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Paper On Plant Disease Detection

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Abstract: Plant diseases are becoming more common, which poses a serious risk to the sustainability of agriculture and global food security. The prevention of crop losses and the reduction of pesticide use both depend critically on the early and precise detection of plant diseases. Deep learning methods, such Convolutional Neural Networks (CNNs), have recently displayed astounding performance in a variety of image identification tasks. In this study, leaf pictures are used to train CNNs for the identification and categorization of plant illnesses. The suggested method entails a multi-step procedure that begins with a vast dataset collection of healthy and diseased plant leaves that includes a variety of diseases.

***Index Terms* - Convolutional Neural Networks, Deep Learning, Plant Disease Detection, Gray-level Concurrence Matrix, Support Vector Machine, Discrete Wavelet Transform ,Recurrent Neural Network ,Deep Belief Network ,Deep Boltzmann Machine ,Passive Infrared ,Miniature Circuit Breaker ,Artificial Neural Network**

I. Introduction

In India's economy, agriculture is a crucial sector. It employs almost half of the people in our nation. Pest damage that results in leaf diseases has always been a major concern. To meet the needs of a population that is continually expanding, agriculture productivity must be boosted by 70%. A lot of researchers in the field of detection and classification have been drawn to sophisticated developing technologies since bared eye diagnosis of leaf disease is thought to be ineffective and low-accuracy. Approaches including machine learning, deep learning, and transfer learning have been used to identify crop diseases. In response to the many applications of AI in daily life, the phrases "machine learning" (ML) and "deep learning" (DL), which, in terms of simplicity, allow machines to "learn" a great number of patterns and then take action, have recently been proposed. Machine learning and deep learning allow software applications to improve their prediction accuracy without being expressly designed to do so. The relationship between DL and computer vision has led to the development of smart algorithms that can analyze and classify patterns or images more precisely than humans.

While computer vision focuses on teaching computers to think and behave with the least amount of human interaction, DL focuses on teaching machines to think using architecture inspired by the nervous system. The most popular deep learning method currently being used for plant disease diagnosis is CNN. Deep learning is a novel development in machine learning, with ground-breaking results in a number of study areas, including computer vision, pharmaceuticals, and bioinformatics.

II. LITERATURE REVIEW

The use of image processing to identify plant diseases has been the subject of much research throughout history, and this field of study still appeals to academics. Since there is now a big gap in automatic disease diagnosis, research is now focusing more on its AI-assisted development.

According to Siva K., neural networks have proven to be extremely effective at detecting plant illnesses. Because of their capacity to reduce data dimensionality and train on image pixels, neural networks are also despised in the field of illness diagnosis. Ruchi Gujar's suggested autonomous agriculture crop disease detection system can detect leaves and identify the type of illness present in the crop with an accuracy of 96.59% using real-time video frames gathered in the field by a camera coupled to a handheld embedded device. Azath M. recognized each type of leaf disease and pest in cotton plants with 96.4% accuracy using 3117 leaf images and a deep learning model.

Xihuizi Liang investigated the use of the KNN classifier for cotton disease diagnosis in the presence and absence of SSO. They directly used VGG, DenseNet, and RexNeXt. Color moments, HOG, and GCLM are used. Based on BPSO, Ashutosh Kumar Singh proposed a framework for hybrid feature extraction and selection. In addition to the proposed model, it was discovered that the best committee's total number of trainable parameters was fewer than the designs VGG-16 and VGG-19, which are frequently used in computer vision.
Shantanu Kumbhar created a technique that uses CNN to classify leaf images. Based on the retrieved attributes, the built model can detect the disease and recommend treatment options. The model achieved an accuracy of 89% during training and 93% during validation. Sandhya D. discussed the role of Machine Learning techniques in detecting and classifying diseased cotton plants. The ML algorithm was thoroughly compared based on feature value, predictive accuracies, training speed, and predicting speed.

