Deep Convolution Neural Network For Classifying Corn Leaf Diseases From Unmanned Aerial Vehicle

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Abstract- *In the agriculture field, plant disease diagnosis is one of the leading factors. Therefore, to create an automated system that may identify plant disease diagnosis as simple as possible. The exact identification of crop diseases is exceptionally wanted in the field of agriculture. In this project, to propose a convolution neural network architecture for corn leaf disease identification. The analysis is implemented using corn leaf images from the plant village dataset. The proposed CNNs are trained to identify three different classes, that is two diseases and one healthy class. The trained model achieves an accuracy of 96.04%. The trained program specimens are embedded in the raspberry pi, and it fitted on the drone. Recently, Unmanned Aerial Vehicle (UAVs) has increased a lot of consideration. Specifically, there is a developing in utilizing UAVs for agricultural application such as crop monitoring and management. Proposing a computerized framework that is capable of detecting corn leaf diseases with high accuracy. The framework embraces computer vision and deep learning to process the images captured by UAVs at low altitudes and to identify the infected corn leaf.*

Keywords- corn leaf diseases, deep learning, convolution neural network and UAV.

I. INTRODUCTION

In India, corn is rising as third most important crop after rice and wheat. Its significance lies within the way that it's not just for human food and animal feed and yet it's additionally generally utilized for corn starch industry, corn oil generation, baby corns and so on. However, the recent years, the quantity of type of corn diseases and the level of damage they cause have expanded, fundamentally because of change in development frameworks, the variety of pathogen assortments, and in sufficient of plant insurance measures. Mostly, there are two common leaf diseases gray leaf spot, common rust. Corn leaf diseases have different indications. It might be more difficult for the unpracticed framer to analyze ailment than for proficient plant pathologists. As a verification framework in disease diagnostics, a programmed that is intended to distinguish plant diseases by the plant's appearance furthermore, visual indications could be of extraordinary assistance to a framer. Numerous attempts have been applied to the fast and the exact conclusion of leaf diseases. By utilizing image processing techniques and neural networks, can distinguish and classify leaf diseases. Deep learning has made huge advances in the past few years. It is currently ready to extract useful feature portrayals from countless input images. Deep learning gives an opportunity for detector to identify crop diseases in a convenient and accurate manner, which won't as it were improve the accuracy of plant production, but also expand the scope of computer vision in the field of agriculture.

The rest of this paper is organized as follows, related work in section 2, the proposed approach explained in section 3, material and method is described in section 4, results and discussion are presented in section 5 and finally the conclusion in section 6.

II. RELATED WORK

Plant diseases are a significant threat to production and quality, and numerous analysts have put forth different attempts to control these infections. In the last few years, machine learning algorithms have been generally used to recognize disease detection. In [1], Lu et al. (2017) Proposed a novel diagnose approach for rice diseases dependent on deep convolutional neural network system. Utilizing a dataset of 500 normal pictures of diseased and healthy rice leaves and stems, CNNs were prepared to distinguish 10 common rice diseases. The test result showed that the proposed model achieved an average accuracy of 95.48%. In [2], Mohanty et al. (2016) build up a CNN-based model to recognize 26 infections and 14 yield species. Utilizing an open dataset of 54,306 pictures of infected and healthy plant leaves. The proposed model was prepared and accomplished an exactness of 99.35%. In [3] Rothe et al. (2015) Proposed a pattern recognition system and characterizing three cotton leaf infections. Utilizing the captured dataset of common pictures, a functioning from model was utilized for picture division and Hu's moments were separated as feature in preparation of a training of an adaptive neural-fuzzy inference system. The pattern recognition system accomplished a normal exactness

