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DISEASE DETECTION OF PADDY FROM THE LEAF IMAGES AND RECOMMENDATION OF FERTILIZERS USING MCNN

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Abstract: Agriculture plays undeniably an indispensable role to human kind. Due to increased population, demand for the food is also getting increased, hence the production should be maximized. To ensure this, crops should be protected from diseases that are caused by fungi, viruses and bacteria. Deep learning is a part of a broader family of machine learning methods based on Artificial Neural Networks with representation learning. It can draw conclusions from various sets of raw data. It can aid farmers to predict the yield and quality of crops, detect weed and diseases. Precision Farming applies real time and historical data along with machine learning and deep learning algorithms to arrive at specific decisions for small regions of the application rather than applying the same working for a large range in the traditional method. In order to increase the production and maximize the profit, the crops should be protected from the diseases. In existing system, only the fungal disease called Anthracnose in Mango leaves is detected. For the pre-processing of leaves, histogram equalization method for contrast enhancement and for resizing the image to a standard size central square crop method are used. And for the classification multilayer convolutional neural network is used. In the proposed work, diseases for crops like paddy, plants like brinjal and tress like citrus family will be detected. Grayscale conversion is to be done for the pre- processing and noises in images will be removed by using median filter algorithm.For the leaf segmentation Active Contour approach is going to be implemented. For the classification part, Multilayer Convolutional Neural Network (MCNN) is going to be implemented. And the crucial improvement in our work is recommending the fertilizers and pesticides for the affected diseases.

***Index Terms* – Agriculture, Precision Farming, Machine Learning, Deep Learning, MCNN>**

I. INTRODUCTION

In imaging science, image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Images are also processed as three-dimensional signals with the third-dimension being time or the z-axis. Image processing usually refers to digital image processing, but optical and analog image processing also are possible. This article is about general techniques that apply to all of them. The acquisition of images (producing the input image in the first place) is referred to as imaging. Closely related to image processing, are computer graphics and computer vision. In computer graphics, images are manually made from physical models of objects, environments, and lighting, instead of being acquired (via imaging devices such as cameras) from natural scenes, as in most animated movies. Computer vision, on the other hand, is often considered high-level image processing out of which a machine/computer/software intends to decipher the physical contents of an image or a sequence of images (e.g., videos or 3D full-body magnetic resonance scans). In modern sciences and technologies, images also gain much broader scopes due to the ever growing importance of scientific visualization (of often large-scale complex scientific/experimental data). Examples include microarray data in genetic research, or real-time multi-asset portfolio trading in finance. Image analysis is the extraction of meaningful information from images; mainly from digital images by means of digital image processing techniques. Image analysis tasks can be as simple as reading bar coded tags or as sophisticated as identifying a person from their face.

Computers are indispensable for the analysis of large amounts of data, for tasks that require complex computation, or for the extraction of quantitative information. On the other hand, the human visual cortex is an excellent image analysis apparatus, especially for extracting higher-level information, and for many applications — including medicine, security, and remote sensing — human analysts still cannot be replaced by computers. For this reason, many important image analysis tools such as edge detectors and neural networks are inspired by human visual perception models. Image editing encompasses the processes of altering images, whether they are digital photographs traditional, photochemical photographs, or illustrations. Traditional analog image editing is known as photo retouching, using tools such as an airbrush to modify photographs, or editing illustrations with any traditional art medium. Graphic software programs, which can be broadly grouped into vector graphics editors, raster graphics editors, and 3D modelers, are the primary tools with which a user may manipulate, enhance, and transform images. Many image editing programs are also used to render or create computer art from scratch. Raster images are stored in a computer in the form of a grid of picture elements, or pixels. These pixels contain the image's color and brightness information. Image editors can change the pixels to enhance the image in many ways. The pixels can be changed as a group, or individually, by the sophisticated algorithms within the image editors. Many graphics applications are capable of merging one or more individual images into a single file. The orientation and placement of each image can be controlled. When selecting a raster image that is not rectangular, it requires separating the edges from the background, also known as silhouetting. This is the digital analog of cutting out the image from a physical picture. Clipping paths may be used to add silhouetted images to vector graphics or page layout files that retain vector data. Alpha compositing, allows for soft translucent edges when selecting images. There are a number of ways to silhouette an image with soft edges, including selecting the image or its background by sampling similar colors, selecting the edges by raster tracing, or converting a clipping path to a raster selection. Once the image is selected, it may be copied and pasted into another section of the same file, or into a separate file. The selection may also be saved in what is known as an alpha channel. A popular way to create a composite image is to use transparent layers. The background image is used as the bottom layer, and the image with parts to be added are placed in a layer above that. Using an image layer mask, all but the parts to be merged are hidden from the layer, giving the impression that these parts have been added to the background layer. Performing a merge in this manner preserves all of the pixel data on both layers to more easily enable future changes in the new merged image.

