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Sorghum Leaf Disease Detection Using Convolutional Neural Network

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ABSTRACT – Agriculture is considered a very major field in India. Mostly the farmers don't have subsequent knowledge about some crop or leaf diseases. So, in this paper, we propose a new Sorghum Leaf Disease detection method based on Convolutional Neural Networks (CNNs) technique. The main focused areas of this project are – preprocessing, feature extraction, segmentation, and classification. We use a dataset of 260 leaf images of diseased and healthy sorghum leaves captured from the sorghum experiment field, which will make the system understand both the situations perfectly and thus can give results accurately. We use libraries like Keras, OpenCV, TensorFlow, pillow, Matplotlib with CNN. It allows us to carry out various functions on the dataset like image filtration, feature extraction, weight estimation. This paper describes a system that detects the Sorghum Leaf Disease using computer technology. Sometimes, crop-based disease detection might be challenging due to the same color leaves or same texture, which has been work out in this project. The main aim behind developing this project was to create awareness among farmers about the sorghum leaf disease.

Key Words: Machine learning, deep learning, Sorghum, Agriculture, CNN, feature extraction, image filtration, weight estimation, TensorFlow, OpenCV, matplotlib, pillow, classification, detection, segmentation, preprocessing.

1.INTRODUCTION

Agriculture or farming is one of the main occupations in India from where all of our food requirements are satisfied. For the past few years, farming required a lot of physical effort. But in recent years, because of advanced technology, Farming and growing crops is made much easier by reducing the actual physical efforts of the farmer. But only reducing physical effort is not enough, the farmers should also know about the different crop or leaf diseases or else it would be harmful to all of us. In some rural areas, the farmers don't have much idea about the sorghum crop disease. Our main aim is to educate more and more farmers about this disease so that farmers can grow crops without being afraid of any crop disease. This project focuses on sorghum leaf disease.

Figure 1: Red spots on sorghum leaf.

Diseases can be hazardous to control in the grain sorghum after they develop, So to provide early detection of the disease we have proposed this system, which will be beneficial for farmers to know that their crops have the disease and thus will take the necessary steps to overcome the disease.

First, we train the machine by giving the machines two types of dataset – 1.) healthy sorghum leaves, 2.) diseased sorghum leaves, which will make the machine understand input images properly and thus, give an accurate result. For training machines and also for the further processing of the data the CNN algorithm has been used. Using this algorithm, first, the input image gets filtered which means if any image is blur, it will make that image readable. After the image preprocessing, the segmentation process takes place, in which the image is disassociated into many small parts for the machines to understand the image more thoroughly. The final step is the classification which determines if the input image is having the disease or not.

2. PROBLEM STATEMENT

Design a productive structure that examines disease leaf images to study the techniques of feature extraction, segmentation and classification so that leaves can resist diseases. To enhance the identification of sorghum leaf disease and reduce the count of network parameters, the

GoogLeNet model depends on deep learning for leaf disease identification.

3. LITERATURE SURVEY

So many different architectures are proposed and compared in various studies. IT mainly included Convolutional Neural Network (CNN) and its variants. CNN can be applicable on 2D (knownas2DCNN/ConvNet) and 3D data (known as 3D CNN/C3D/3D ConvNet). These architectures are modified for several applications and datasets.

Identification of rice diseases using deep convolutional neural networks. The automatic identification and diagnosis of rice diseases are highly taken care of in the agricultural field 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 survey, we present a novel rice disease identification method based on deep CNN techniques. Using a dataset of 500 realistic images of diseased and healthy rice leaves and stems captured from the rice experimented field, CNNs are trained to identify ten (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 the conventional machine learning model. The simulation results for the identification of rice diseases show the feasibility and effectiveness of the proposed method.

4. OBJECTIVE

The main objectives of this project are as given below.

1] To study the image preprocessing technique for detecting Sorghum leaf images in various types of diseases of the leaf image dataset.

2] To study Deep Learning architecture for feature detection and classification.

3] To increase the efficiency of Deep Convolutional Neural Network by modifying the architecture.

5. SYSTEM ARCHITECTURE

The Block Figure of the proposed work is specified below. The steps proposed include the image database collection, preprocessing of those images, feature extraction from those images using k-means clustering-based color segmentation technique, Feature extraction using GLCM method, and finally the training of the artificial neural network using Convolutional neural network Algorithm. Firstly, some images help to guide the neural network and other images to find the correctness of the result.