of 85%. In [4], Andreas kamilaris et al. (2018) As of late, the convolutional neural network systems (CNNs) have 60 had remarkable accomplishment in numerous applications, on account of their great capacity to tackle issues with the aid of computer vision and pattern recognition. Up until this point, there has been little consideration regarding utilize a profound learning approach in agriculture. In [5], Jaen Alberto Arroyo et al. (2017) Programmed infection recognition utilizing sensors can play an important role in addressing the issue of plant infection control. In recent years, innovation has gained significant progress in the advancement of Unmanned Aerial Vehicles (UAV), prompting too many remote sensing applications. In [6], Anandhakrishnan et al. (2017) Convolutional neural system (CNNs) is generally studied and utilized in the field of crop disease recognition. These studies show that convolutional neural systems have decreased the interest of picture preprocessing, yet in addition improved the acknowledgment precision. In [7], Amara et al. (2017) Proposed a banana leaf characterization issue, that model was powerful under testing conditions, for example, light, complex foundation, different resolution, size and direction of the pictures. In [8], Malusi Sibiya et al. (2019) Proposed a CNN was used for the classification of diseases in maize plants and histogram techniques to show the significance of the model. The experimental result of the proposed model achieved an average accuracy 92.85%. In [9], Md.Helal Sheikh et al. (2019) Proposed an image processing, convolutional neural network algorithm to train the corn and peach dataset. At the end of this model achieved accuracy 99.28%. In [10], kussul et al. (2017) Proposed a staggered DL approach for land spread and crop type order utilizing multitemporal multisource satellite symbolism. A perplexity among maize and soybeans was apparent in and variety was low in naturally related crops, such as, glade, neglected, triticale, wheat, and rye.

III. PROPOSED APPROACH

In this system propose to implement the corn leaf disease classification using the deep convolutional neural network. In that CNN's network explained in section 4. The trained leaf images are loaded in raspberry pi, and it puts on the drone. Recent years, the drone system is a popular technology in industry, and it's used in many applications. In this paper, the drone system is used to monitor the corn leaf. Figure 1 shows the block diagram of the system proposed for corn leaf diseases identification using drone. Finally, the drone system is used to spray the pesticides and fertilizer after monitoring the corn leaf.

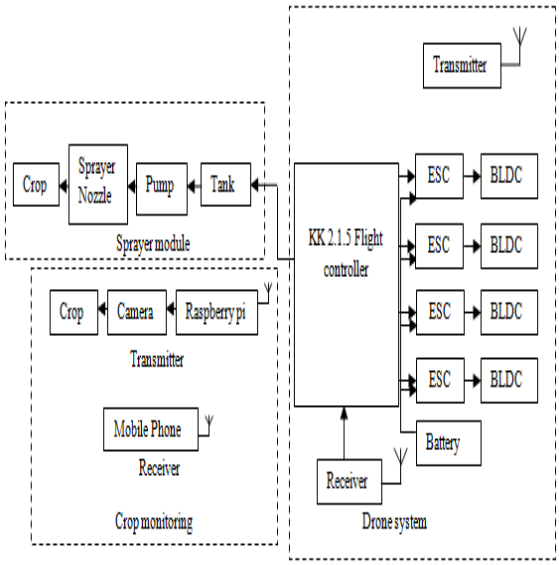


Figure 1.Block diagram of the proposed system

IV. MATERIAL AND METHODS

A. DATASET

A suitable dataset is required at all phases of object acknowledgment research, beginning from the training stage to assessing the presentation of acknowledgment calculations. A sum of 2876 pictures is gathered from plant village, including various periods of event of corn leaf diseases, which are branched into 3 different classes. There are 2 grades representing diseased corn leaves and a category representing healthy leaves. Two sorts of corn leaf diseases are shown in fig 2 gray leaf spot and common rust; these are the main diseases to the analysis in this paper. The gathered image had been uniformly compressed via the decision of each image using software python 3.7, and the compression length turned into 50x50. Finally, the image was stored in JPEG format to construct a corn leaf ailment image database.

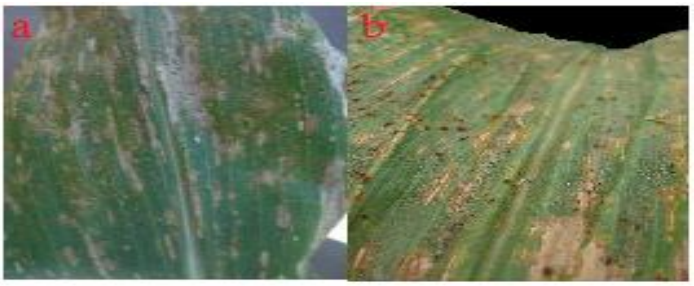


Figure 2. Two common corn leaf diseases: a. gray leaf spot and b. common rust

Table 1. Dataset for corn leaf disease image

Class	Total number of image	Number of image for training	Number of image for testing
Common Rust	1192	953	239
Gray leaf spot	513	410	103
healthy	1162	929	233

B. IMAGE PROCESSING

First the images of corn leaves are obtained utilizing high resolution camera to show signs of improvement results and productivity. Then image processing strategies are applied to these images to extricate valuable features which will be required for more analysis. The image processing contain with image acquisition, image preprocessing, image segmentation, feature extraction and disease classification, which are explained in the Fig. 3.

