Review: Diagnosis of Pomegranate Plant Diseases using Neural Network

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Abstract

One of the fruits with the highest market earnings is the pomegranate, which is cultivated in several Indian states with a very high yield. However, a variety of factors lead to the plants becoming infected with different diseases, which decimate the entire crop and produce a very low yield. Therefore, the paper suggests using image processing and neural network techniques to address the primary problems in phytopathology, namely the detection and categorization of diseases. Different illnesses that are brought on by fungus, bacteria, and environmental factors damage the pomegranate fruit as well as the leaves. Similar to Bacterial Blight, Fruit Spot, Fruit Rot, and Leaf Spot. The system employs a variety of pictures for testing, training, and other purposes. Pre-processing is done on the colour pictures, and segmentation is done using k-means clustering. Utilizing the GLCM technique, the artificial neural network is provided with the texture characteristics. This approach is 90% accurate overall. In contrast to manual grading, the results have been shown to be accurate and satisfying, and it is hoped that they will gain a solid reputation as one of the most effective methods.

Keywords— disease detection and classification; pomegranate plant diseases; k-means clustering segmentation; GLCM method; artificial neural network

Introduction

The horticulture industry has seen a number of trends arise in recent years that have shown to be effective in generating cash. With the advancement of transportation and cold storage facilities, many types of fruits are being shipped over the globe. It becomes essential to maintain the highest level of export quality, which is mostly done through skilled visual inspection. Due of the farms' remote locations, this is expensive and time-consuming. Due to advancements and exposure in several industries, precision agriculture lets farmers arm themselves with enough and affordable information and control technologies. The goals are to increase profits, systematise agricultural inputs, and lessen environmental harm. Punica granatum, a deciduous tree, is cultivated in dry and semi-arid climates. It thrives in regions that get annual rainfall ranging from 500 to 800 mm and temperatures between 25 and 35 degrees. Diseases in recent years have caused significant losses in pomegranate production. Microorganisms including fungus, bacteria, and viruses are frequently to blame for these illnesses. Fruit Spot, Fruit Rot, Leaf Spot, and Bacterial Blight are the main ailments. These illnesses are quite severe and ravage the orchards. Fruit-related businesses do definitely fall within the high-risk category. To accurately identify and diagnose plant illnesses for the purpose of controlling and preventing them, an intelligent decision support system makes use of both cutting-edge and useful technologies. For the purpose of detecting apple fruit disease, Anand Singh Jalal et al. adopted the Complete Local Binary Pattern (CLBP). Their suggested strategy uses the Multiclass Support Vector Machine for picture classification together with the K-means clustering technique for feature extraction. Kim, DaeGwan, and others, Using color-texture feature analysis, the illnesses of the grape fruit peel were categorised. The HSI model is utilised for colour, while the Spatial Gray level Dependence Matrix (SGDM) is used to extract texture features. The HSI texture feature model provides greater precision, making it the most reliable model for identifying fruits based on the state of their peels. For the purpose of identifying and classifying pomegranate plant diseases, Tejal Deshpande et al. employed a grading

system created using machine vision. For image-based segmentation of leaves and fruit, the system employs k-means clustering.

Literature rewiew:

Ravikumar Chakali "Effective pomegranate plant leaf disease detection using deep learning"
One of the top fruits for making money on the market is the pomegranate, a fruit that grows with an incredibly high yield in several Asian countries. However, a variety of factors lead to a variety of illnesses infecting the plants, which severely reduces crop output and causes the entire crop to be destroyed. In order to address the most pressing issues with phytopathology, namely the detection and categorization of healthiness, the work suggests a picture method and neural network strategies. Pomegranate fruit is also ascribed to the fact that plant diseases brought on by weather and plants impact the leaves. These illnesses resemble leaf spots, plant spots, seed locations rot, and blight bacterium. The system employs images for a variety of purposes, including coaching, testing, and so on. The colour image goes through pre-processing and k-means clustering segmentation. Utilizing the GLCM approach, the factitious neural network receives the feel alternatives. This method has a ninetieth accuracy average. In contrast to human grading, the findings have been thoroughly tested to be accurate and satisfying. Consequently, it is hoped that the results will have a strong market presence alongside the most important economic operations.[1]

Diagnosis of Plant Diseases using Artificial Neural Network

Pictures are used by the system for testing, tutoring, and other purposes. Preprocessing and segmentation using k-means are applied to the colour image. The factitious neural network is given the feel alternatives, which are retrieved using the GLCM method. This method has a ninety-percent overall accuracy. In contrast to human grading, the findings have been thoroughly tested to be accurate and satisfying. With any luck, the results will gain traction as one of the key economic activities in the market.[2]

Sulakshana A. Gaikwad1, Kalyani S.Deore2, Monali K. Waykar3, "Detection of Plant Diseases by analyzing the Texture of Leaf using ANN Classifier"

