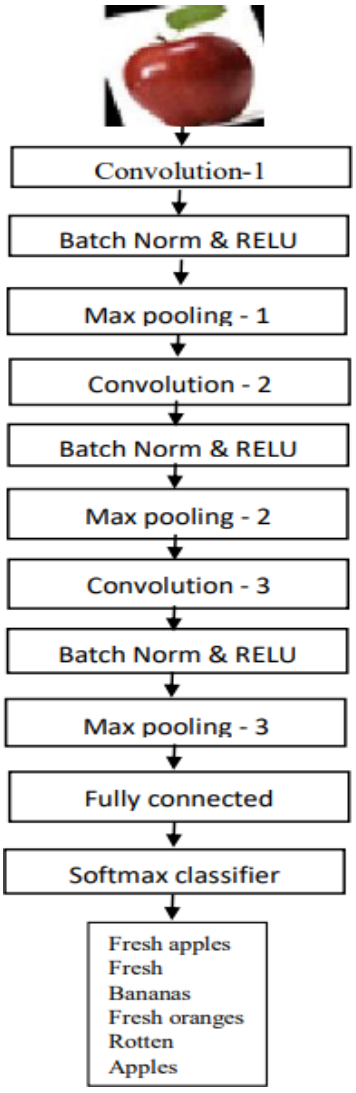
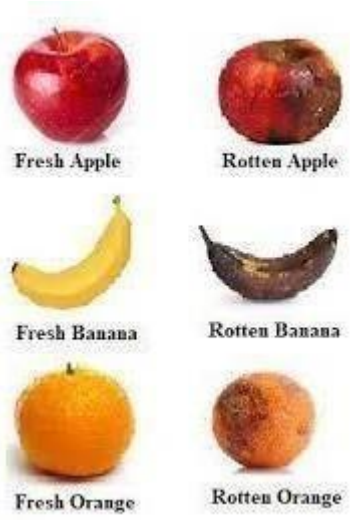


Fig. 8 CNN Implementation

Define a simple CNN architecture with two convolutional layers followed by max pooling, and then two fully connected layers. The final layer uses SoftMax activation for multi-class classification. You would need to load and preprocess your own dataset according to your task and specify the appropriate input shape, number of classes, and activation functions based on your requirements.

Data Analysis

Three different fruit types—Apple, Banana, and Orange—make up the dataset. The CNN algorithm knowledge is mentioned in the Implementation Section with the suitable figure of flow. The approach is consistently used to train a specific model to determine if a fruit is fresh or rotten.



Accuracy = No of correct predictions / Total No of Correct predictions

The Most Common Metric used to evaluate the performance of classification accuracy. Typically, the accuracy of a predictive model is good.

In This Project, we detect rotten fruit and disease with this fruit detector. Our model not only identifies the patches but as well as the cause of damage. It provides Pesticides based on fruit disease which are used to protect crops against insects, weeds, fungi, and other pests. An early detection system of fruit disease can aid in decreasing such losses and can halt the further spread of thedisease. Data analysis in rotten fruit disease detection enables the identification of relevant features, understanding of disease characteristics, and the building of effective detection models. It helps uncover patterns and insights that can contribute to accurate disease identification and classification, ultimately aiding inthe development of robustdetection systems.

To develop a system for detecting and treating rotten fruit disease using recommended pesticides, the following steps can be taken:

Dataset collection: Collect a dataset of images of various types of fruits affected by different types of rot diseases. This dataset can be collected from various sources such as Kaggle, public research papers, or by capturing images of diseased fruits.

Image Preprocessing: Preprocess the collected dataset by resizing the images, removing noise, and enhancing the contrast. This step will improve the quality of the images and make them more suitable for analysis.

Feature Extraction: Extract features from the preprocessed images using techniques like color histogram, texture analysis, and edge detection. This step will help in identifying the patterns andfeatures that are characteristic of different types of rot diseases.

Training: Use a machine learning algorithm such as a convolutional neural network (CNN) to train the model on the extracted features. The training data should be split into training and validation sets to avoid overfitting.

Testing: Once the model is trained, test it on a separate set of images to evaluate its accuracy in detecting different types of rot diseases. This step is important to ensure that the model is generalizable and can accurately detect rot diseases in new images.

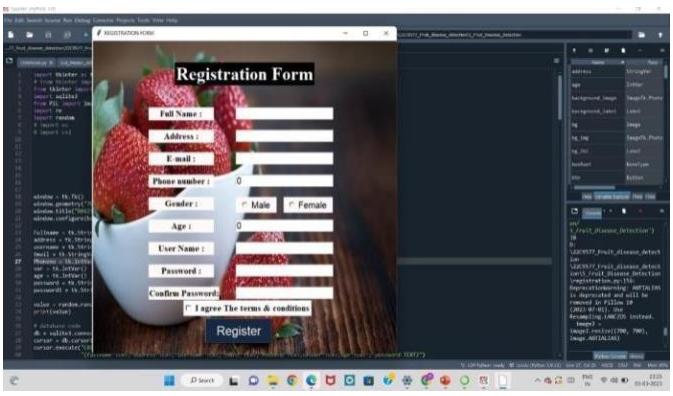
Treatment Recommendation: Based on the type of rot disease detected, recommend the appropriate pesticide treatment to the user. This can be achieved by mapping the detected disease to a database of recommended treatments.