II. Related Work

Iqbal et al. in [1] have presented the number of studies for the identification and classification of the citrus plant leaves diseases. In this review work, the authors have discussed almost all the methodologies associated with detecting the disease, including concepts of image processing, techniques, challenges, advantages, and disadvantages etc. Golhanietal.in [2] has present various studies of neural network approaches used for the identification and classification of the disease from the leave images of the plant. This work introduces various models, types, mechanisms, and classifiers used and the further they have presented the various concepts of imaging with respect to hyperspectral images. Four cucumber diseases named as anthracnose, downy mildew, powdery mildew, and target leaf spots are classified from the leaves in the work proposed by Maetal.in [3] all the images are acquired in the real-time and has been classified using the Deep Convolutional Neural Network (DCNN). Ferentinos in [4] has proposed a VGG convolutional neural network for the identification and classification of the plant leaves. The proposed method classifies the given images between healthy and diseased. The result was validated on a large dataset shows the accuracy of the deep learning approach. Too et al. in [5] have used four different deep convolutional network architectures including VGG 16, Inception V4, Res Net and Dense Nets for the classification of disease from an image. The images were taken from the plant Village dataset consists of 38 diseased classes and 14 health classes. the dense nets network achieves higher classification accuracy and lesser computational time when compared with other architectures. Barbedo [6] have presented a study of the deep learning in the plant pathology. The author in this work has presented various issues and parameters that affect the efficiency of the network. Finally, the results verified the performance of the convolutional neural network on the images taken from the Digipathos repository. Kamilaris and Prenafeta-Boldu in [7] have introduced various studies of the deep learning that were adopted in agriculture. This study compromises the different methods, imaging and computer vision theories, related problems, application, and evaluation metrics etc. the size and variety of the images in the database are an important aspect when working with the concepts of deep learning. Therefore, Barbedo in [8]. have present various issues and challenges in the classification of plant diseases. The author has investigated this work with twelve different plants having different attributes and with different diseases. Kaur et al. in [9] have presented a study of the computer vision concepts and methods adopted for the detection and classification of the plant leaves. The advantages and disadvantages of the several studies have been discussed separately. In [10] Picon et al. have used DCNN for the classification of three fungal diseases found in the wheat plant. The images in the proposed work were collected in the real-time environment at two locations for about three consecutive years. Google Net and Cifar10 network have been presented by Zhang et al. in [11] for the classification of diseases from the maize leaf images. The proposed models achieve higher accuracy when compared with other networks like VGG and Alex Net for classifying nine different types of maize leaves. In [12] Lu et al. have proposed a DCNN for the classification of ten different types of rice leave disease from the repository of about five hundred images containing both the healthy and infected images. Authors have adopted the 10-fold cross validation strategy for achieving higher classification results. Gandhi et al [13] have worked with Generative Adversarial Networks (GANs) and CNN for the identification of diseases from the plant leaf images using a mobile application. Alex Net and then Squeeze Net deep learning network has been used by Durmus et al. in [14] for the classification of plant leaf diseases. The images are taken from the plan Village database for the tomato plant leaf images in ten different classes. CNNs have been proposed by Jainetal.in [15] for the real-time classification of the disease from the plant leave images. The proposed method is built on a cloud-based environment for performing this task. The images of the plant leaves are collected in the real-time for classification.

III. PROPOSED WORK

In agriculture research of automatic leaf disease detection is essential research topic as it may prove benefits in monitoring large fields of crops. Implementing image processing techniques to extract high level features such as histogram, scattering and colour features.

