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Plant Disease Classification using CNN

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ABSTRACT: Plant disease classification is the process of identifying and categorizing plant diseases from leaf images using deep learning techniques. It helps in early detection and precise treatment of affected crops. In this paper, the technique presented is for classification of plant leaf images into healthy or diseased categories. The system uses a Convolutional Neural Network (CNN) for automatic feature extraction and classification, eliminating the need for manual feature engineering. The input image is preprocessed, resized, and passed through multiple CNN layers to learn deep features, followed by classification into predefined classes. The model is trained on a labeled dataset of plant leaves with various disease types, and it provides accurate predictions with minimal human intervention.

KEYWORDS: Plant disease, CNN, Classification, Deep learning, Image processing.

I. INTRODUCTION

Plant disease classification is a method for identifying and categorizing various diseases in crops using leaf images. It plays a vital role in agriculture by enabling early detection of plant diseases and ensuring timely treatment, which helps in reducing crop loss and improving productivity. In the real world, farmers and agricultural experts need a reliable system to diagnose diseases quickly and accurately, especially when manual inspection is time-consuming and prone to error.

This system could assist in identifying diseases through a technique called Convolutional Neural Network (CNN). CNNs automatically extract features from images and classify them into disease categories without requiring manual feature selection. This deep learning approach makes disease detection more efficient and scalable.

Leaves may show signs of infections such as spots, blight, rust, or mildew, which may vary in size, shape, and color. Recognizing these patterns is crucial in detecting the type of disease. Accurate classification of these symptoms can be useful for applying proper pesticides and managing the disease effectively. There are many applications of plant disease classification, including smart farming, mobile plant diagnostics, agricultural research, and autonomous crop health monitoring systems.

The paper is organized as follows. Section II describes the preprocessing of plant leaf images and the architecture of the Convolutional Neural Network used for classification. The block diagram represents the overall workflow of the system. After the preprocessing, how the CNN model is trained and used for prediction is explained in Section III. Section IV presents experimental results showing classification accuracy and performance on test images. Finally, Section V presents the conclusion.

II. LITERATURE SURVEY

The concept of plant disease detection using image processing and machine learning was explored in various studies. One of the earliest approaches was presented by Arivazhagan et al. [1], where color and texture features were extracted manually from leaf images and classified using Support Vector Machines (SVM). Although this method worked well, it required hand-crafted features which limited scalability.

With the rise of deep learning, Convolutional Neural Networks (CNNs) became a powerful alternative for automatic feature extraction and classification. In [2], Mohanty et al. demonstrated the use of deep CNN models trained on a large dataset of plant leaves, achieving high accuracy in disease classification. This work laid the foundation for data-driven plant disease diagnosis.

In [3], the authors proposed a transfer learning-based method using pre-trained CNN models such as VGG16 and ResNet, which improved the efficiency of training and boosted accuracy even with limited data. A novel technique combining data augmentation and CNNs was introduced in [4], making the model more robust to variations in lighting, background, and leaf orientation.

In [5], a hybrid method was proposed where CNN features were fused with traditional texture features before classification, leading to improved results in noisy datasets. Another study [6] implemented a lightweight CNN model for mobile applications, showing that real-time disease detection is feasible even on resource-constrained devices.

The work in this paper is divided into two stages: 1) Image Preprocessing 2) CNN-based Classification. In the preprocessing step, leaf images are resized, filtered, and normalized. In the classification stage, a custom CNN model is trained on labeled data to identify specific plant diseases. The model learns hierarchical features from raw pixel data and performs accurate classification without manual feature engineering.

III. METHODOLOGY

Convolutional Neural Network (CNN) is used for the classification of plant disease images, which performs both structure and feature learning together. The classification is done in such a manner that it identifies patterns, textures, and color changes in leaf images, matching them to specific disease types. The algorithm is based on a layered architecture with a patch-based feature learning process.

The algorithm automatically classifies the plant leaf image into one of the predefined disease categories without user interaction, based on the learned features from the training dataset.

IV. EXISTING SYSTEM

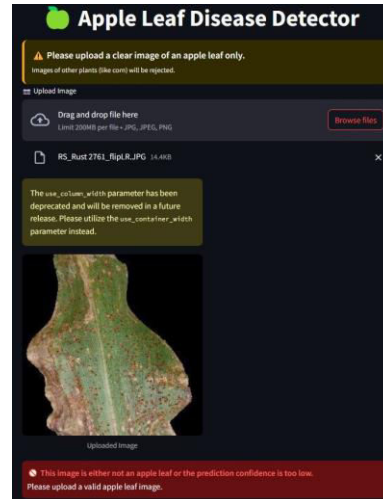
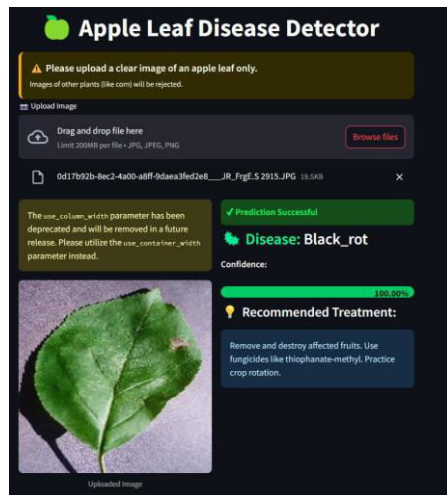
The current system for managing hospital appointments and patient information is largely manual or relies on rudimentary digital tools such as phone calls, emails, and basic spreadsheet applications. Patients are generally required to call or visit the hospital in person to schedule appointments, with schedules maintained on paper or in software like Microsoft Excel. This method provides minimal real-time visibility into doctors' availability, leading to inefficiencies in appointment scheduling.

Patient medical records, including histories, prescriptions, and diagnostic reports, are stored as physical documents. These are vulnerable to being lost, damaged, or misplaced, making it difficult to retrieve and review historical data quickly and reliably. Furthermore, there is no centralized database to manage records across multiple doctors and departments, requiring patients to repeatedly provide the same personal and medical information during each visit.

V. EXPERIMENTAL RESULTS

Figures show the results of plant disease classification from input leaf images using a Convolutional Neural Network model. Figs. 2, 3, 4 (a) show the original input leaf images taken from the dataset. (b) is the output image after preprocessing such as resizing and normalization. The CNN model is then applied for feature extraction and classification.

VI. OUTPUT



VII. CONCLUSION

We have implemented an automatic plant disease classification system using Convolutional Neural Networks. Our algorithm successfully identifies the disease from leaf images that may contain complex patterns and textures. We have applied our model on a wide variety of leaf images and found that it accurately classifies the plant diseases with high reliability.

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