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Leaf Disease Detection and Classification Using Machine Learning

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Abstract:

Leaf diseases are generally caused by pests, insects, pathogens and the productivity to a large scale if not controlled within time. Agriculturists are facing loss due to various crop diseases. It becomes tedious to the cultivators to know whether the plant is healthy or diseased. Various researches have taken place under the field of Machine Learning for plant disease detection such as traditional machine learning approach being Random Forest, Artificial Neural Network, Support Vector Machine, Fuzzy Logic, K-Means Method. These techniques consume high time and gives less accuracy. This problem can be resolved by Machine Learning in the field of agriculture. The objective of the proposed system is the early detection of disease before it spreads to the other leaves of the plant. The solution is to check and detect the plant diseases using tensorflow, an Open source and reliable software for Machine Learning applications which provides high accuracy, which is its main advantage. This system works in two phases: the first phase deals with training the dataset using Convolutional Neural Network algorithm. This includes training both healthy as well as diseased leaves. The second phase deals with checking the leaves with the test dataset and thereby identifying the disease.

Keywords: Pathogens, Random Forest, Artificial Neural Network, Support Vector Machine, Fuzzy Logic, K-Means Method

1. INTRODUCTION

The agriculture sector, being the backbone of India's economy, faces challenges in crop production and disease control. In order to meet the increasing demand for food, advancements in agriculture are crucial. The health of crops directly impacts yield, and precise diagnostic methods are needed. Crop diseases significantly reduce both quality and quantity, and while various pesticides exist, identifying the most suitable and effective one remains challenging, requiring expert advice.

Traditional methods of plant disease identification rely on visual inspection, but recent advancements in digital image acquisition allow for image-based diagnosis. However, processing these images, which contain dense information, is challenging for computers. Deep learning, especially Convolutional Neural Networks (CNNs), has emerged as a solution. CNNs can autonomously learn features like color and shape without manual intervention, making them suitable for image recognition in plant disease diagnosis.

CNNs operate by assigning importance to various aspects in an input image, enabling them to differentiate between different objects or features. Compared to other classification algorithms, CNNs require lower pre-processing efforts. In primitive methods, filters are hand-engineered, but CNNs can learn these filters through training. This capability makes CNNs a valuable tool in automating and improving the accuracy of plant disease diagnosis in agriculture.

2. LITERATURE SURVEY

A web-based tool has been developed to identify fruit diseases by uploading fruit image to the system. Feature extraction has been done using parameters such as colour, morphology and CCV (colour coherence vector). Clustering has been done using the k means algorithm. SVM is used for classification as infected or non-infected. This work achieved an accuracy of 82% to identify pomegranate disease. Crop production problems are common in India which severely effect rural farmers, agriculture sector and the country's economy as a whole. In Crops leaf plays an important roleas it gives information about the quantity and quality of agriculture yield in advance depending upon the condition of leaf. In this paper we proposed the system which works on pre-processing, feature extraction of leaf images from plant village dataset followed by convolution neural network for classification of disease and recommending Pesticides using Tensor flow technology. The main two processes that we use in our system is android application with Java Web Services and Deep Learning.We have use Convolution Neural Network with different layers five, four & three to train our model and android application as a user interface with JWS for interaction between these systems. Our resultsshow that the highest accuracy achieved for 5-layer model with 95.05% for 15 epochs and highest validation accuracy achieved is for 5-layer model with 89.67% for 20 epochs using tensor flow.

