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Tomato Leaf Disease Identification by Restructured Deep Residual Dense Network

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Abstract: As COVID-19 spread worldwide, many major grain-producing countries have adopted measures to restrict their grain exports; food security has aroused great concern from various parties. How to improve grain production has become one of the most important issues facing all countries. However, crop diseases are a difficult problem for many farmers so it is important to master the severity of crop diseases timely and accurately to help staff take further intervention measures to minimize plants being further infected. In this paper, a restructured residual dense network was proposed for tomato leaf disease identification; this hybrid deep learning model combines the advantages of deep residual networks and dense networks, which can reduce the number of training process parameters to improve calculation accuracy as well as enhance the flow of information and gradients. The original RDN model was first used in image super resolution, so we need to restructure the network architecture for classification tasks through adjusted input image features and hyper parameters. Experimental results show that this model can achieve a top-1 average identification accuracy of 95% on the Tomato test dataset in AI Challenger 2018 datasets, which verifies its satisfactory performance. The restructured residual dense network model can obtain significantimprovements over most of the state-of-the-art models in crop leaf identification, as well as requiring less computation to achieve high performance.

Keywords: Residual dense network, leaf disease identification, agricultural artificial intelligence,tomato leaf diseases.

I. INTRODUCTION

Indian economy is highly dependent on agriculture. The sustainable development of agriculture is dependent on agricultural production and the production is affected by crop diseases. One of the widely adopted vegetables in India is tomato. Tomato diseases occur frequently due to different environmental factors. According to the statistical data, there are more than 20 tomato leaf diseases which have directly affected the tomato crop yield and tomato quality which directly reflects the economic loss. Earlier days, farmers have used the artificial recognition methodology for tomato leaf disease detection. It comprises the following stages 1. Detection of tomato plant diseased depending on farmers past experience as well as from the related books 2. Obtaining the images of disease leaf and searching on the internet regarding the information. 3. Consultation of the expert for opinion about disease. Hence in earlier days only experienced or highly educated farmers were able to diagnose the disease properly. By generally farmers are not highly qualified with necessary professional knowledge. They always fail in appropriate judgment of plant disease type and hence they lead to reduced production cost.

II. LITERATURE SURVEY

1.Paper Name: Automated Image Capturing System for Deep Learning-based Tomato

Plant Leaf Disease Detection and Recognition.

Author:Robert G. de Luna, Elmer P. Dadios, Argel A. Bandala

Abstract ::- Smart farming system using necessary infrastructure is an innovative technology that helps improve the quality and quantity of agricultural production in the country including tomato. Since tomato plant farming take considerations from various variables such as environment, soil, and amount of sunlight, existence of diseases cannot be avoided. The recent advances in computer vision made possible by deep learning has paved the way for camera-assisted disease diagnosis for tomato. This study developed the innovative solution that provides efficient disease detection in tomato plants. A motor-controlled image capturing box was made to capture four sides of every tomato plant to detect and recognize leaf diseases. A specific breed of tomato which is Diamante Max was used as the test subject.

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2.Paper Name: :- Tomato Leaf Disease Diagnosis and Severity Measurement
Author: Haridas D. Gadade,Dr. D. K .Kirange
Abstract : Indian economy is mostly dependent on agriculture. One of the highly used food crops in India is Tomato. Hence detection and analysis of leaf disease on tomato plants so as to increase the yield is highly essential. It becomes very hard to manually detect and analyze the tomato leaf diseases. Hence, in this paper we have proposed a segmentation-based approach for automatic segmentation of infected regions. The segmented area is further analyzed for disease classification and severity measurement. Leaf disease detection technique proposed here involves various stages including preprocessing, segmentation, feature extraction, training and classification followed by the severity measurement from the disease segmented region. We have analyzed the performance of different features extraction techniques including color, texture and shape features along with various classification techniques. The performance of the proposed system really inspires the farmers to use the automated system for detection and severity measurement of tomato plant dis-ease

3.Paper Name: TLNet: A Deep CNN model for Prediction of Tomato Leaf Disease Author::-Md. Afif Al Mamun abstract : Tomato production has been rising in Bangladesh over recent years. Apart from nutritional values, tomato production also plays a significant role in terms of creating job opportunities for a lot of people. Even though the most suitable season for producing tomato is winter, tomato cultivation has been proved profitable throughout the year. However, the production of tomatoes gets hindered due to various diseases of tomato leaves. The goal of our research is to create a model that can predict these diseases earlier with the intent that suitable actions can be taken to mitigate the situation. This work presents a deep CNN model named TLNet (Tomato Leaf Net) with over 11800 images divided into 3 parts: Training, validation, and testing. The dataset was prepared using necessary normalization, augmentation, and label encoding techniques. Total 8 classes (7 diseases and 1 healthy class) were taken into consideration. 50 instances were separated from each class for testing purposes.of the remaining data was used for training and was used for validation. The model was eventually able to achieve a high accuracy of for the considered dataset. The outcomes of the work shows the effectiveness along with feasibility of our suggested model.

