Tomato Leaf Disease Detection System

Dr. M. R. Sanghavi[1], Shreyas kolhar[2], Gauri Aher[3] , Vaishnavi Gupta[4] , Kalyani Bhosale[5]

[1]*Vice Principle . SNJB's LS KBJ COE, Chandwad, India*

Email : sanghavi.mrcoe@snjb.org

[2] *Department of Computer Engineering , SNJB's LS KBJ COE , Chandwad , India*

Email : shreyaskolhar1045@gmail.com

[3] *Department of Computer Engineering , SNJB's LS KBJ COE , Chandwad , India*

Email : graher2019@gmail.com

[4] *Department of Computer Engineering , SNJB's LS KBJ COE , Chandwad , India*

Email : vashnavigupta373@gmail.com

[5] *Department of Computer Engineering , SNJB's LS KBJ COE , Chandwad , India*
Email : kalyanibhosale751@gmail.com

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Abstract - Tomato is a widely cultivated crop with significant economic importance in the agro based industry. However, tomato plants are susceptible to various diseases that can severely impact yield and quality. Early and accurate detection of these diseases is crucial for effective disease management and ensuring optimal production. In this study, we propose a novel approach that a convolutional Neural Network (CNN) for the automated detection of tomato leaf diseases. First, Convolutions is employed to reduce the dimensionality of the input data, extracting the most relevant features for disease detection. The CNN leverages its ability to learn complex patterns and features from the data, enabling accurate classification of various tomato leaf diseases. To evaluate the effectiveness of our approach, we conducted experiments using a diverse dataset of tomato leaf images with different disease manifestations.

*Key Words***:** Agriculture, Tomato diseases, Leaf disease detection, Deep learning, neural network, Disease Diagnosis.

1.INTRODUCTION

Early detection and diagnosis of plant diseases is important for the agricultural sector to be productive and profitable. In recent years, machine learning and artificial intelligence (AI) have shown great potential to revolutionize the way diseases are diagnosed and treated. A powerful method is to use neural networks (CNN) for accurate and effective disease detection, especially for tomato leaf diseases. Tomato is one of the most important crops and is grown and used worldwide. However, there are many diseases in tomato plants caused by fungi, bacteria, viruses and other environmental factors. Early diagnosis of these diseases is important to prevent their spread and reduce crop losses. Deep learning is a branch of artificial intelligence that shows great potential in many areas such as image recognition and classification.

DeepNet is a neural network with many hidden algorithms that can learn complex patterns and features directly from data transformed by CNN. To verify the effectiveness of the proposed model, we conducted experiments on different datasets of tomato leaf images. We evaluate the model's performance in terms of accuracy, sensitivity, specificity, and other measures to demonstrate its effectiveness in accurately identifying and classifying different disease types in fruit tomato. The method proposed in this study is promising for early detection and classification of tomato leaf diseases.

2. Motivation

Detecting and diagnosing diseases in tomato plants is crucial for the agricultural industry as it directly impacts crop yield, quality, and overall economic viability. Timely and accurate detection of leaf diseases is essential to implement appropriate measures to mitigate the spread of the disease and prevent potential crop loss. Conventional methods of disease detection often rely on manual observation and expertise, which can be time-consuming, subjective, and may not always yield precise results. The motivation behind using a novel approach for detecting tomato leaf diseases in agro-based industries lies in improving accuracy, efficiency, early detection, adaptability, sustainability, and providing valuable data-driven insights to optimize agricultural practices. These benefits collectively contribute to a more sustainable and productive agricultural industry.

