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ijirset@gmail.com

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Plant Leaf Disease Detection Using Deep Learning Approach

Prof. Poonam Nalge¹, Tejas Lidhure², Sagar Gaikwad², Bhargav Burgul²

Professor, Department of Computer Engineering, NBN Sinhgad School of Engineering, Pune, Maharashtra, India¹

U.G. Student, Department of Computer Engineering, NBN Sinhgad School of Engineering, Pune, Maharashtra, India²

ABSTRACT : Agriculture sector in India is one of the most important sector economically. To sustain maximum possible yield of crop production in agriculture, it is necessary to monitor the condition of leaves as it grows. The disease can be predicted before its spread by observing type of spots/response it creates on the leaf. By using advanced technology such as drone technology/imaging technology, the regular monitoring of leaves is possible. The technology for early detection of the disease can reduce the time needed for diagnosis, testing and analysis. The expansion of the use of neural network algorithms for the segmentation of leaves and the plantation approach can be achieved with the use of such tools. Dealing with the idea of "malady" is referred to as differentiating multiple diseases by different symptoms. With the latest advancements in deep learning, it is proving to be difficult for pattern recognition and machine learning, but eventually they can surmount this obstacle. This project seeks to use CNNs to create a new species classification technique that is much more expansive than PALS to classify cause of all leaf diseases. For improved plant disease recognition and networking parameters, we recommend the AlexNet deep learning model.

KEYWORDS: Machine Learning, CNN Model, Deep Learning.

I. INTRODUCTION

A study of prehistoric agriculture reveals how people came to settle in agricultural societies. Since 80% of the population of India is employed in agriculture, the country's economy is strongly reliant on the cultivation of crops. The economic stability is dependent on the successful operation of the agricultural sector. There are a number of fundamental and transformative changes occurring in the Indian market, and a great deal of expansion in the agriculture, which would be needed for continued yield. Crops are vulnerable to many threats, including disease and nutrition deficit, which directly and indirectly influence the production and composition of agricultural commodities. There are modern and creative approaches to recognize the most up-to-date disease prevention techniques those are needed to get involved in this topic. The primary disease impact of the plant's status is based on the response it shows on its leaves. If diseases can be found using an accurate detection system, then something inexpensive and autonomous, which uses smaller and miniaturized unmanned aerial vehicles is chosen. When more advanced plant breeding technology is employed, disease can be kept at bay with a lesser use of human intervention. Plant diseases affect the growth and crop yield of the plants and make social, ecological and economical impacts on agriculture. Recent studies on leaf diseases show how they harm the plants. Plant leaf diseases also cause significant economic losses to farmers. Early detection of the diseases deserve special attention. Plant diseases are studied in the literature, mostly focusing on the biological aspects. They make predictions according to the visible surface of plants and leaves. Detection of diseases as soon as they appear is a vital step for effective disease management. The detection is traditionally carried out by human experts.

Convolutional networks model to achieve fast and accurate automated detection by using different plant leaf disease images. Plant leaf diseases have various symptoms. It may be more difficult for inexperienced farmers to detect diseases than for professional plant pathologists. As a verification system in disease detection, an automatic system that is designed to identify crop diseases by the crop's appearance and visual symptoms could be of great help to farmers. Many efforts have been applied to the quick and accurate detection of leaf diseases. By using digital image processing techniques and neural networks, we can detect plant leaf disease. Deep learning has made tremendous advances in the past few years. It is now able to extract useful feature representations from a large number of input images. Deep learning provides an opportunity for detectors to identify crop diseases in a timely and accurate manner, which will not only improve the accuracy of plant protection but also expand the scope of computer vision in the field of precision agriculture.



MOTIVATION

Main motivation for the use of the development of the full disease model for plant-leaf detection systems include usage of simple digital cameras for farmers and process to detect the infection earlier. Additionally, collecting the data and classifiers is difficult process, though people can find it time-consuming. CNNs are widely anticipated to be function learning mechanisms that use the valuable yet difficult aspects of non-trained features effectively.

BACKGROUND

The state of India's primary healthcare services has left many of its farmers vulnerable to sickness and injury, and its maldeveloping ability to identify and treat these illnesses contributes to this. When planted crop loss due to disease ranks only second to food survival, the effects of plant diseases on world food sources are accounted for. In semi-arid climates, including those found in most of Africa, the majority of the world, such cereals like wheat and rice are also agriculturally useful but need less fertilisation and irrigation. One to two months after planting, there is a greater incidence of plant disease in the wetter areas. One of the most noticeable problems recently has been a surge in plant diseases, and the occurrence of pathogen organisms. This research was created to deliver deep image-based models which helps both a robot and human models to correctly identify plant disease by allowing them to view numerous image segments. Many distinct diseases are found on plants, some of them are most commonly caused by rust and fungi. Any plant pathogens will give evidence of the occurrence in the appearance of stains, colour abnormalities, or of mould or mildew, due to the presence of unwanted odours. You will face greater challenges in establishing a more solid records if you are a new to the pathogen detection business because you haven't yet obtained as much information on your own results. The emergence of automation for disease-checking technologies that are driven by appearances and symptoms has proved useful in locating disease patterns Although there have been a range of approaches employed to raise the flow and smoothness of movement, to this end the increase has been improved on. To make the disease diagnosis of various disease problems in plant leaves simpler, we are adding information-gathering systems that uses neural networks and biological images to the concept of artificial images. An excellent number of advancements have been made in the area of deep learning over the past few years. Today, thanks to this modern feature extraction technology, the most features can be extracted from various files. This is what happens when you allow for more advanced models of artificial intelligence to be implemented: Scientists like Agumä Agunson believe that they have the capability to have time- and species-specific solutions, like deep learning, for various agricultural problems.