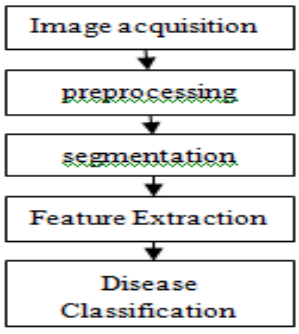


Figure 3. Steps of image processing

I. Image Acquisition

The images of different leaves acquired using a digital camera with necessary procedure for better quality. The creation of an image database is depending on the application. All the images are saved in JPEG layout for keeping uniformity.

II. Image Preprocessing

Image preprocessing is the second step in image processing system. Image preprocessing is needed to resize caught image from high goals to low goals. The image resizing should be possible through the procedure of addition. Caught input image is being converted into a grayscale image utilizing color conversion by the equation. The gray leaf images are show in fig 4.

Image=0.3R+0.59G+0.11B

The caught image put in white background result in large differences between grey values of object and background.

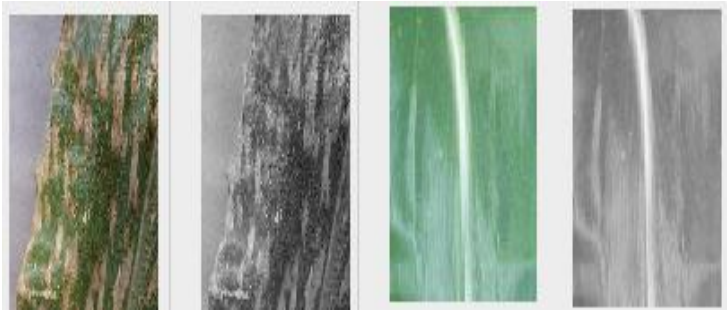
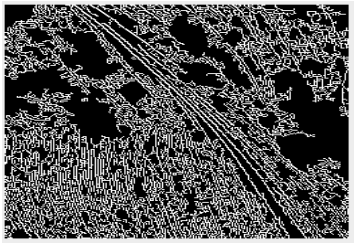
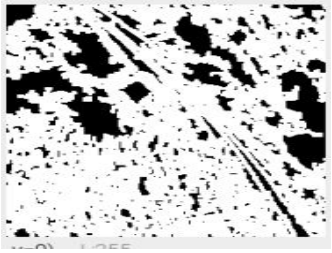


Figure 4. RGB to grayscale image

III. Image Segmentation

Segmentation is the technique of assigning a label to each pixel in an image such that pixels with the identical label percentage positive visible characteristics. It entails partitioning an image into groups of pixels which are homogeneous with respect to the pixel labeling criterion. Segmentation approach occupied with in the present work namely canny edge detection. The reason of edge detection in general is to noticeably lessen the amount of information in an image, at the same time as maintaining the structural properties to be used for further image processing. In this segmentation consists also morphological operation, that operation based on the shape and it have two parts. In a morphological activity, every pixel in the image is balanced dependent on the estimation of different pixels in its neighborhood. Dilation adds pixels to the bounds of object in a picture, even as erosion removes pixels on object obstacles. The canny edge detection and morphological operations are show in figure 5.





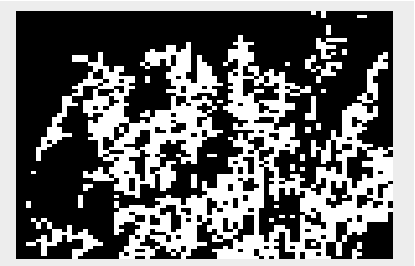


Fig: 5.Canny edge detection, dilation operation, erosion operation.

