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HealthyLeaf

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Abstract-

Crop diseases are a major threat to food security, but their rapid identification remains difficult in many parts of the world due to the lack of the necessary infrastructure. Plant diseases and pests are important factors determining the yield and quality of plants. Plant diseases and pest identification can be carried out by means of digital image processing.

Plant disease automation in agriculture science is the primary concern for every country, as the food demand is increasing at a fast rate due to an increase in population. Moreover, the increased use of technology today has increased the efficacy and accuracy of detecting diseases in plants and animals. The detection process marks the beginning of a series of activities to fight the diseases and reduce their spread.

Some diseases are also transmitted between animals and human beings, making it hard to fight them. For many years, scientists have researched how to deal with the common diseases that affect humans and plants. The technology used in medical procedures has not been adequate to detect all diseases on time, and that is why some diseases turn out to become pandemics because they are hard to detect on time.

Our focus is to clarify the details about the diseases and how to detect them promptly with artificial intelligence. We discuss the use of machine learning and deep learning to detect diseases in plants automatically. Our study also focuses on how machine learning methods have been moved from conventional machine learning to deep learning in the last five years. Furthermore, different data sets related to plant diseases are discussed in detail. The challenges and problems associated with the existing systems are also presented.

Key words: Plant Disease Detection, Convolution Neural Network, OpenCV, Machine Learning

INTRODUCTION

India is a cultivated country and about 70% of the Population depends on agriculture. Farmers have large range of diversity for selecting various suitable crops and finding the suitable pesticides for plant. Hence, damage to the crops would lead to huge loss in productivity and would ultimately affect the economy. The plant leaf for the detection of disease is considered which shows the disease symptoms.

Crop diseases are a significant threat to human existence because they are likely to lead to droughts and famines. They also cause substantial losses in cases where farming is done for commercial purposes. The use of computer vision (CV) and machine learning (ML) could improve the detection and fighting of diseases. Computer vision is a form of artificial intelligence (AI) that involves using computers to understand and identify objects. It is primarily applied in testing drivers, parking, and driving of self-driven vehicles and now in medical processes to detect and analyze objects. Computer vision helps increase the accuracy of disease protection in plants, making it easy to have food security.

One of the areas that CV has helped most is the detection of the severity of the diseases. Deep learning (DL), a part of the CV, is useful and promising in determining the severity of diseases in plants and animals. It is also used to classify diseases and avoid the late detection of diseases. Plant diseases are slightly different from those that affect human beings. Many factors make diseases similar as well. However, the diseases that can be transmitted from humans to plants and vice versa are rare.

The analysis of the data related to this field helps identify how the use of the latest technology can be improved. The images of leaves and other parts of the plants can be used to detect diseases in plants. The technology could be applied in analyzing images in human beings that also prove the presence of diseases and determine the extent of their destruction. This research study is aimed at analyzing the way image-based technology can be used in detecting diseases in both plants and animals.

Literature Review

The most recent study in plant leaf disease classification from various plant species is discussed in this stage. A cloud-based method was used to evaluate if the crop was healthy or unhealthy. The goal is to use supervised learning to produce a real-time classification. They came to the conclusion that the size of the enormous data set they used—which included even an RBF kernel—meant that Convolutional Neural Networks (CNNs) had superior