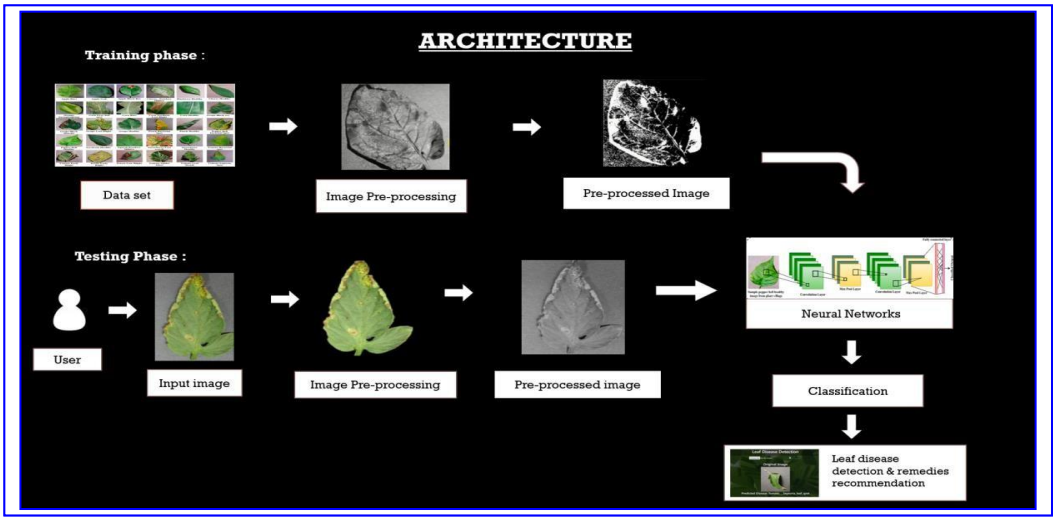
3. EXISTING SYSTEM

In the existing system, plant diseases are detected and classified manually by experts, which is a time-consuming process. Also, the accuracy of manual detection and classification depends on the performance of the person doing it. There are also some existing automated systems, but they require alarge amount of training data and also produce low accuracy results in detecting plant disease. Plants are considered as energy supply to mankind. Plant diseases can affect the agriculture which can be resulted in to huge loss on the crop yield. Therefore, leaf diseases detection plays a vital role in agricultural field. However, it requires large manpower, more processing time and extensive knowledgeand skills about plant diseases. Hence, machine learning comes in play in the detection of diseases in plant leaves as it analyzes the data from various areas, and classifies it into one of the predefined set ofclasses. The features and properties like color, intensity and dimensions of the plant leaves are considered as a major fact for classification and the various types of plant diseases and different classification techniques in machine learning that are used for identifying diseases in different plants leaf.

4. PROPOSED SYSTEM

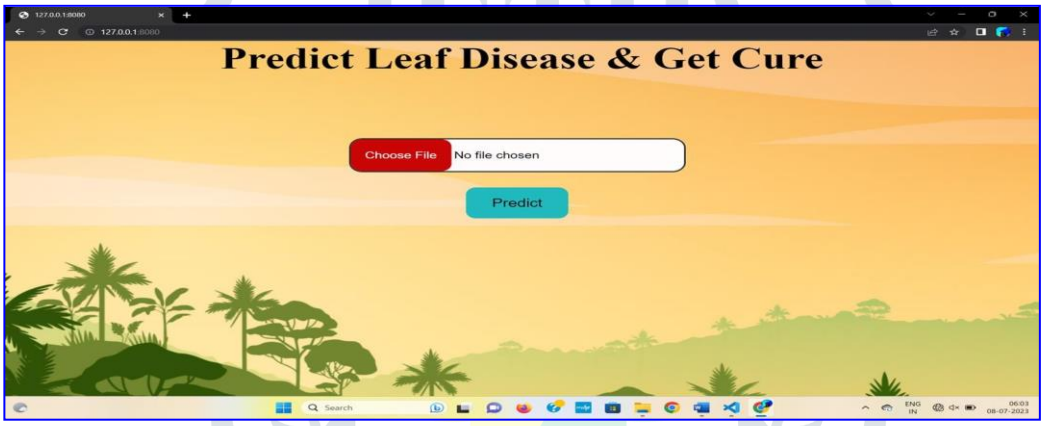
In our proposed system, we will use machine learning algorithms to automatically detect and classify plant diseases with high accurate results. The system will consist of three main components: a data collection and preprocessing module, and a machine learning module. The data collection and preprocessing module will collect plant images and preprocess them to extract relevant features for disease detection. The machine learning module will use these features to train a model to classify plantdiseases. We plan to use a convolutional neural network (CNN) as our machine learning algorithm, which has shown great promise in image classification tasks. We will train the CNN using a large dataset of plant images, including both healthy plants and plants with various diseases. The trained CNN model will then be used to predict the type of disease and percentage of disease in plant images. This model will also provide remedies to reduce the plant diseases.