II. LITERATURE SURVEY

Lucas G. Nachtigall and Ricardo M. Araujo , Gilmar R. Nachtigall “Classification of Apple Tree Disorders Using Convolution Neural Networks”[1],Presented as,This paper studies the use of Convolutional Neural Networks to automatically detect and classify diseases, nutritional deficiencies and damage by herbicides on apple trees from images of their leaves. This task is fundamental to guarantee a high quality of the resulting yields and is currently largely performed by experts in the field, which can severely limit scale and add to costs. By using a novel data set containing labeled examples consisting of 2539 images from 6 known disorders, we show that trained Convolutional Neural Networks are able to match or outperform experts in this task, achieving a 97.3% accuracy on hold-out set.

Siddharth Singh Chouhan , (Student Member, IEEE), Ajay Kaul , Uday Pratap Singh and Sanjeev Jain , (Member, IEEE) “Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases: An automatic approach towards Plant Pathology”[2],presented as, The contribution of a plant is highly important for both human life and environment. Plants do suffer from diseases, like human beings and animals . There is the number of plant diseases that occur and affects the normal growth of a plant. These diseases affect complete plant including leaf, stem, fruit, root, and flower. Most of the time when the disease of a plant has not been taken care of, the plant dies or may cause leaves drop, flowers and fruits drop etc. Appropriate diagnosis of such diseases is required for accurate identification and treatment of plant diseases. Plant pathology is the study of plant diseases, their causes, procedures for controlling and managing them. But, the existing method encompasses human involvement for classification and identification of diseases. This procedure is time-consuming and costly. Automatic segmentation of diseases from plant leaf images using soft computing approach can be reasonably useful than the existing one. In this paper, we have introduced a method named as Bacterial foraging optimization based Radial Basis Function Neural Network (BRBFNN) for identification and classification of plant leaf diseases automatically. For assigning optimal weight to Radial Basis Function Neural Network (RBFNN) we use Bacterial foraging optimization



(BFO) that further increases the speed and accuracy of the network to identify and classify the regions infected of different diseases on the plant leaves. The region growing algorithm increases the efficiency of the network by searching and grouping of seed points having common attributes for feature extraction process. We worked on fungal diseases like common rust, cedar apple rust, late blight, leaf curl, leaf spot, and early blight. The proposed method attains higher accuracy in identification and classification of diseases.

Sharada Prasanna Mohanty, David Hughes, and Marcel Salathé, “Using Deep Learning for Image-Based Plant Disease Detection”[3], Presented as, 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. The combination of increasing global smartphone penetration and recent advances in computer vision made possible by deep learning has paved the way for smartphone-assisted disease diagnosis. Using a public dataset of 54,306 images of diseased and healthy plant leaves collected under controlled conditions, we train a deep convolutional neural network to identify 14 crop species and 26 diseases (or absence thereof). The trained model achieves an accuracy of 99.35% on a held-out test set, demonstrating the feasibility of this approach. When testing the model on a set of images collected from trusted online sources - i.e. taken under conditions different from the images used for training - the model still achieves an accuracy of 31.4%. While this accuracy is much higher than the one based on random selection (2.6%), a more diverse set of training data is needed to improve the general accuracy. Overall, the approach of training deep learning models on increasingly large and publicly available image datasets presents a clear path towards smartphone-assisted crop disease diagnosis on a massive global scale.

Yang Lua, , Shujuan Yi , Nianyin Zeng , Yurong Liud , Yong Zhangf, “Identification of rice diseases using deep convolutional neural networks”[4], Presented as, The automatic identification and diagnosis of rice diseases are highly desired in the field of agricultural information. Deep learning is a hot research topic in pattern recognition and machine learning at present, it can effectively solve these problems in vegetable pathology. In this study, we propose a novel rice diseases identification method based on deep convolutional neural networks (CNNs) techniques. Using a dataset of 500 natural images of diseased and healthy rice leaves and stems captured from rice experimental field, CNNs are trained to identify 10 common rice diseases. Under the 10-fold cross-validation strategy, the proposed CNNs-based model achieves an accuracy of 95.48%. This accuracy is much higher than conventional machine learning model. The simulation results for the identification of rice diseases show the feasibility and effectiveness of the proposed method.

III. METHODOLOGY

This chapter describes the method of implementation for the proposed system which includes the block diagram, its elements and the functioning of each block.