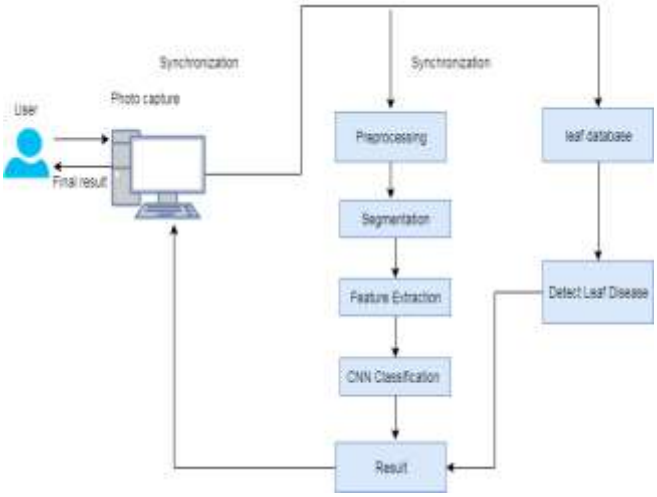

Figure 2: System Architecture

6. PROPOSED SYSTEM

The Software Requirement Specification gives the total requirement for our project. The software requirement specification will incorporate the needs, system architecture, proposed algorithm data flow diagram.

A] Requirement Collection and Analysis Phase

Project requirements are put together in this phase. This phase is the main focus of the project managers and stakeholders. Meetings are held with managers, stakeholders, and users to determine the requirements like; who will be responsible for using this system? How will they work on this system? What data should be presented by the system? These are general questions that get answered during the requirements gathering phase. After the requirement collection, the needs are studied deeply for their sustainability and for the probability for the expected structure to be built.

B] Project Design Phase

The software design and system structure are developed from requiring specifications, as mentioned in the first phase. System Design helps in specifying hardware and system requirements and also helps in defining overall system architecture. The system design specifications serve as input for the next phase of the model.

C] Implementation Phase

In this phase, On receiving system design documents, the work is divided into modules or units & actual coding will be started. The implementation phase the main focus for the developer. This phase is the prolonged phase of the project development.

D] Testing Phase

After the coding part is developed it is tested against the requirements to make sure that the product is solving the needs addressed and gathered during the requirements phase. During this phase, unit testing, integration testing, system testing, acceptance testing is performed.

E] Modification Phase

In this phase, a modification is made if we require some changes after the testing phase.

F] Deployment Phase

After successful testing, the product is deployed to the customer for their use.

G] Research Model

In our project, we will use the waterfall model of the software development process. The waterfall model is a sequential development approach where development will be flowing steadily downwards (like a waterfall) through the phases of Conception, Initiation, Analysis, Design, Construction, Testing, implementation, and maintenance. The waterfall model is a traditional engineering approach applied to software engineering. A strict waterfall approach discourages revisiting and revising any earlier phase once it is complete. This inflexibility in a pure waterfall model has been a source of criticism by supporters of other more flexible models. It has been widely blamed for several large-scale government projects running over budget, over time, and sometimes failing to deliver on requirements due to the Big Design Up Front approach. Except when contractually required, the waterfall model is highly taken place by more flexible and versatile methodologies developed specifically for software development. The below figure is showing the waterfall model.

Figure 3: Steps in Waterfall Model

7. CNN ARCHITECTURE

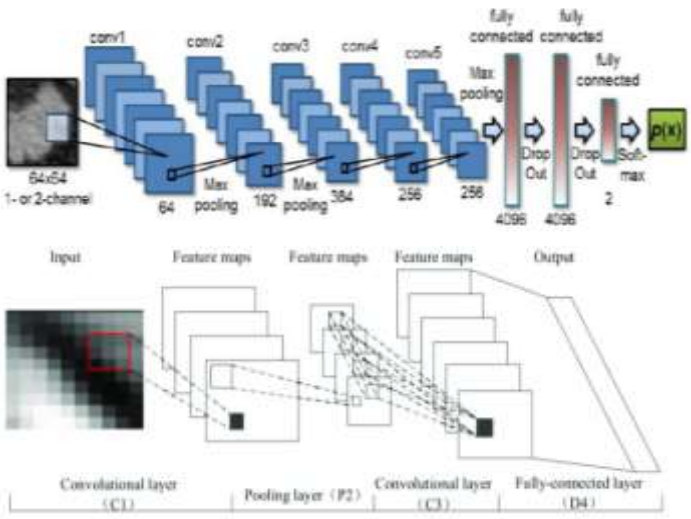

Figure 4: CNN Architecture

8. ADVANTAGE

1)Easy to find out sorghum disease by using image processing.
2)To decrease the time for finding out sorghum disease.
3) Anyone can use this application

RESULTS

After the complete setup and development of the project are achieved, at the output screen we can input any leaf image, the input image will then be preprocessed and will go through different processes to give a proper error-free output. So finally, on the main screen, we can see if the input image is having any disease or not.

CONCLUSIONS

To conclude, sorghum leaf disease detection is developed for the ease of farmers on whom we are directly or indirectly dependant. Adding on this project will also be very user-friendly so that it's not much tedious to operate with the app.

FUTURE SCOPE

Considering that this project is agricultural-based, this project can run on any operating system with an overall better configuration. Besides this, we planned to extend this project in terms of performance up-gradation and a quick response time to users, so it becomes easier and less time-consuming for users to operate this app.

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