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Rice Plant Disease Prediction using Transfer Learning

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Abstract: *Rice is one of the most important food crops worldwide, and its yield is often threatened by various diseases. Early detection and accurate diagnosis of these diseases are crucial to ensure optimal crop management and reduce yield losses. In recent years, deep learning-based approaches, such as convolutional neural networks (CNN) and transfer learning, have shown great potential for disease detection in plant images. In this study, we propose a novel framework for rice plant disease prediction using CNN and transfer learning. The proposed method is based on a pre-trained CNN model, which is fine-tuned using a dataset of rice plant images with different disease symptoms. The performance of the proposed method is evaluated using various evaluation metrics, and the results demonstrate that it can accurately detect and classify rice plant diseases with high accuracy. The proposed method has the potential to serve as an effective tool for automated disease detection and diagnosis in rice crops, enabling farmers to take prompt action to prevent the spread of diseases and minimize yield losses.*

Keywords: CNN, Image processing, Transfer Learning

I. INTRODUCTION

Rice is a staple food for a large portion of the global population, and diseases that affect the rice plant can have significant impacts on food security and agricultural economies. Early detection of plant diseases is crucial for effective management and mitigation of their effects. Machine learning techniques have been used to detect diseases in plants, and transfer learning is an approach that has shown promise in improving the accuracy of disease detection models. Transfer learning involves taking a pre-trained model on a large dataset and fine-tuning it on a smaller, related dataset for a specific task, such as detecting diseases in rice plants. This approach can help overcome the challenge of limited data availability for training models and can improve the efficiency and accuracy of disease detection.

In this context, the goal is to develop a system that uses a transfer learning approach to accurately detect diseases in rice plants. By leveraging pre-trained models and fine-tuning them on datasets of rice plant images, we can create a powerful tool that can quickly and accurately detect diseases in rice plants, allowing farmers to take appropriate measures to prevent further spread and reduce crop losses. One key advantage of transfer learning is that it can be used to build models that are highly specific to types of rice disease, allowing for more accurate and targeted detection. For example, models can be trained specifically to detect diseases such as bacterial blight, blast, and sheath blight, which are among the most common and damaging diseases affecting rice.

We propose a novel framework for rice plant disease prediction using CNN and transfer learning. The proposed method is based on a pre-trained CNN model, which is fine-tuned using a dataset of rice plant images with different disease symptoms. The performance of the proposed method is evaluated using various evaluation metrics, and the results demonstrate that it can accurately detect and classify rice plant diseases with high accuracy. The proposed method has the potential to serve as an effective tool for automated disease detection and diagnosis in rice crops, enabling farmers to take prompt action to prevent the spread of diseases and minimize yield losses.

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Overall, the application of transfer learning in rice plant disease detection has the potential to greatly benefit the agricultural industry by facilitating early detection and management of plant diseases, thereby improving crop yield and food security.

II. LITERATURE REVIEW

Detection of Plant Diseases and Pests using Deep Learning: As Compared with traditional image processing procedures, which deal with plant disease detection tasks in several steps, plant disease detection procedures based on deep learning bound them into end-to-end feature extraction, which has a wide development prospects and great strength. As plant disease detection technology is developing rapidly, it has been moving from academic research to agricultural application, there is still a certain distance from the mature application in the real natural environment, and there are still some problems to be solved.[1]

Rice Disease Recognition using Effective Deep learning Models: This paper involves Deep learning-based Classification of Plant diseases using deep neural network, Res Net, Dense Net, image processing. [2]

A Computer Based Image Processing Approach to identify Rice Blast: Identification of Rice Plant Disease using Convolutional Neural Network (CNN). In compare to existing available approaches this study proposed approach is capable of providing better results in terms of accuracy.[3]

Rice Leaf Disease Detection Using Machine Learning Techniques: This study uses K-Nearest Neighbour, Decision Tree and Naive Bayes algorithm for the detection of the rice plant disease. Mainly brown spot, leaf blight and leaf smut was identified using this method.[4]

Rice plant Disease Detection and Classification using Machine Learning Algorithm: This study involve Identification of Plant Diseases using Image Analysis Algorithm and Artificial Neural Network. By using the machine learning algorithm, the system detects the disease precisely for the rice plant. By this method farmers can protect their crops from diseases. This method provides a disease-free environment and increase the productivity of crop.[5]

Image processing is an important aspect for the analysis of Rice plant diseases. Rice Plant diseases can be detected based on the disease symptoms. In this dataset of affected leaves is considered for experiment. SVM-CS approach is used for this. In this, concept of cuckoo search is used to optimize the classification parameters. This autonomous approach also extracts the healthy portion and disease affected leaf portion along with the accuracy of results.[6]

In this study the system is depend on combination technique of two SVM classifiers. One classifier makes use of the colour that classify the images; it considers, at this phase, that specifies the diseases with same or nearest colour belonging to the same class while the other classifier is used to differentiate between the classes with similar colour according to the shape and texture features.[7]

Image Processing is popular technique which is adopted for the plant leaf diseases detection and classification. This paper is focusing on detection and classification leaf diseases of grape using SVM classification technique. First the diseased region is found using segmentation by K-means clustering, then both colour and texture features are extracted. Finally classification technique is used to detect the type of leaf disease.[8]

Rice leaf diseases have reduced the rice quality and yield. In proposed system, BP neural network classifiers are useful for classifying the healthy and diseased rice leaves. This paper selects rice brown spot as study object. The result of the proposed system shows that the system is capable to identify rice brown spot using image analysis and BP neural network classifier.[9]

In this study a deep learning-based approach is used for the identification of leaf diseases in Mango plant. Different leaf diseases Mango has been identified in a dataset consisting of 1200 images of diseased and healthy mango leaves. In the proposed system CNN model achieves greater accuracy of 96.67% for identifying the leaf diseases in mango plant.[10]

III. METHODOLOGY

3.1 Description of the Dataset

In this research, to experiment on the rice plant disease detection, we have used the rice plant leaf dataset which we obtained from Kaggle. The dataset consists of two classes and 2000 images.