BLOCK DIAGRAM

Block Diagram for the Proposed System is follows:

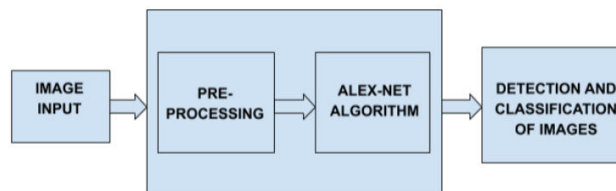
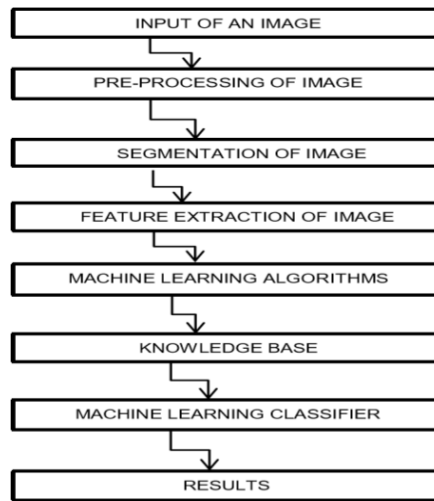


Fig.2.1. Block Diagram of the System



Block Diagram Explanation



WORKING

Any suspected image of leaf is provided as input to proposed system. Further pre-processing on that image carried out in the following manner:

1. Grayscale RGB conversion: In a grayscale image, each pixel value reflects a single sample containing only a small amount of light, i.e. only intensity information. Grayscale images, also known as black and white or brown monochrome photographs, are made up of a wide range of grey colours. The variations are represented in black and white, with black representing the lowest and white representing the highest.
2. Edge detection: The Canny edge detector is a multi-stage edge detector that employs a multi-stage algorithm to detect a wide variety of edge images. John F. Canny built the platform in 1986.
3. Image thresholding: Image thresholding is a simple but effective technique for separating foreground and background areas in a picture. Thresholding is a method for turning a grey image into a binary image.
4. Noise Reduction in Cameras: A noise reduction algorithm is a method for eliminating or reducing image noise. By smoothing the whole picture while leaving regions close to the contrast, noise reduction algorithms reduce or eliminate noise generation. Noises include things like salt and pepper, Gaussian noise, gun sounds, and other tones.

Alex-Net is a website that is exclusively dedicated to Alex-related content. In the image processing process, the algorithm is the next step.

AlexNet is made up of three layers and five convolutional layers that are all interconnected. A variety of Convolutional kernels (also known as filters) are used to remove critical image properties. Typically, a single convolutional layer consists of several kernels of the same size. In AlexNet's first Convolutional layer, for example, there are 96 11x11x3 kernels. The diameter and height of the kernel are usually the same, and the number of channels determines its volume. The Overlapping Max Pooling layers are the next to emerge after the first two Convolutionary layers. Direct relations exist between the third, fourth, and fifth layers of convolution. After the fifth convolutionary layer, an alternating Max pooling layer is added, and its output is fed into a series of two fully connected layers. In the second completely connected sheet, a softmax classifier with 1000 class marks is used. ReLU non-linearity is introduced after both the convolution and all of the fully connected layers have been achieved.

Plant Disease Identification and Classification: At this point of the differentiation process, the data was used to isolate and contrast the co-occurrence properties of the leaves to their respective attribute values. A supervised dataset is the polar opposite of this. Following that, a classifier is used to determine if the leaf is disease-infected or not.



OBJECTIVES

The objective of the proposed system is to early detection of diseases as soon as it starts spreading on the outer layer of the leaves. The main goal of this project is to detect and classify different types of sorghum leaf diseases. Objectives are as given below:

1. To study the image pre-processing techniques such as segmentation and feature extraction for Detecting sorghum leaf diseases.
2. To study Deep Learning architectures for classification.
3. To classify leaf diseases by using deep convolutional neural network.
4. To increase efficiency of Deep Convolutional Neural Network by modifying the architecture.

Processor:

1. System Processors: Intel processor
2. Speed : 2.4 GHz
3. Hard Disk : 150 GB
4. RAM : 8 GB

IV. CONCLUSIONS

Leaf disease-caused plant disease will generate considerable monetary loss in agriculture if control measures are not taken. An integrated framework that can provide early detection of disease can be created by using computer and communication technology. The ALEX-NET approach has proven useful in both in the realm of philosophy and in application. An advanced ALEX-NET expansion will be implemented in this article, where we explore new approaches to model semantic data abstraction and facilitate semantic training by using deep learning. The proposed AlexNETs would be good at classifying diseases by image recognition, helping it to do more than originally intended. The study in the use of plant disease is in vegetation agrees with the proposed new data banks, and expands upon them, and proves that the ALEX-NETs model is an efficient tool for accurately and fully identifying plant diseases with picture data. However, ALEX-NETs are outstanding function extractors. Extracting valuable attributes from a previously qualified weights by using them and tuning the ALEXNET for the mission In this experiment, we've introduced techniques like image analysis and plant classifying leaf disease identification to detect occurrence of leaf disease.

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