3. Literature Survey

M.H.Saleem et al : The main goal of this research was to perform the complex task of plant disease localization and classification in a single framework. [1]

A.Rao et al : A novel hybrid approach carried out in three forms. During the first phase, image enhancement and image conversion scheme are incorporated, which helps to overcome the low-illumination and noise related issues. [2]

Abade et al ::A systematic review of the literature that aims to identify the state of the art of the use of convolutional neural networks(CNN) in the process of identification and classification of plant diseases, delimiting trends, and indicating gaps. [3]

H. Ajra et al : This paper proposes plants leaf disease detection and preventive measures technique in the agricultural field using image processing and two well-known convolutional neural network (CNN) models as AlexNet and ResNet-50. [5]

Kowshik B et al.: The proposed method uses a convolutional neural network and a Deep Neural Network to identify and recognise crop disease symptoms effectively and accurately. Furthermore, multiple efficiency metrics are used to assess these strategies. This article offers a thorough description of the DL models that are used to visualise crop diseases.

SABBIR AHMED et al.: Fast and accurate recognition of leaf diseases can go a long way to meeting the ever-increasing demand in food production. In this regard, we have proposed a lightweight deep neural network by combining a fine-tuned pretrained model and a classifier network. [10]

YANG WU et al.: This paper proposes a fine-grained disease categorization method based on attention network to solve the problem. In ''Classification Model'', attention mechanism is used to increase identification ability. [8]

Lerina Aversano et al.: One of the main problems of tomato cultivation is represented by diseases that reduce the yield, compromising the quantity and quality of the crops.In the proposed work, the public PlantVillage dataset was used, which contains leaf images of 9 diseases classes and one healthy class. [9]

Omneya Attallah et al.: In recent years, numerous studies have utilized deep learning (DL) models for automatic tomato leaf illness identification. However, many of these methods are based on a single DL architecture that needs a high computational ability to update these hyperparameters leading to a rise in the classification complexity.

Anusha Rao et al.: Detection of plant leaf disease has been considered an interesting research field which is helpful to improve the crop and fruit yield. Computer vision and machine learning based approaches have gained huge attraction in digital image processing field. [2]

4. Proposed System

Identification of tomato diseases is important for the agro-based industry to obtain a healthy and optimized product. The method you mentioned, using a combination of deep neural networks (DeepNet), seems like a new way to achieve this goal. I will explain the general meaning of using such a technique. DeepNet aims to achieve accuracy in detecting various tomato diseases, allowing farmers to make timely interventions and plans. to know for sure. In addition, standards need to be constantly monitored and updated to adapt to new diseases and increase detection accuracy.
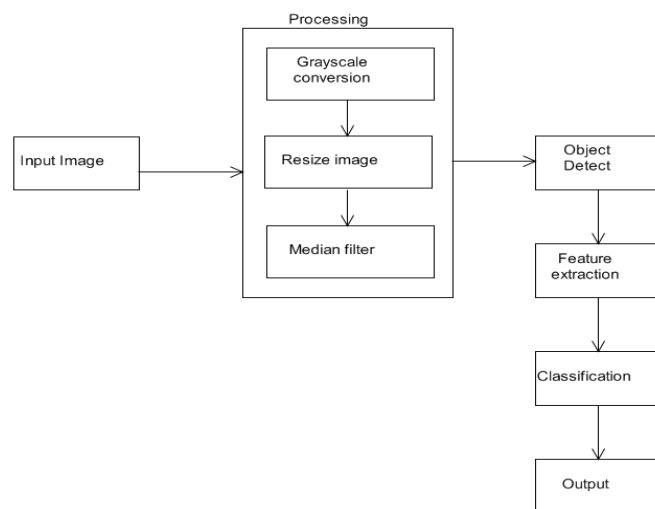
5 . System Architecture

Fig -1: Block Diagram

3. CONCLUSIONS

Commercial agriculture relies on tomato diseases to maintain crop health and achieve better yields. Deep learning is an example of a technology that can improve the accuracy of disease diagnosis and classification. A new deep neural network method is proposed for the system to accurately identify and classify different tomato diseases. In this process, the complexity of the dataset is reduced but important information about the disease is preserved. The technology concept shows promise in accurate and effective detection of tomato leaf diseases and provides important information for crop management and monitoring in agriculture. Further research and development into these systems may lead to the development of more accurate and powerful anti-virus systems..

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