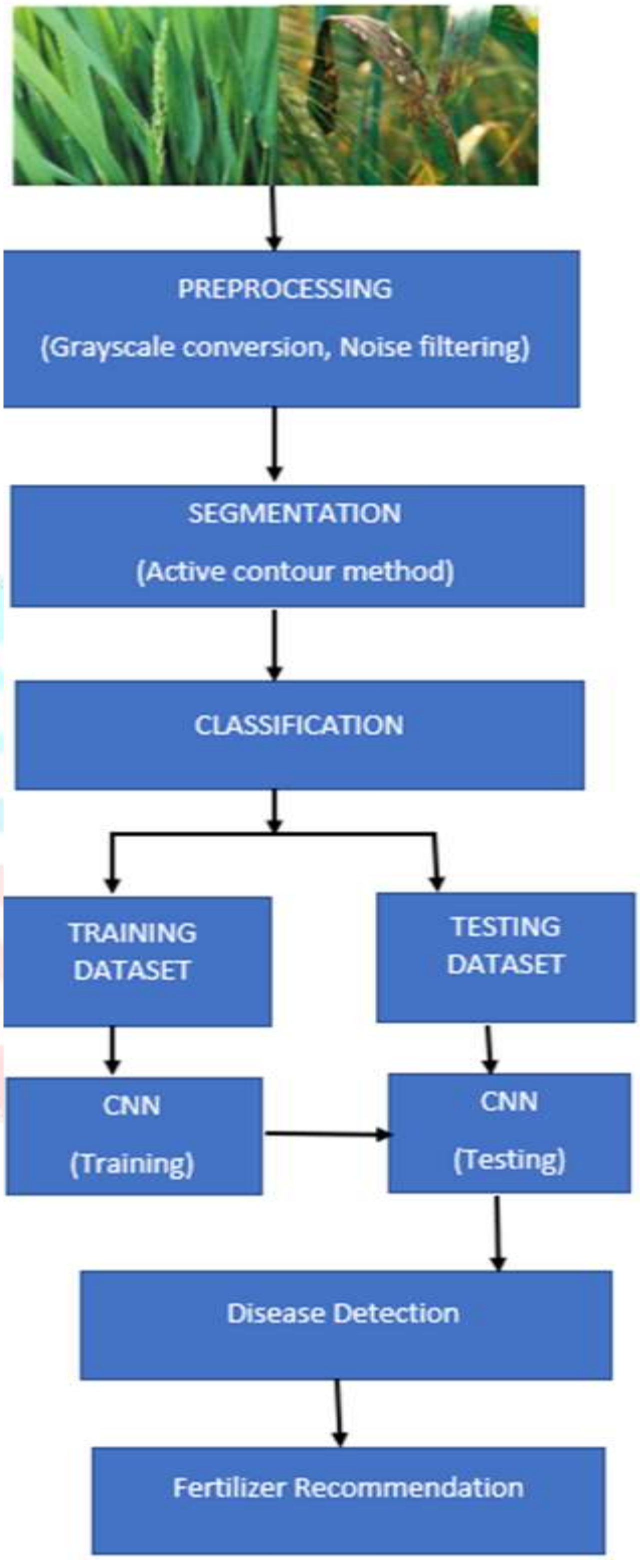

Figure 3.1: Proposed Work Flowchart

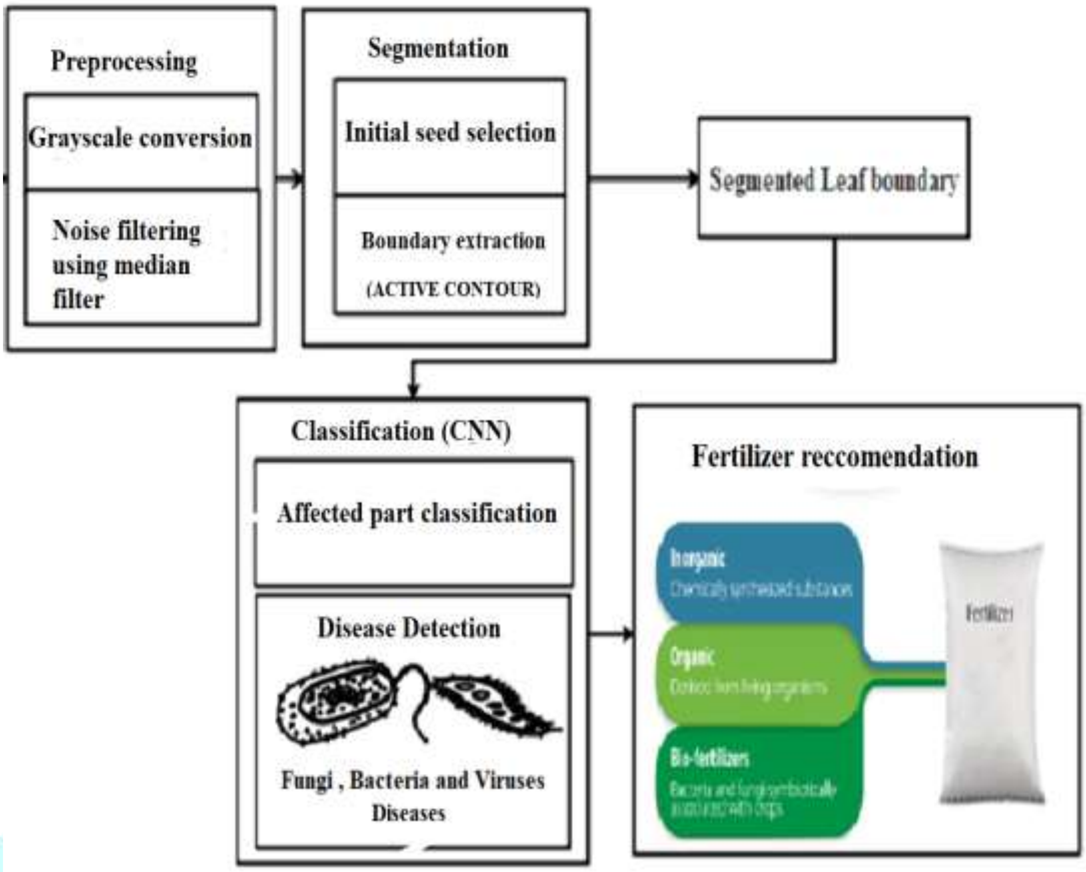

Figure 4.2: System Architecture

Segmenting the tree leaves using active contour approach based on pixel intensity of the green component. Implement deep neural network algorithm to classify the diseases and provide improved accuracy rate.

By an early diagnosis of diseases and its severity, efficient and appropriate treatment can be taken.

It will also help in analysing the nature and biological clock of the disease, thus assists in learning liability among them.This work recommends a deep learning model called MCNN for the classification of paddy leaves infected by diseases. For this work, real time healthy and infected leaves images are gathered for various crops like paddy, plants like brinjal and trees like citrus family, suffering from diseases. The projected technique is computationally proficient and economical, that can help in sustaining the importance of the crops and plants and their yields both ecologically and economical.

IV. Implementation

4.1 Image Acquisition

Leaf is snap shot of the whole plant. The leaf images can be acquired from dataset. Through real time acquisition, leaf images may be either healthy or affected. The image can die any size and any resolution. The image will be in RGB form the colour transformation structure for the RGB leaf image is created.

4.2 Pre-Processing

The given RGB image (64 bit) should be converted into grayscale image (8 bit). The grayscale image is represented by luminance using 8-bit value. The range of luminance of a pixel is from 0 to 255. For eliminating the noise in images, medium filter algorithm is used. The medium filter algorithm is a non-linear digital filter technique, often used to remove noise in image. Such noise reduction is a typical pre-processing step to improve the results of later processing.

4.3 Image Segmentation

For the needs of image segmentation, guided active contour method is implemented. It can be defined as use of energy forces and constraints for segregation of pixels for further processing and analysis. It is also called snakes model used for delineating an object outline from a 2D image. At first leaves features are tracked and pointed as high-level features. Based on feature values, foreground leaves part is detected using contour algorithm.

4.4 Classification

All the features are tracked and the features of affected parts are calculated. convolutional Neural Network algorithm is used to predict the diseases by classifying the input images based on trained features.

4.5 Fertilizer Recommendation

The key improvement in the proposed work is recommending fertilizers. For the diseases identified, corresponding fertilizers are to be recommended based on the trained features. It provides improved classification rate based on severity levels.

