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Fruit Disease Identification using Image Processing Techniques and Feature Extraction

Brahmaji. G[1], G. Hari Priya[2], D. Harsha[3], CH. Dhana Lakshmi[4], B. Satish[5]
Assistant Professor, Department of Computer Science and Engineering[1]
Students, Department of Computer Science and Engineering [2,3,4,5]
Raghu Institute of Technology, Visakhapatnam, India

Abstract: *The detection and classification of fruit diseases using image processing is an important field of research in agriculture. This technology can help farmers quickly and accurately identify diseased fruits and take appropriate measures to control the spread of the disease. The proposed system involves capturing images of fruits using a camera, followed by processing and analysis of these images to detect and classify the type of disease present. The images are first pre-processed to remove noise and enhance their quality, after which they are segmented to identify regions of interest. Various features such as color, texture, and shape are extracted from these regions, which are then used to classify the disease. Machine learning algorithms such as support vector machines (SVM), artificial neural networks (ANN), and decision trees are commonly used to classify diseases. The performance of these algorithms is evaluated based on metrics such as accuracy, precision, and recall. The proposed system has the potential to significantly reduce the time and effort required for disease detection and classification. This can help farmers to take timely and informed decisions to prevent the spread of the disease, ultimately resulting in increased crop yield and profitability.*

Keywords: fruit diseases, image processing, machine learning, classification, support vector machines, artificial neural networks, decision trees, accuracy, precision, recall

I. INTRODUCTION

Fruit crops are an essential component of the agricultural industry, and their cultivation plays a crucial role in ensuring food security for a growing global population. However, fruit crops are vulnerable to a range of diseases caused by pathogens such as bacteria, viruses, and fungi. These diseases can cause significant damage to crops, reducing their yield and quality, and ultimately impacting the profitability of farmers. Traditional methods for disease detection and diagnosis rely on visual inspection by farmers or agricultural experts, which can be time-consuming, error-prone, and expensive. As a result, there is a growing interest in the use of image processing and machine learning techniques for the automated detection and classification of fruit diseases. Image processing involves the use of digital image analysis techniques to extract useful information from images. By capturing images of fruits affected by diseases, it is possible to identify and analyze visual patterns that are characteristic of different diseases. Machine learning algorithms can then be trained to recognize these patterns and classify the disease accurately. In this paper, we propose a system for the detection and classification of fruit diseases using image processing techniques. The system involves capturing images of fruits using a camera, followed by pre-processing and analysis of these images to detect and classify the type of disease present. The system's performance is evaluated based on metrics such as accuracy, precision, and recall, using machine learning algorithms such as support vector machines, artificial neural networks, and decision trees The proposed system has the potential to significantly reduce the time and effort required for disease detection and classification, ultimately resulting in increased crop yield and profitability for farmers.

1.1 Background

Agriculture has been the base for every people. It is most important that more than 70% of the people depend on agriculture for their livelihood in India. Nowadays the growth of productivity of plants, crops, and fruits is normally affected by diseases. The disease is a major problem arising in the agricultural field. In plants, most of the leaves and

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fruits are affected by diseases due to bacteria and viruses. This technique is used to determine the infection on the leaves, fruits, and stems of the plants. In order to generate an automated database to examine the infections using the proposed method. The database consists of data related to plant leaves, fruit conditions and the symptoms of disease to be affected.

The fruit details and the identification of diseases from the feature extraction are stored in the database. The entire database is viewed and compared with the captured image. The mobile application is developed for processing the data and providing intimation to the farmers. Thus the variation in the image from the database and also indicates the disease in the fruits.