Deployment: Finally, deploy the system on a suitable platform such as a web or mobile application so that users can easily access it and detect and treat rot diseases in their fruits.

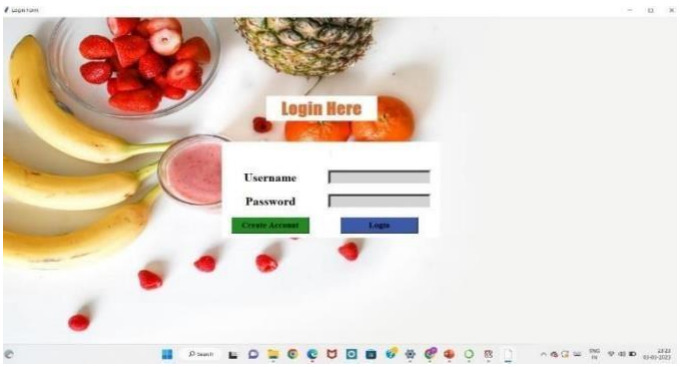
7. RESULTS


Login
Register
Rotten fruit disease detection treatment using recomended pesticides
.....Welcome to Fruit Disease Detection System .....


Rotten fruit disease detection treatment using reccommended pesticides
Process
Select_Image
Image_preprocess
CNN_Prediction
Exit


Registration Form
Full Name :
Address :
E-mail :
Phone number :
Gender :
Male
Female
Age :
User Name :
Password :
Confirm Password :
I agree The terms & conditions
Register


Rotten fruit disease detection treatment using reccommended pesticides
Process
Select_Image
Image_preprocess
CNN_Prediction
Exit


Login Here
Username
Password
Create Account
Login


Rotten fruit disease detection treatment using reccommended pesticides
Process
Select_Image
Image_preprocess
CNN_Prediction
Exit
Please Select Image For Prediction....
Selected Image is Apple-Normal
Execution Time: 4.77 seconds

8. APPPLICATIONS

Gives an effective savvy cultivating method which will help for better yield and development with less human endeavors.

With brilliant cultivating the present agriculturist can utilize choice instruments and mechanization strategies that flawlessly coordinate items, learning, and administrations for better efficiency, evaluating and surplus yield.

It would likewise elevate Indian Farmers to do smart cultivating which sets aside opportunities to time choices which additionally spare time and lessen the loss of fruit because of diseases.

Improved crop yield and quality: The early detection and treatment of rotten fruit disease can help preventthe spread of the disease and minimize its impact on crop yield and quality. This can result in higher profitsfor farmers and better-quality fruits for consumers.

Increased food safety: The use of recommended pesticides ensures that the fruits are safe for consumption by reducing the risk of contamination from disease-causing fungi. This is essential for ensuring food safetyand preventing potential health risks to consumers.

Sustainable farming practices: The use of recommended pesticides and preventive measures helps promote sustainable farming practices by minimizing the use of harmful chemicals and reducing the impact on theenvironment.

Improved farmer education and awareness: The application of this disease detection and treatment methodcan also result in improved farmer education and awareness of the proper use of pesticides, effective preventive measures, and sustainable farming practices. This can help ensure long-term sustainability andprofitability for farmers.

CONCLUSIONS

Image processing-based method for the identification and categorization of fruit ill- nesses The proposed method consists mostly of three steps. Using the K-Means clustering technique, image segmentation is carried out in the first stage. Features are extracted in the subsequent stage. The third step involves training and classification on a CNN. Additionally, it would encourage Indian farmers to use smart farming which enables them to make timely decisions that also save time and lessen fruit loss from diseases. Our paper's main goal is to increase the utility of fruit disease diagnosis. The main reason to propose this idea is to replace the manual assessment. As we all are well aware of the fact that with the agricultural revolution, People are more concerned about their health and prefer to use fresh fruits for their diets. In the past, sensor- based machines were being used to detect the rottenness of fruits whereas DRF is a desktop application that is going to solve this issue without using any sensors and additional gadgets. This project explores the classification of rotten fruits based on a dataset gathered from Kaggle. So, the conclusion is that the problem regarding the rottenness of fruits can be overcome by this idea. The accuracy and loss curves were generated by using various combinations of hidden layers and models of CNN. This idea can be the best-fit solution because It can be utilized even by common people. The applications in the play store are not providing accurate results but DRF shows 90% accuracy of the rottenness of fruits, among 10 images every 2 images may not be classified properly.

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