4.6 Convolutional Neural Network

A convolutional neural network entails of an enter and an output layer, as well as a couple of hidden layers. The hidden layers of a CNN generally encompass a chain of convolutional layers that convolve with a multiplication or different dot product.CNN is a sequential model, which consists of a series of layers for processing image into a image set.Convo-layer with 128 filters and RELU as the activation function are the first two layer.Max-pooling layer is the third layer. Its function is to reduce the size of convoluted image.The next two layer are again convolutional layer with 256 filters and an activation function, RELU.A max-pooling layer is there which has a dropout rate of 0.2.

4.7 Training and Testing

First, the dataset is categorised into two parts, training and testing dataset.The training set consists of 80% of images and testing set has 20% of images.To train a CNN, the training examples should be made run through the model from the input layer to output layer, concurrently nabbing prediction and figuring out results.

V. RESULT

The proposed model along with training and trying out procedure had been applied using an open source software framework regarded to be tensor flow with python programming language. The gaining knowledge of fee is ready to 0. 01, dropout price varies from zero. 2 to 0. Five, and the momentum become chosen to be zero. 09, with weight decay of 1e-6 respectively. Training turned into carried out in approximately three days and checking out become finished in a few minutes. The schooling procedure changed into applied at the GPU of an NVIDIA GTX 1080 card, the usage of the cuda platform. Within the experiments for testing the proposed algorithm is implemented on a desktop computer with intel(r)core(tm): 7-7700 CPU (3. 60 GHZ), home windows 10 pro (64 bit) operating machine,16. 0ram, GPU (incorporated 2 GB NVIDIA GeForce GT 710), and 1. The effects of offered methodology focus on:

1. Primary task is to categorise the given image is crop leaf or no longer. Then, the secondary venture is to identify the leaf is a non-diseased crop leaf, and Third is to perceive and classify that the leaf is a diseased crop leaf or now not.
2. Measuring the accuracy for each the schooling method and the testing manner of the proposed network.
3. Evaluating consequences with the alternative trendy processes particleswarm optimization (PSO), aid vector device (SVM), and radial foundation characteristic neural network (RBFNN).
4. To file corresponding missing report rate, and false report fee.

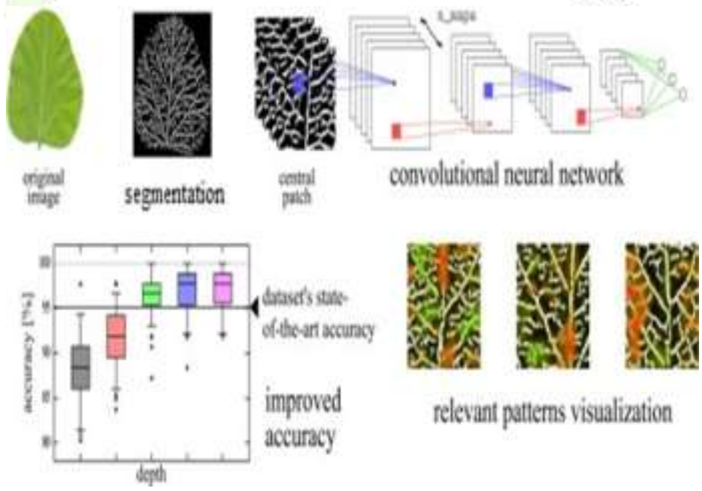

Figure.5.1: Classification Results For Proposed Work

5.1 Future works can be:

- Usage of some other activation functions for intensifying the CNN performance to make it able to classify multiple diseases.
- Inconsistences while working with real time dataset should be resolved.
- Cash crop should be given more importance, since they have a major role in the economy of a country.
- Apart from leaves, other parts of the plants may also be used in calculating the disease severity.
- Real-time monitoring system may be built using IOT.

VI .CONCLUSION

The productivity and quality of crops can be increased by detecting the diseases earlier. Machine learning and deep learning methodologies have emerged as the recent trends that help to solve number of plant disease problems such as pattern recognition, classification, etc.., In the work, we propose a deep learning model called MCNN for the classification of crop and plants leaves infected from various diseases. This model has achieved higher accuracy on detecting the diseases and recommend the fertilizers as well.

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