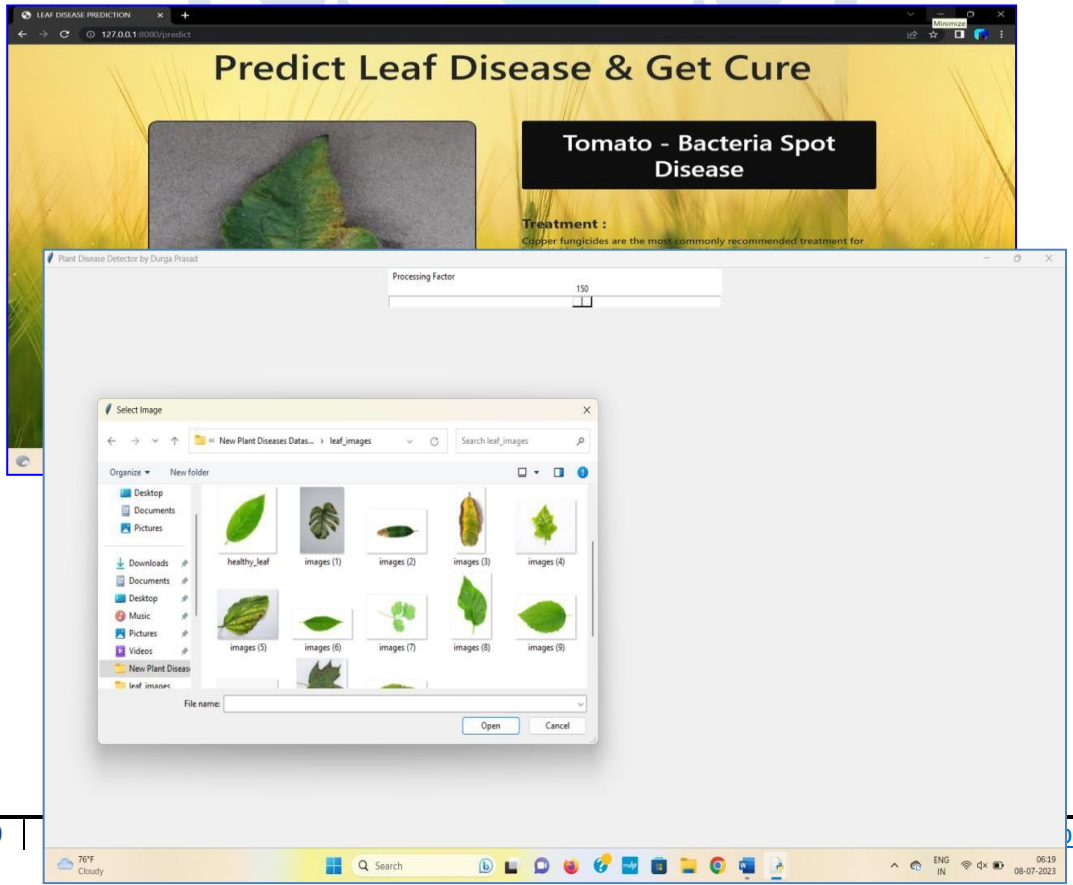
Block Diagram of the Proposed Work:



Home Page:

5. EXPERIMENTAL RESULTS





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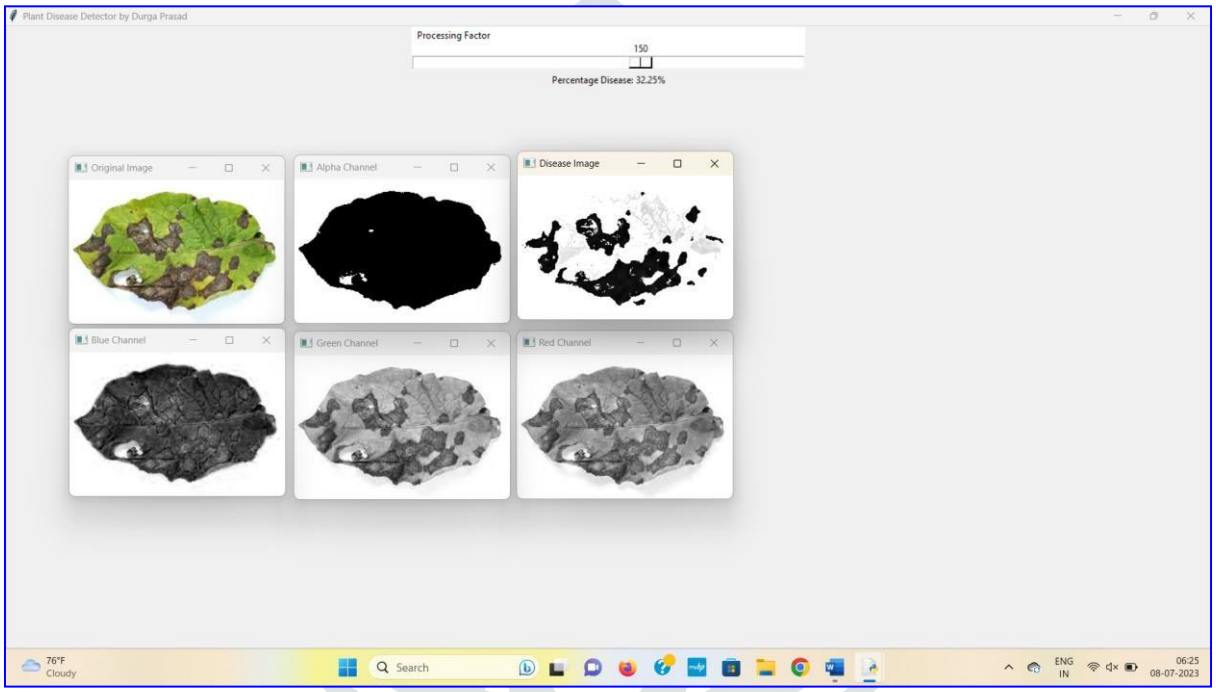

CONCLUSION

In the agricultural domain, significant yield losses often result from the proliferation of diseases. The timely detection and identification of diseases become apparent only when the condition has advanced to a severe stage. This delay leads to substantial losses in terms of yield, time, and financial resources. Plant diseases pose a longstanding threat to food security, causing a drastic reduction in crop yield and compromising overall quality. Achieving accurate and precise disease diagnosis has remained a formidable challenge.The proposed system aims to address this challenge by enabling the early detection of diseases as soon as they manifest on the leaves. This early detection capability holds the potential to mitigate losses and reduce dependency on experts to a certain extent. The system is designed to assist individuals with limited knowledge about diseases by offering predictions related to the identified leaf diseases and suggesting appropriate remedies for plant recovery.To achieve these objectives, the system involves the extraction of features specific to each disease. This application not only facilitates the prediction of diseased leaves but also provides valuable insights into potential remedies for plant recovery. As a future enhancement, the system can be further developed into an Android application, offering a more user-friendly and accessible platform for users. This expansion into mobile technology could enhance the feasibility and practicality of utilizing the system for a broader audience.

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