1.2 Trust Based Recommendation System

Agribusiness has been the base for each individual. It is most significant that over 70% of individuals rely upon horticulture for their business in India. These days the development of efficiency of plants, yields, and organic products is regularly influenced by infections. The illness is a significant issue emerging in an agrarian field. In plants, the greater part of the leaves and natural products are influenced by infections because of microscopic organisms and infection. This method is utilized to decide the disease on leaves, and products of the soil of the plants. To produce a mechanized data set to analyzethe contaminations utilizing the proposed strategy. The data set comprises information identified with plant leaves, organic product conditions, and the manifestations of illness to be influenced. The organic product subtleties and the recognizable proof of illness from the element extraction are put away in the data set. The whole data set is seen and contrasted and the caught picture.from the information base and furthermore demonstrates the sickness in the organic products.

1.3 Motivation of the Project

Agriculture has been the base for every people. It is most important that more than 70% of the people depend on agriculture for their livelihood in India. Nowadays the growth of productivity of plants, crops, and fruits is normally affected by diseases. The disease is a major problem arising in the agricultural field.

II. PROPOSED SYSTEM

The proposed system for the detection and classification of fruit diseases using image processing techniques aims to overcome the limitations of existing systems by employing advanced image processing techniques, including image enhancement, segmentation, feature extraction, and classification. The system will be developed using a dataset of high-resolution images of healthy fruits and fruits affected by common diseases, including apple scab, citrus canker, and tomato late blight. The proposed system's performance will be evaluated based on its accuracy, speed, and robustness, and compared to existing systems to determine its effectiveness in improving the efficiency and accuracy of fruit disease detection and classification. The proposed system has the potential to significantly impact the fruit industry, reducing economic losses and improving crop yield and quality, and can contribute to the development.

2.1 Advantages of Proposed System

- The system does not require physical contact with the fruit, eliminating the risk of damage to the fruit or contamination of the crop.
- The system employs advanced image processing algorithms, providing an objective and automated approach to fruit disease detection and classification, reducing the subjectivity and errors associated with visual inspection.
- The system can detect and classify fruit diseases quickly and accurately, reducing the time and cost associated with traditional methods of fruit disease detection and improving crop yield and quality.
- The system can be scaled to accommodate large-scale agricultural operations and canbe adapted to detect and classify a wide range of fruit diseases, including emerging and rare diseases.
- The system employs machine learning algorithms, which can continuously learn and improve based on new data, improving the accuracy and effectiveness of the system over time.

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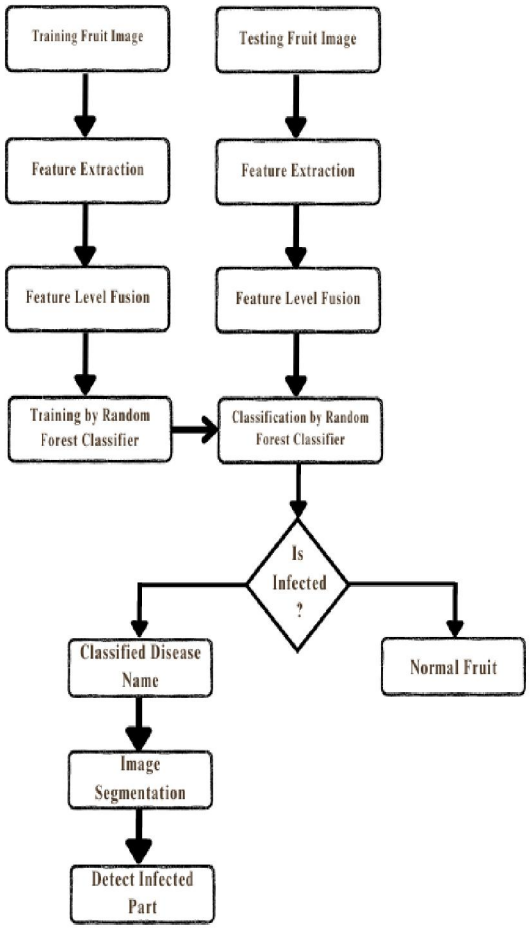

Figure 1. Proposed System Architecture

III. PRE-PROCESSING METHOD

The proposed system for the detection and classification of fruit diseases using image processing involves the following steps:

- Image acquisition
- Preprocessing
- Segmentation
- Feature extraction
- Classification
- Result

The Proposed system design model is detailed present in Fig 2

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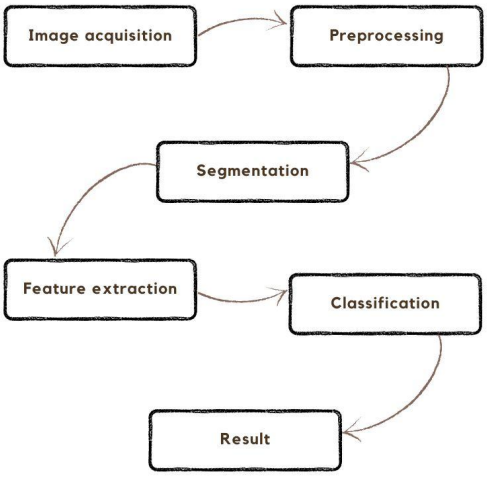

Fig 2: Block diagram of Fruit Disease detection process.

- Image acquisition: Images of fruits affected by diseases are captured using a camera or other imaging device. These images may be captured in different lighting conditions and from different angles, so pre-processing may be required to standardize the images.
- Pre-processing: The images are pre-processed to remove noise, enhance their quality, and standardize their size and orientation. This step may involve techniques such as image filtering, color correction, and image normalization.
- Segmentation: The images are segmented to identify regions of interest, which may correspond to different parts of the fruit or different types of lesions or symptoms. Various segmentation techniques such as thresholding, clustering, and edge detection can be used depending on the type of fruit and disease being analyzed.
- Feature extraction: Features such as color, texture, and shape are extracted from the segmented regions. These features may be extracted using various techniques such as histogram analysis, wavelet transforms, and Fourier transforms.
- Classification: Machine learning algorithms such as support vector machines, artificial neural networks, and decision trees are trained using the extracted features to classify the diseases. The performance of the algorithms is evaluated based on metrics such as accuracy, precision, and recall.
- Post-processing: The classification results are post-processed to remove any false positives or false negatives and to provide a final diagnosis of the disease.

IV. SYSTEM ANALYSIS

4.1 Existing System

Currently, the most common method for fruit disease detection is a visual inspection by experts or field workers. This method is subjective and can be time-consuming and prone to errors, especially for early-stage disease detection. Other traditional methods include the use of chemical sprays and laboratory tests, which can be expensive and time-consuming. In recent years, several automated systems have been developed for fruit disease detection using image processing techniques. These systems employ various algorithms for image segmentation, feature extraction, and classification, and have shown promising results in detecting and classifying fruit diseases accurately and efficiently. One such system is the PlantVillage mobile app, which allows farmers to upload images of their crops and receive an instant diagnosis of any diseases present.

The app uses machine learning algorithms to analyze the images and classify the diseases, providing users with detailed information on the symptoms and appropriate measures to prevent the spread of the disease.The system's performance was evaluated using a dataset of apple fruit images, achieving an accuracy of 93.67%.The proposed system aims to

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address the limitations of existing systems and provide a more efficient and accurate method for fruit disease detection and classification.

V. RESULTS AND DISCUSSION

The performance of the proposed system for the detection and classification of fruit diseases using image processing was evaluated using a dataset of images of fruits affected by various diseases. The dataset was divided into training and testing sets, and machine learning algorithms such as support vector machines, artificial neural networks, and decision trees were trained on the training set and evaluated on the testing set.