IV. Feature Extraction

Feature extraction is the crucial part to gracefully predict the infected region. Here shape and textural function extraction is performed. The shape orientated feature extraction like area, color axis duration, eccentricity, solidity and perimeter are calculated. Similarly the feel orientated function extraction like contrast, correlation, energy, homogeneity and mean. Leaf image is captured and processed to determine the health of every plant.

V. Disease Classification

Classification of diseases is based totally on the predefined dataset values."For type segment, one of a kind sort of device getting to know strategies are being hired to allocate a class to a fixed of unclassified records". In this project used to classify the corn leaf disease using convoutional neural network techniques. Deep learning is a rising examination region in the field of machine learning just as in convolutional neural network. It is a subset of machine learning strategies. Deep learning approaches have been utilized for image arrangement and acknowledgment. In deep learning, CNN is one of the most noticeable methodologies. It comprises of two center structures: a convolutional layer and a pooling layer. This paper focuses predominantly on the yields which have been grouped through deep learning convolutional neural network.

C.CONVOLUTIONAL NEURAL NETWORKS

Architecture dependent on CCC language planned explicitly for deep learning and CNNs-related algorithms, has numerous advantages, such as quicker updates and adaptable expansibility. It provides a complete toolkit for training and testing. AlexNet structure has 8 layers, which is characterized by going deeper. The AlexNet has 60 million parameters and 500,000 neurons, comprises of five convolutional layers, some of which are followed by max-pooling layers, and two all inclusive associated layers with a last 1000 way softmax. To make training quicker, to utilized non-saturating neurons and an effective GPU usage of convolutional nets. To decrease overfitting layers to utilized another regulation strategy that end up being extremely powerful. It utilizes the pyramid model to build the width and puts forward the concept of an "inception module".

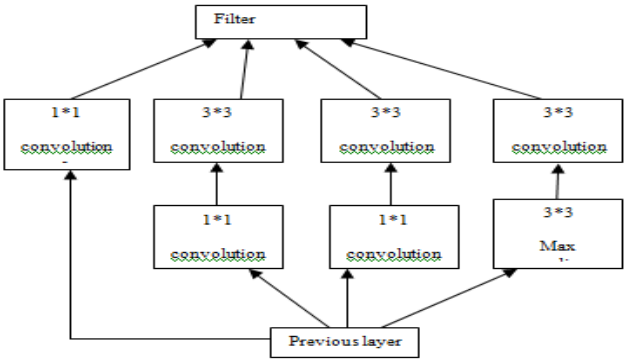


Fig:6. The Inception module of AlexNet

D. LEAF MONITORING SYSTEM OVEVIEW

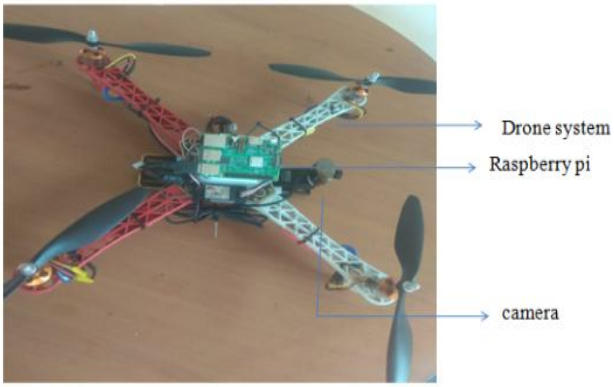


Fig: 12.Monitoring System

In this study corn leaf classification are process into the raspberry pi and it placed on the quadcopter. In that quadcopter components are explained in below. The hardware components of quadcopter consists of BLDC motor, ESC, propeller, kk 2.1.5 flight controller, raspberry pi, transmitter and camera. The corn leaf monitoring system shown in figure 12.

Raspberry pi

Raspberry pi is a small computer board functioning on the Linux working system which connects to a computer monitor, keyboard and mouse. Raspberry pi may be implemented to a digital shape and programming network work, it is able to also serve as a private computer and it is able to install some libraries for corn leaf diseases detection on

the board. The convolution neural network operating system could be run on the inside of raspberry pi.

Camera

A web cam camera is an enter device because it captures a video picture of the scene in the front of it. It is either constructed in to the raspberry pi or it is linked through an USB cable. In this project the camera used to capture the corn leaf in the field of corn.

