



Automated Fruit Disease Detection using Convolutional Neural Networks

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Abstract—

This study proposes a convolutional neural network (CNN)-based method for the automated detection of fruit diseases. Using deep learning techniques, the model is trained on a large collection of fruit images to accurately recognize and classify different types of diseases affecting fruits. The system provides a rapid, reliable, and cost-effective approach for early disease identification, which can support better crop management and minimize the excessive use of harmful chemicals. Experimental results demonstrate high classification accuracy, highlighting the significant potential of artificial intelligence in enhancing modern agricultural practices. In the proposed approach, the application first captures an input image from the user. The image then undergoes segmentation to extract the relevant region of interest. The segmented image is subsequently provided as input to the CNN model, which extracts important feature vectors for accurate fruit disease detection and classification. The proposed model attains 95% detection accuracy.

Keywords— Fruit disease detection, CNN, Image classification, Agricultural, automation, Disease identification.



I. INTRODUCTION

Traditionally, fruit disease detection and identification have relied on visual inspection by agricultural experts. However, in many developing regions, access to specialists is limited, expensive, and time-consuming due to their remote availability. As a result, automated fruit disease detection systems have become increasingly important for identifying disease symptoms at an early stage of fruit growth. Early detection helps reduce crop losses, improves fruit quality, and supports effective disease management practices.

Fruit diseases can significantly affect both the yield and quality of harvested crops. Identifying diseases accurately is essential for determining suitable preventive measures, such as the application of pesticides, fungicides, and other treatments, to minimize future losses. In some cases, diseases not only damage fruits but also spread to other parts of the plant, including leaves, branches, and twigs. For instance, common apple diseases include apple scab, apple rot, and apple blotch. Apple scab typically appears as gray or brown rough spots on the fruit surface. Apple rot causes circular brown or black lesions that may be surrounded by reddish rings, while apple blotch is a fungal infection characterized by dark, irregularly shaped patches on the fruit skin.

Although machine vision systems are already used in the fruit industry for tasks such as sorting based on size and color, detecting diseases and defects remains challenging. This difficulty arises due to variations in fruit skin color, differences in defect appearance, and the presence of natural structures such as stems and calyxes. Therefore, continuous monitoring of fruit health using advanced image processing and deep learning techniques is crucial for accurate disease identification and effective crop management.

II. LITERATURE REVIEW

A literature survey on fruit disease detection focuses on various methods and advancements aimed at identifying diseases affecting fruits, such as apples, citrus, tomatoes, and grapes. This survey includes traditional techniques, machine learning approaches, and recent developments in deep learning, particularly Convolutional Neural Networks (CNNs).

III. METHODOLOGY

The main objective of the proposed system is to provide a user-friendly interface for Fruit disease detection using deep learning model. The system is implemented Convolutional Neural Network are a family of machine learning models used in computer vision and image processing. Specially designed for disease detection, the original goal of any CNN is a model which is designed to process arrays of data such as images. Our proposed application first captures input image from user. Then Image is extracted using the image segmentation finally the segmented image is given as an input and we get the feature vectors which are then performed for the Fruit disease detection task.

3.1 Images dataset Collection: The dataset used for the proposed methodology is gathered from the Kaggle (Fruit disease) dataset. The dataset contained information of disease. It contains two separate folders, train and test, where the train folder is consists of classes, and every category contains various images.

3.2 Image Resize Using Pre-Processing Model:

CNN model is that they cannot be trained on a different dimension of images. So, it is mandatory to have same dimension images in the dataset. Dimension of all the images of the dataset so that we can process the images into having similar dimensions. In this dataset, the images have a very dynamic range of dimensions from $16*16*3$ to $128*128*3$ hence cannot be passed directly to the Convnet model.

3.3 Build CNN Classifier Using Train Data: The architecture of the proposed CNN model is a feed-forward network with a sequential model in which each layer is connected in a single-input and single-output manner. CNN model to classify the images into their respective categories 2 Conv2D layer, MaxPool2D layer, SoftMax. To train our model, proposed use the model. Fit () method that works well after the successful building of model.

3.4 Test image evaluate: This module completely for user. Using this web application user can able to select and browse fruit images. This image may



contain Jpeg or png format. High dimensional Image will get better classification result.

3.5 CNN Classifier Model Evaluation: Each and every Test image analysis using neural networks will predict the Fruit disease effectively using our model. Finally test image is going to match with model it takes to perform detection on an image. Training is not done in a single step. There are different models for doing different parts which make the training process. Finally, this classifies upload images has Fruit disease or not effectively.

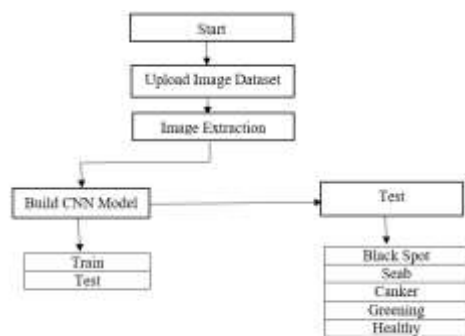


Figure-1 System Architecture

IV. CONCLUSION

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus, it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective. Proposed system successfully implements user-friendly interface to user can upload fruit image. After successful of user image upload image is considered as input this will apply to CNN Model. Once CNN model build user can upload test image. Then this application automatically identifies and detect fruit disease information such as Black spot, canker, greening, scab or healthy more effectively.

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