4.Paper Name:Tomato Septoria Leaf Spot Necrotic and Chlorotic Regions Computational Assessment Using Artificial Bee Colony-Optimized Leaf Disease
Author: Ronnie Concepcion II,Sandy Lauguico
Abstract: Visual inspection of plant health status and disease severity may yield subjective assessments due to errorprone sphere of colors and textures as affected by angular photosynthetic light source and the complexity of chlorosis. Quantification of damages on leaves due to destructive diseases is paramount for plant and pathogen interactions. To address this challenge, the proposed solution is the integration of computer vision and computational intelligence for tomato Septoria leaf spot necrotic and chlorotic region computational assessment. Dataset contains healthy and diseased tomato leaves that were captured individually. Non-vegetation pixels removal was done using CIELab color space. RGB color components and five Haralick texture features were extracted from the segmented leaf. Hybrid neighborhood component analysis and ReliefF algorithm were employed to select the important predictors resulting to RGB-entropy vector. A new tomato leaf disease index (tomLDI) optimized using artificial bee colony (ABC) was developed by normalizing visible red reflectance, and introducing red-green and red-blue reflectance ratios to enhance Septoria leaf spots pixels and reducing sensitivity to healthy green pixels. KNN bested classification tree, linear discriminant analysis and Na¨ıve Bayes in detecting Septoria leaf disease with accuracy of 97.46regression was tested using raw infected leaf images and the tomLDI transformed colored channels through MobileNetV2, ResNet101 and InceptionV3. Using tomLDI channel, MobileNetV2 and ResNet101 bested other networks in estimating leaf diseased region percentage and number of Septoria spots with R2 values of 0.9930 and 0.9484 respectively. tomLDI channel proved to be more accurate than using raw images for regression.

5.paper Name: Literature Review of Disease Detection in Tomato Leaf using Deep Learning Techniques
Author: Hepzibah Elizabeth David1,Hemalatha Gunasekaran3
Abstract: —Tomatoes are the most common vegetable crop widely cultivated in the agricultural fields in India. The tropical climate is ideal for its growth, however certain climatic conditions and various other factors affect the normal growth of tomato plants. Apart from these climatic conditions and natural disasters, plant Fdisease is a major crisis in crop production and results in economic loss. The traditional disease detection methods for tomato crops could not produce the expected outcome and the detection period for diseases was slow. The early detection of diseases can give better results than the existing detection models. Thus, computer vision-based technology deep learning techniques could be implemented for earlier disease detection. This paper introduces a comprehensive analysis of the disease classification and detection techniques implied for tomato leaf disease identification. This paper also reviews the merits and drawbacks of the methodologies proposed. This paper finally proposes the early disease detection technique to identify tomato leaf disease using hybrid deep-learning architecture.

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III. PROBLEM STATEMENT

Tomato leaf diseases are causing substantial economic losses for tomato growers. The primary problem is the prevalence of various diseases that affect tomato leaves, including but not limited to early blight, late blight, leaf spot, and powdery mildew. These diseases can result in reduced crop yields, lower fruit quality, and increased production costs due to the need for disease management measures.

Additionally, the spread of these diseases can lead to long-term damage to the environment and soil health. The problem is exacerbated by the limited understanding of the specific diseases affecting tomato leaves, their causes, and effective control measures

IV. PROPOSED SYSTEM

It can be designed to be user-friendly, with a simple interface that allows farmers to easily capture and upload leaf images for analysis. The system can also provide detailed information about the identified diseases, including recommended treatments and preventive measures. Overall, the purpose is to empower farmers with a reliable and efficient tool for disease management in tomato plants.System can predict the disease and provide the nearest Agricultural drug store.

V. WORKING

• Data Collection and Preprocessing: Collect a diverse dataset of images containing both healthy and diseased tomato leaves.

• Model Architecture: Dense connectivity from DenseNet promotes feature reuse and can aid in learning intricate patterns from the images.

• Model Layers and Blocks:The model might start with a few convolutional layers for basic feature extraction

• Pooling and Global Average Pooling:Periodic pooling layers can downsample feature maps and focus on more prominent features.

• Classifier Head:The final layers of the model consist of one or more fully connected layers leading to the output layer.

• Loss Function and Training:Use an appropriate loss function for multiclass classification, such ascategorical cross-entropy

VI. ADVANTAGE

- Disease Identification: Recognizing and studying tomato leaf diseases helps researchers and farmers identify specific diseases affecting their tomato plants. This knowledge is essential for early intervention and effective disease management.

- Disease Management: Understanding tomato leaf diseases is crucial for developing and implementing effective disease management strategies. Farmers can employ various techniques, such as crop rotation, disease-resistant varieties, and appropriate fungicides, to reduce disease incidence and maintain healthy tomato crops.

VII. CONCLUSION

Our contribution and results while being a new using of mobile device on farms to recognize the plants diseases based on deep convolutional neural networks, compared to the previously published, is still preliminary, and deriving from a rather straightforward adaptation of MobileNets goolge Model. Deep convolution neural networks have achieved great performance breakthroughs in machine learning fields, but there still exist some research challenges.

The proposed CNN based model can effectively classify 10 common tomato leaves diseases through image recognition. We can extend the model for fault diagnosis. To improve tomato diseases identification accuracy, we still need to provide thousands of high-quality tomato diseases images samples. We believe that the simple use of deepconvolutional neural networks in computer vision and its applications, specially smart mobil.

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