Flight Controller

The flight controller facilitates to force the drone through taking stability, pace, gyro acceleration in consideration. The flight controller has to be easier to mount and dealt with. For this cause to pick the kk 2.1.5 controller. The important function of those kk is it's easier for calibration. It has inbuilt firmware.

V. RESULT AND DISCUSSION

This proposed model has been applied on convolution neural network method for identifying corn leaf diseases and it got a satisfying result for training, testing and validation set.

Hardware and Software Specifications

In this phase, the experimental setup is first added, and information of the experimental platform and benchmarks are provided. Finally, experimental results are analyzed and mentioned. The corn leaf diseases detection method is used in hardware and software devices. Some hardware devices used in this method are shown in Table 2, and the software used is shown in Table 3.

Training

The training procedure is a method t make the machine study the functions that exist within the image and classify those capabilities. In this observe the use of a dataset of corn diseases images with a number of 2876 image with varieties of diseases, namely common rust and gray leaf spot. Table 4 shows the amount of training dataset in the Convolutional Neural Network model.

Table 4 Training Dataset

Data Train	Epoch	Loss	Time	Accuracy
10%	1	0.98738	16.112	0.5003
15%	2	0.55200	2.309	0.7280
20%	2	0.39697	10.576	0.8684
40%	2	0.35226	18.883	0.8655
80%	3	0.21480	4.548	0.9273
100%	3	0.13905	12.344	0.9461
140%	4	0.10803	7.760	0.9529
160%	4	0.06762	9.378	0.9643

In figure 12.shows the process of training the corn leaf diseases dataset with a comparison training data of 80% and data testing by 20%. With an epoch number of 008 epochs, with training time of 275 minutes. Get the accuracy of 0.9643 and loss results are 0.02210.

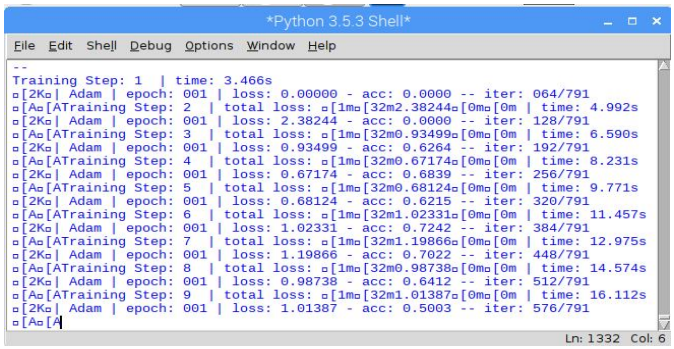


Fig :12.Training dataset

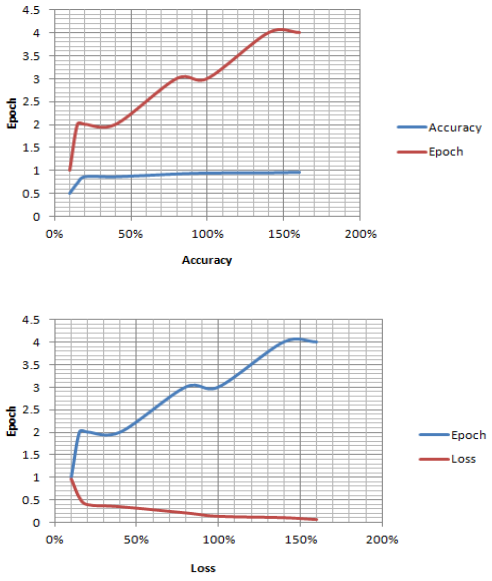


Fig: 14. Model Accuracy and .Model Loss

In figure 14.shows the results of accuracy on the CNN model used, with accuracy results on the train at

.9643.In figure 15. The graph shows the loss results in the CNN model with the results of the loss on the train 0.02148.

VI. CONCULTION

In this paper to described convolution neural network technique for identifying corn leaf diseases detection using unmanned aerial vehicle in the field of corn. When the drone is flying in the corn field, the image of the corn leaves is captured using the camera. The deep convolution neural network technique are run into the raspberry pi after capturing the corn leaves image. In research on corn leaf disease diagnosis using the convolution neural network the method achieves 96.4% accuracy

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