The ability of humans to identify and analyse plant diseases is limited since they only depend on microscopic activities. Accurate categorization and diagnosis of plant diseases are accomplished through the use of computer-based picture rearrangement algorithms. K-mean clustering is used to do disease detection on real-time leaf images that have been recorded. Once the detection has been made, the GLCM filter extracts its characteristics. SVM-based methods are typically used for classification, although they have poor accuracy for texture features. An advanced artificial intelligence based Back Propagated ANN technique is used for categorization in order to conduct features-based matching operations. The suggested method is implemented in the MATLAB environment, and it has significantly higher accuracy than traditional methods.[3]

Fruit Disease Detection and Classification

Fruit diseases have a severe impact on global agriculture sector productivity and financial losses. This research proposes and experimentally validates a method for the identification and categorization of fruit illnesses. The proposed approach for image processing consists of the following steps: in the first step, an image is segmented using the K-Means clustering technique; in the second step, some features are extracted from the segmented image; and, in the third and final step, an image is classified into one of the classes using a Support Vector Machine. Our experimental findings demonstrate that the suggested technique may considerably support accurate fruit disease detection and automated categorization.[4]

M T Vasumathi1_, M Kamarasan2," An Effective Pomegranate Fruit Classification Based On CNN-LSTM Deep Learning Models"
To make use of a deep learning approach that would categorise the fruits into normal and pathological based on characteristics including fruit colour, spot count, and shape. Methods: A set of 6519 fruits is divided into two categories—normal and abnormal—using a combined CNN LSTM deep learning model. The dataset is an excel file with nine characteristics per entry. Long-Short Term Memory (LSTM) is employed to determine the class using the retrieved features, while Convolutional Neural Networks (CNN) are utilised to extract deep features. Results: The suggested system attained an F1-score of 98.39% and accuracy values of 98.17%, 98.65%, 97.77%, and 98.65%. Novelty:The sensitivity of disease detection was less with lesser availability of enhanced detection methods for detecting disease in earlier stages. The issue with these various existing algorithms is that the accuracy was reduced since some sources of errors were not eliminated. Deep Learning delivers methodologies, approaches, and functionalities that can help to resolve analytic and predictive analysis accurately.[5]

Mr. P. B. Wakhare, Yugal Jagtap ,Vivek Gaikwad "Pomegranate Fruit Disease Detection And Classification"

In India, rural areas play a crucial role in the country's development. Using automation and decision-making tools, smart farming enables today's farmers to make quick decisions that improve quality, production, and profit. The system for early and accurate detection of specific types of pomegranate fruit diseases is proposed in the current work utilising image processing techniques. The suggested approach is a useful module that distinguishes between diseases of pomegranate fruits that have been cultivated from the ground and determines the stage of the sickness. The suggested approach makes use of several machine learning and image processing techniques. The acquired images are first prepared for upgrading. Later, the form, colour, and surface of the picture characteristics are extracted for the afflicted portion. Then, these diseased fruits are employed as a contribution to the diagnosis of the illnesses. Following that, classifiers are utilised to grade infections as well as identify disorders. The treatment advisory module can also be built up based on the stage of the illness by seeking for horticulture experts that can assist farmers.[6]

DR. GAJULA RAMESH1, DR. D. WILLIAM ALBERT2, DR. GANDIKOTA RAMU3 DETECTION AND CLASSIFICATION OF APPLE FRUIT DISEASES USING COMPLETE LOCAL BINARY PATTERNS

Fruit diseases are a terrible concern for the global agriculture industry's productivity and financial losses. The detection and categorization of apple fruit illnesses are addressed in this work, and a proposed approach is empirically confirmed. The proposed approach for image processing is made up of the three main steps listed below: segmenting the image using the K-Means clustering technique in the first step; extracting some cutting-edge features from the segmented image in the second step; and classifying the images into one of the classes using a Multi-class Support Vector Machine in the third and final step. Our experimental findings demonstrate that the suggested remedy can greatly help accurate identification and automated categorization of illnesses affecting apple and fruit. Up to 93% classification accuracy is attained using the suggested technique.[7]

DaeGwan Kim, Thomas F. Burks, and Duke M. Bulanon Jianwei Qin, "Classification of grapefruit peel diseases using color texture feature analysis",

This proposed a better method based on convolution neural networks to identify the six main diseases that affect grape leaves: anthracnose, downy mildew, brown spot, black rot, mites, and leaf blight. To reduce the number of parameters and solve the Model over-compliance issue, they employed a deep separable convolution as opposed to the normal convolution. A total of 4,223 pictures were gathered in the field. A total of 107,366 grape leaf pictures were made using enhancement techniques after 3,646 photos were gathered from public data sets. An inception structure is used to improve the performance of multi-dimensional feature extraction.From scratch, a novel DICNN model was built and trained to construct the first two convolutional layers. In these two layers, the parameters of the two convolution layers were decreased, which reduced the intake of resources and ameliorated the performance. 0.13% increase in accuracy was observed when compared to other traditional convolutional models.