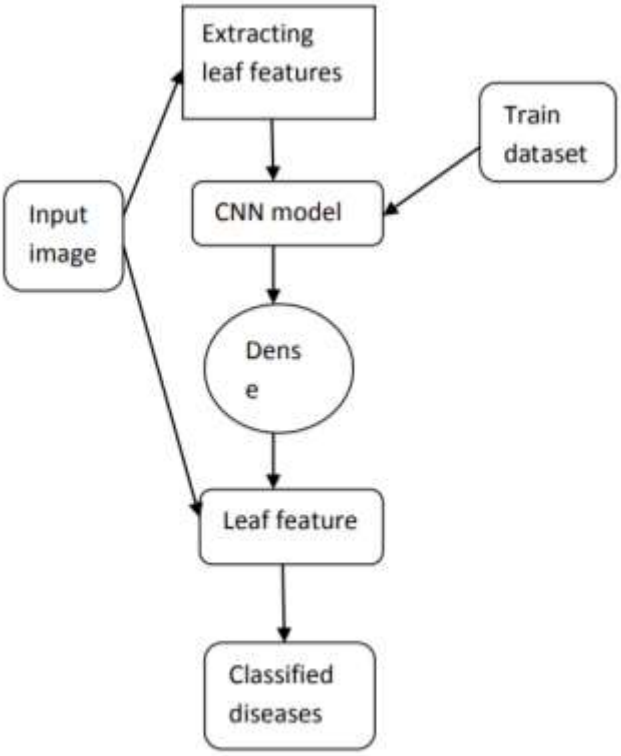
classification scores than Support Vector Machines (SVM) because the data was nonlinear in nature and so large. The train test split module of the Sklearn toolkit was used to divide the dataset of 1030 plant disease photos into 430 validation photos and 600 training images. At this point, Using the validation images and data, the CNN model is evaluated. achieve an accuracy score of 93.4%, which represents the effectiveness of the example. The accuracy score obtained during the creation of the it is improvised using the model by adjusting the hyper the classification of 20 distinct diseases is improved by modifying nonlinearities, adding or removing layers, and adjusting parameters from the dataset obtained from 10 different plant species database for plant diseases XDB. This procedure included the application of two modified VGG architectures, VGG16 and VGG19, together with pre-trained weights from the ImageNet database, as well as two pre-processing activities (picture selection and resizing). On training and validation data, the classification results of VGG16 and VGG19 were 94.3% and 87.1%, and 84.3% and 80.4%, respectively. Based on categorization measures like accuracy, precision, recall, and F1-score, [10] conducted a comparison study. The obtained results showed that a pre-trained CNN with depth equal to or less than VGG16 for this particular database could compute disease-sensitive features that aggregated more refinement to recognise plant pathologies, which justified the better performance of VGG16 against VGG19 on training, validation, and test data.

Solution Proposed

At present, machine vision-based plant diseases and pests detection equipment has been initially applied in agriculture and has replaced the traditional naked eye identification to some extent. Using digital image processing method, the disease detection in plant is efficient, less time consuming and accurate. This technique saves time, efforts, labors and use of pesticides. Different authors propose different techniques with the help of digital image processing for accurate plants disease identification. Detection of plant disease through some automatic technique is beneficial as it reduces a large work of monitoring in big farms of crops, and at very early stage itself it detects the symptoms of diseases i.e. when they appear on plant leaves.

On a small leaf dataset, deep learning with convolutional neural network will be used with fine-tuning methods. A score for accuracy can go up. Since the dataset is tiny, data augmentation will also be used, with the photos supplemented before they are entered into the model, in contrast to many other situations when augmentation is applied on-the-fly. By doing so, you might improve the success rate value and lessen overfitting. Additionally, it will demonstrate how the model's performance might be enhanced by the augmentation that will be used in this manner. Transfer learning using the same augmentation technique will be used, which could produce outcomes with lower overfitting and higher test accuracy. The plant leaf dataset that will be used in the trials may yield positive results using the suggested methods. Last but not least, a framework for better leaf recognition-based plant disease classification will be presented. Python, OpenCV, Anaconda, Jupyter Notebook, and Keras Deep Learning Model with Tensorflow in the backend will be used to construct the deep learning framework.

Use Case diagram



Technology Used

Python:

Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation. Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured, object-oriented and functional programming.

JavaScript

JavaScript is a dynamic computer programming language. It is lightweight and most commonly used as a part of web pages, whose implementations allow client-side script to interact with the user and make dynamic pages. It is an interpreted programming language with object-oriented capabilities.

Tensorflow

TensorFlow is a free and open-source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks.

OpenCV

OpenCV is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez. The library is cross-platform and free for use under the open-source Apache 2 License.

HTML

The HyperText Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets and scripting languages such as JavaScript.

CSS

Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language such as HTML or XML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript.

Study of Existing System.

No.	Existing system/website/software	Features	Disadvantages	Limitations/Gaps
1.	Plantix	It covers more than 45 crops and can detect more than 500 diseases.	Limited database. It does not determine disease properly	Not for PC desktop
2.	Fouxa	Disease symptoms relevent photos to ensure that the app detected the disease accurately	Identifies the problem but it doesn't gives definitive results but it gives the likliest possibility.	It does not dentify disease of any house plants or plant used for garderning. Limited database

Limitation of Work

The performance of a system highly depends on the quality of the training data. In plant disease automation, it is the training images and certain extracted features, which significantly affect the performance of a system. A system trained with good quality data is trained well.

However, most of the existing systems have a specific set of requirements needed to be fulfilled for a system to perform accurately If some of these constraints are not fulfilled, the system may give inaccurate results, ultimately leading to wrong disease detection.

CONCLUSION

In summary, with the development of artificial intelligence technology, the research focus of plant diseases and pests detection based on machine vision has shifted from classical image processing and machine learning methods to deep learning methods, which solved the difficult problems that could not be solved by traditional methods. There is still a long distance from the popularization of practical production and application, but this technology has great development potential and application value.

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