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Figure 1: Sample images of leaves from dataset

3.2 Data Pre-processing

Data pre-processing is the process of transforming and cleaning raw data to make it suitable for analysis. It involves tasks such as data cleaning, data integration, data transformation, and data reduction. Data pre-processing is essential to ensure that the data used for analysis is accurate, complete, and consistent, leading to more reliable results.

3.3 Algorithm

Step 1: Image Acquisition
Step 2: Image Pre-processing and Augmentation
Step 3: Training and Validation of Data
Step 4: Providing data to the CNN Model
Step 5: Classification of Disease

3.4 System Architecture

The proposed system uses dataset named as Rice leaf Images. It contains approximately two thousand images of diseased and non-diseased Rice leaf. The dataset is divided for training, validation and testing in the ratio 80:10:10. Further, it is given to the Convolutional Neural Network and after passing through the layers of CNN, it gives the result.

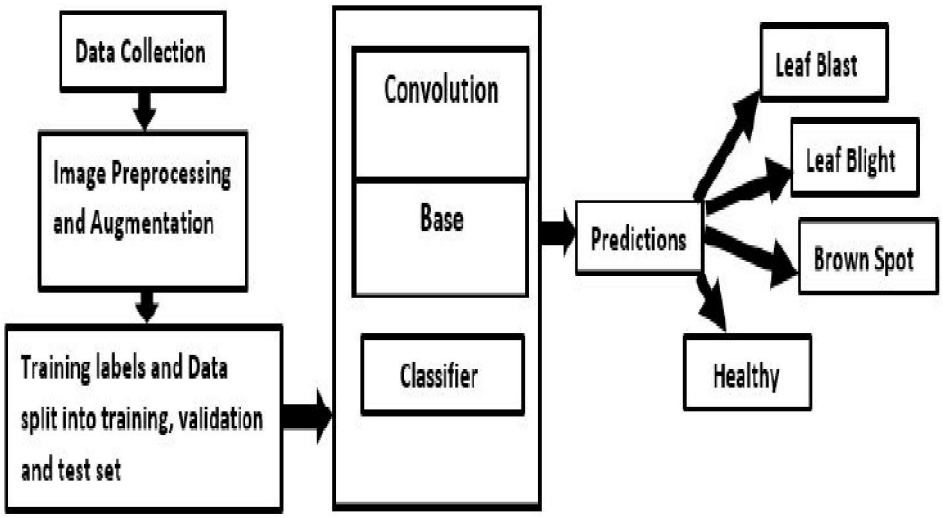

Figure 2:System Architecture

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IV. RESULTS

Convolutional Neural Network(CNN)

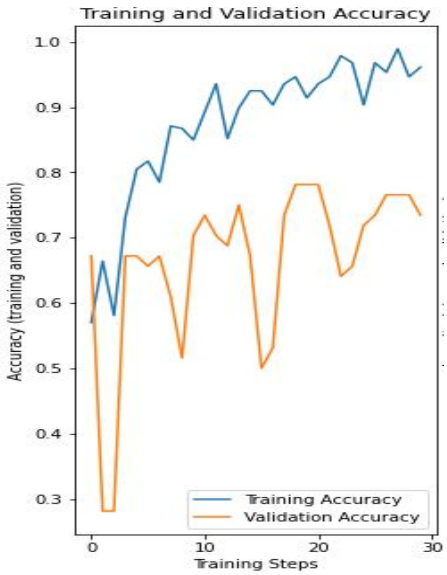

Figure 3: Training and validation accuracy for Rice LeafModel

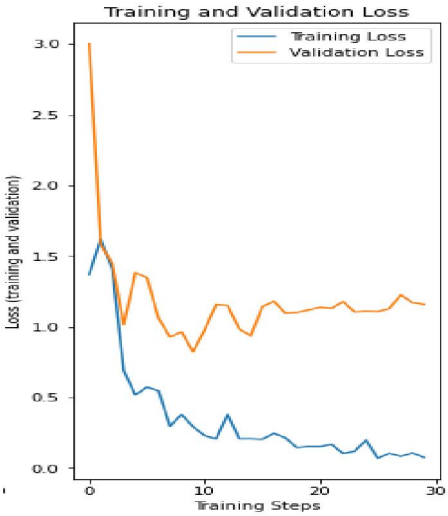

Figure 4: Training and validation Loss for Rice Leaf Model

V. CONCLUSION

There are several methods available for detecting plant diseases and suggesting remedies, each with their own advantages and limitations. Visual analysis is one of the least expensive and simplest methods, but it may not always be the most efficient and reliable. Image processing is a technique which is most spoken for very high accuracy and least time consumption are major advantages offered. The application of Convolutional Neural Networks (CNN) have been formulated for classification of diseases that effect on plant leaves. The primary objective of the proposed approach is to accurately and efficiently recognize plant diseases. Based on the experimental results, the proposed approach has proven to be valuable, as it enables precise detection of leaf diseases with minimal computational effort. In addition to providing farmers with essential cultivation tools, it is crucial to equip them with accurate information for effective crop management. Delivering this service through software would be an ideal way to facilitate access to such information, benefiting farmers in their day-to-day farming operations

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