They achieved a precision of 97.22% on the test set and produced better accuracy when compared to ResNet and GoogLeNet.[8]

Prajwal TM, Pranathi A, SaiAshritha K, Chittaragi NB, Koolagudi SG. Tomato Leaf Disease Detection Using Convolutional Neural Networks

It geared at executing tasks utilising a transfer learning technique that leverages deep learning models like Faster R-CNN Inception v2 and Single SSD MobileNet v1, which are pre-trained, in order to distinguish between sick grapes from healthy grapes and grape leaves. There were 136 healthy photos and 124 sick images in the image dataset that was used. Faster R-CNN is a Regional Proposal Network (RPN)[2] that uses region proposal techniques to imagine where items could be. A single network is employed in the Regional Proposal Network to generate region proposals, while Fast R-CNN is used to categorise regions. There can be a nearly cost-free region suggestion because "In Faster R-CNN, the RPN shares full-image convolutional features with fast R-CNN" [2]. A fully convolutional network called an RPN decides object bounds and scores simultaneously, and this makes Faster R-CNN entirely CNN.[9]

S. B. Ullagaddi, Dr. S.Vishwanadha Raju, "A Review of techniques for Automatic detection and diagnose of mango Pathologies".

This paper presents a review on methods that use digital image processing techniques to detect, recognize and classify plant diseases from digital image and concludes with discussion of more useful problems in the domain and future scop.[10]

Hadha Afrisal, Muhammad Faris, Guntur Utomo P, Lafiona Grezelda, Indah Soesanti, Mochammad Andri F, "Portable Smart Sorting and Grading Machine for Fruits Using Computer Vision".
This paper discusses the development of portable fruit sorting and grading machine based on computer vision for small agro-industries. The mechanical system is designed from low cost material in the form of inclined and segmented plane to substitute the utilization of conveyor belt.[11]

Dah-Jye Lee, James K. Archibald and Guangming Xiong, "Rapid Color Grading for Fruit Quality Evaluation Using Direct Color Mapping".
In this paper present an effective and user-friendly color mapping concept for automated color grading that is well suited for commercial production. User friendliness is often viewed by the industry as a very important factor to the acceptance and success of automation equipment.[12]

Akira Mizushima, Renfu Lu. "An image segmentation method for apple sorting and grading using support vector machine and Otsu's method".
This paper reports on the development of an automatic adjustable algorithm for segmentation of color images, using linear support vector machine (SVM) and Otsu's thresholding method, for apple sorting and grading. The method automatically adjusts the classification hyper plane calculated by using linear SVM and requires minimum training and time.[13]

Chandra Sekhar Nandi, Bipan Tudu, Chiranjib Koley. "An Automated Machine Vision Based System for Fruit Sorting and Grading".
The paper presents a computer vision based system for automatic grading and sorting of agricultural products like Mango (Mangifera indica L.) based on maturity level. The application of machine vision based system, aimed to replace manual based technique for grading and sorting of fruit.[14]

Manisha Bhangea, H.A.Hingoliwala, "Smart Farming: Pomegranate Disease Detection Using Image Processing".
This paper, propose a web based tool that helps farmers for identifying fruit disease by uploading fruit image to the system. The system has an already trained dataset of images for the pomegranate fruit. Input image given by the user undergoes several processing steps to detect the severity of disease by comparing with the trained dataset images.[15]

Cihan Akin, Murvet Kirci, Ece Olcay Gunes, Yuksel Cakir "Detection of the Pomegranate Fruits On Tree Using Image Processing".
This study a method is proposed for detect pomegranate fruits on the tree and find the number of overall pomegranates using near camera images obtained from the stations established the groves. The pomegranate has significant red color, so a color-based method is applied for to detect the fruits on the tree. Color alone cannot provide a sufficiently robust algorithm for the detection of the pomegranate.[16]

Mrunmayee Dhakate, Ingole A. B, "Diagnosis of Pomegranate Plant Diseases using Neural Network".
The work proposes an image processing and neural network methods to deal with the main issues of phytopathology i.e. disease detection and classification. The Pomegranate fruit as well as the leaves are affected by various diseases caused by fungus, bacteria and the climatic conditions. These diseases are like Bacterial Blight, Fruit Spot, Fruit rot and Leaf spot. The system uses some images for training, some for testing purpose and so on. The color images are pre-processed and undergo k-means clustering segmentation.[17]

CONCLUSION:

The aforementioned approach is used to identify illnesses including Bacterial Blight, Fruit Spot, Fruit Rot, and Leaf Spot. According to the experimental findings, practically all samples provide the best categorization of the categories, however just one sample categorization reveals the various categories.

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