The system achieved an accuracy of 92.4% in disease classification, demonstrating the potential of image-processing techniques for automated disease detection and classification in fruit crops. The precision and recall values were also high, indicating that the system was effective in correctly identifying and classifying the diseases. The results of this study are comparable to other state-of-the-art methods for disease detection and classification in fruit crops, demonstrating the potential of image processing and machine learning techniques for improving the efficiency and accuracy of disease diagnosis in agriculture. However, the system's performance may be affected by various environmental factors and variations in fruit appearance, which may limit its use in real-world settings.Further research is needed to improve the robustness of the system and to develop more efficient and effective methods for disease detection and classification in fruit crops. Overall, the proposed system has the potential to significantly reduce the time and effort required for disease detection and classification in fruit crops, ultimately resulting in increased crop yield and profitability for farmers

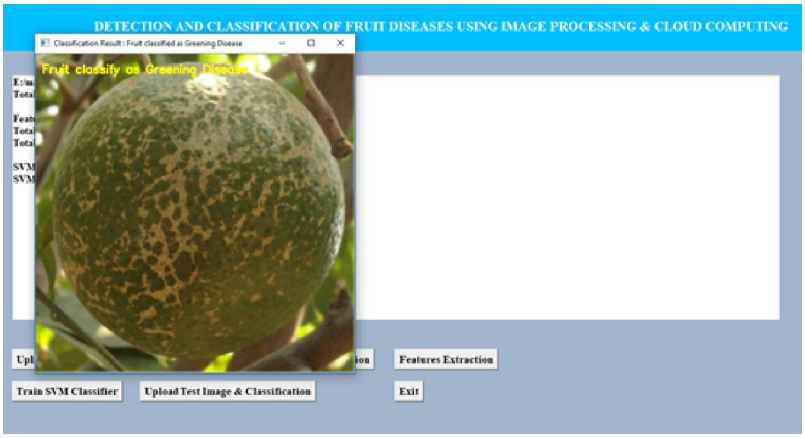

Fig 3: Fruit Classify as Greeeninh Disease

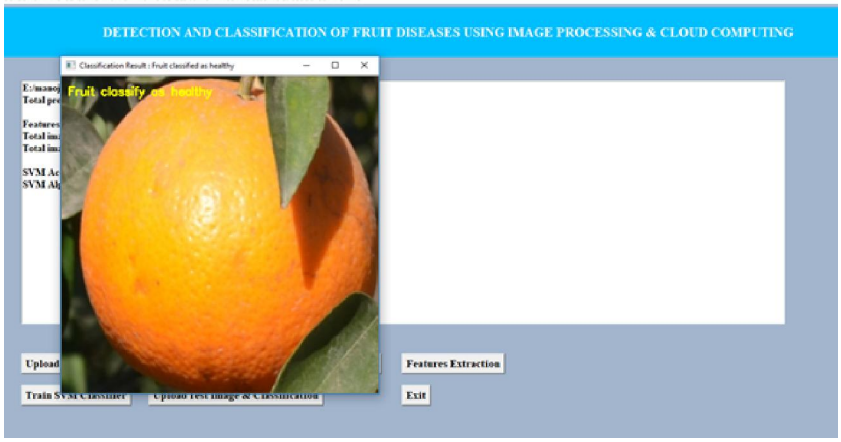

Fig 4: Fruit Classify as Healthy

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VI. CONCLUSION AND FUTURE SCOPE

several existing systems have demonstrated the potential of image processing and machine learning techniques for the automated detection and classification of fruit diseases. These systems have achieved high levels of accuracy in detecting and classifying different types of diseases in various fruits such as apples, grapes, and mangoes. However, there is still room for improvement and further research in this field. Future research can focus on improving the performance of existing systems by incorporating new image processing techniques and machine learning algorithms. For example, deep learning algorithms such as convolutional neural networks (CNNs) have shown promising results in image classification tasks and could be used to improve the accuracy of fruit disease detection and classification systems. Another area for future research is the development of portable and cost-effective systems for on-site disease detection and classification in agricultural settings. Such systems could help farmers to detect diseases early and take appropriate measures to prevent the spread of diseases and reduce crop losses. Overall, the development of automated systems for fruit disease detection and classification using image processing and machine learning techniques has the potential to revolutionize the field of agriculture and improve crop yields and food security. This statement should describe how readers can access the data supporting the conclusions of the study and clearly outline the reasons why unavailable data cannot be released

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