III. EASE OF USE

Any technology, including plant disease detection devices, must be simple to use. In order for farmers, agronomists, and other agricultural stakeholders to use a plant disease detection system efficiently, simplicity of use must be taken into account when building the system. Here are some important elements that affect how simple it is to detect plant diseases

Image Acquisition: The system should be able to accept photographs that have been uploaded as well as those that have been taken with a smartphone or digital camera, among other techniques. It ought to include instructions for taking photos of plant leaves that are of a good quality so that users may get accurate results.
Automated Analysis: The system ought to do as much of the analysis as possible automatically. To use the system efficiently, users shouldn't need a lot of technical know-how or skill in machine learning methods. The detection system should automatically perform activities including feature extraction from images, disease categorization, and picture preparation while giving users results that are understandable and useful.

IV. PROPOSED METHODOLOGY

The proposed methodology for the development of Plant Disease Detection System Using CNN can be divided into several stages.
1.Planning and Design: Determine the project's requirements and scope. Find out what data sources and data pretreatment methods the system needs. Select the ideal deep learning model architecture, such as a CNN, and refine the model's hyperparameters. Create a user interface for the system of recommendations.
2.Development: Data on plant leaves should be gathered and prepared for the disease detection system. Utilise the preprocessed data to train the deep learning model. Implement the illness detection system model.
3.Testing: Test the system to make sure it provides users with accurate and pertinent disease detection. Test your system, your integration, and your units. Address any problems and make any necessary system improvements.
4.Deployment: Install the system in a live setting, such as a web or mobile application. Improve the system's performance and scalability.
5.Maintenance: Keep an eye on the system to make sure it keeps detecting diseases with accuracy and relevance. Fix any problems or bugs that appear. On the basis of user input and evolving requirements, adjust the system as needed.

V. Project Concept

Users' images will be collected by the system, which will then be used to extract visual elements including color schemes, textures, and composition. The CNN model will then be trained using these visual cues, and it will eventually learn to link visual preferences to particular disease, color, and leaf traits. Users will be able to upload photographs and view personalized disease suggestions based on their visual preferences through the user interface. Users may be able to comment on the illness through the UI and hone their preferences over time. Data collection and preprocessing, model selection and optimization, user interface development, testing and validation, deployment, and maintenance are some of the steps that the project will go through. The system will be put through testing to make sure it provides precise and pertinent plant disease diagnosis based on visual preferences and complies with the project's needs and standards.

In general, the project concept for a plant disease detection system using CNN that incorporates user photos involves utilizing computer vision and deep learning techniques to provide tailored recommendations based on visual preferences, with a user-friendly interface that makes it simple for interaction and feedback.

VI. Conclusion And future plans

The models for disease detection in cotton plants have been implemented using deep learning and transfer learning techniques. A collection of photographs of healthy leaves is also used to decide on the best images. The Deep Learning model was implemented using Python, Keras, and Jupyter as the development environment, whereas the Transfer Learning model was implemented using Python. Incorporating additional data sources: Another future plan is to incorporate additional data sources into the system. This could include data from live agricultural field or other online sources, such as PlantVillage Dataset.

Expanding the user interface: A future plan is to expand the user interface to include additional features and functionality. The existing system can be made simpler by creating an Android application, which could be advantageous to users.

However, the effectiveness of CNNs for detecting plant diseases depends on a number of variables, including the dataset's size and quality, the CNN's design, and the training procedure. Accurate data preprocessing, such as data augmentation and normalization, can boost the model's precision. Achieving optimal performance also requires hyperparameter adjustment, such as modifying the learning rate, batch size, and number of epochs.

In conclusion, recent research on CNNs' usage for plant disease detection has yielded encouraging findings. CNNs can accurately categories plant photos into several disease groups by using deep learning to harness the natural learning of complicated information from plant photographs. Right now, the Cotton Disease Detection System can tell the difference between healthy and diseased leaves.

Additionally, the system can be made to recognize specific diseases. We can experiment with louder sounds and distorted images. The system can be connected to hardware such as jetson, which is basically low-power system and is designed for accelerating machine learning applications.

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