

LEAF DISEASE DETECTION USING IMAGE PROCESSING: A review



Apurva Chaskar
Electronics and Telecommunication
AISSMS IOIT chaskarapurva@gmail.com

Riya Dhokariya
Electronics and Telecommunication
AISSMS IOIT riyadhokariya@gmail.com

ABSTRACT

Agriculture is very labor intensive field and only field where the robots are not involved. Now-a-days many industries are trying to reduce this human labor by making robots and machines. Here we are designing a autonomous intelligent farming robot which indicates the plant health by observing the color and texture of their leaves and so detecting the diseased leaf. Leaf disease detection has become very easy to perform using image processing. Convolutional Neural Network (CNN) can be used to recognize image and classify the image. CNN image classification takes an input image, process it and classify it into certain categories. Disease of leaf get detected by observing color, texture. The robot has also spraying mechanism it will spray the pesticides on plants according to their needs.

Keywords- Leaf disease detection, image processing, CNN algorithm, spraying mechanism, Real time

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I. INTRODUCTION

Agriculture is becoming advanced in INDIA. Economy depends upon agricultural productivity. Diseased leaves reduces the product quality hence leaf disease detection is important. For farmers observing disease for every leaf is quite harder, and sometimes diseased leaf may get ignored or unnecessarily pesticides get sprayed thus human health get affected.

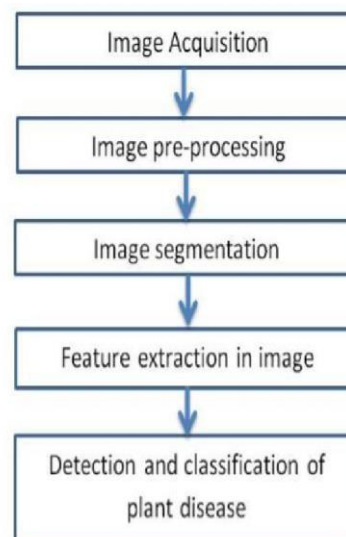
We need automatic mechanism to spray pesticides. It is beneficial as it is real time and automatic. Using this mechanism disease can be detected at early stage. This technique improves accuracy. For detecting difference in colour and texture of leaf, image processing is used.

II. LITERATURE REVIEW

Leaf disease detection uses many different methods. Different modules of image processing and Machine Learning models or Neural Networks can be used for disease detection. We are going to study most widely used methods and models. Various methods for detection are:

A) IMAGE PROCESSING

The author [1] implemented the various phases for detecting the diseases using image processing and they are



Basic steps for plant disease detection and classification

1) Image Acquisition

The process of acquiring images from various sources is known as image acquisition. Here digital camera or mobile phone can be used for capturing

the images and creating the database [2]. Captured image is in the RGB(Red, Green, Blue) form. Input image goes under transformation.

2] Image pre-processing

In this phase, quality of the image is improved by removing unwanted noise from the image. RGB images are converted into grey scale images by using formula

$$f(x) = 0.2989 * R + 0.5870 * G + 0.114 * B$$

Author[1] have worked on different types of noises available in images which are Gaussian noises, Salt and Pepper noises, etc. Using Mean and median filters these noises can be removed. Grey scale image is further undergoes histogram equalization. Histogram equalization is the common method used to remove the noises.

3] Image segmentation

Images are divided into different segments

- For better recognition of separate objects available in the images.
- For finding the boundaries between the region.
- For removing the unwanted region. [2] Image segmentation can be done by various methods.

Segmentation using spot detection and boundary algorithm :-

Image is first converted to HSI model which helps to detect infected part off leaf by detecting their boundary.[2]

1. K means clustering :- Objects are divided into k number of classes according to their features. The square of distance between object and corresponding cluster is minimized for classification[2].

4] Feature Extraction

It is the reduction technique, which represents the most informative part of the image. There are mainly three types of features such as color, shape and texture. Methods of feature extraction are

1. Color co-occurrence method :- Features of images are taken from color and texture of an image. RGB image is converted into HIS by using formula

$$H = \begin{cases} \arccos \frac{B-G}{\sqrt{(R-G)^2 + (R-B)^2}} & B < G \\ 360 - \arccos \frac{B-G}{\sqrt{(R-G)^2 + (R-B)^2}} & B > G \end{cases}$$

$$S = 1 - \frac{3}{R+G+B} [\min(R,G,B)]$$

$$I = 0.333(R+G+B)$$

B] MACHINE LEARNING

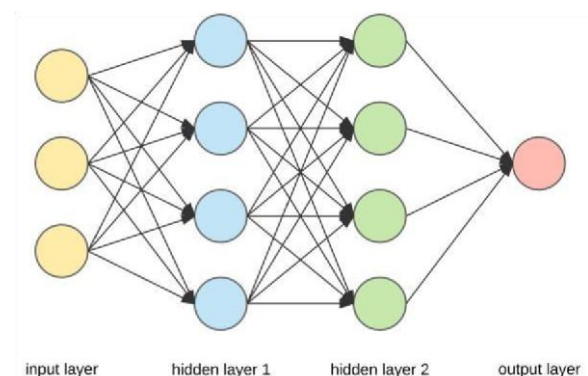
Machine learning is a process which uses data base and construct algorithm based on it. In machine learning, for detecting disease, classification techniques are used viz SVM, KNN, NN

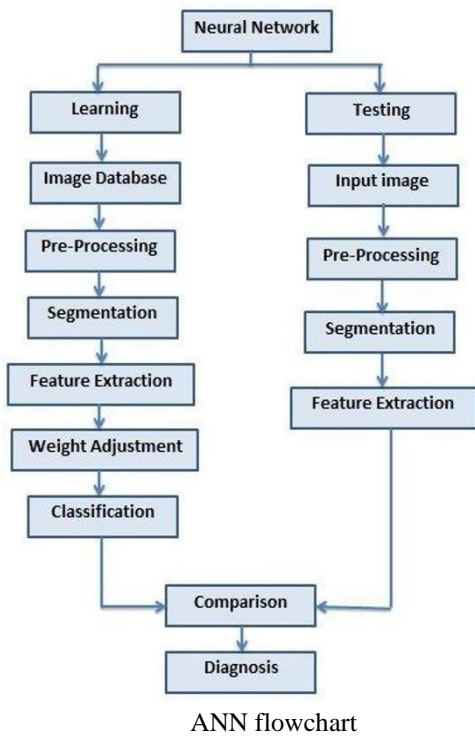
1] Support vector machine (SVM):-

To separate data, decision boundaries are defined based on concept of decision planes. In SVM, hyper plane is used to separate data[1]. It can be found by measuring the hyper plane margin and detecting maximum points. SVM can analyse two kinds of data linear and non linear data. But it is difficult to select kernel function parameter.

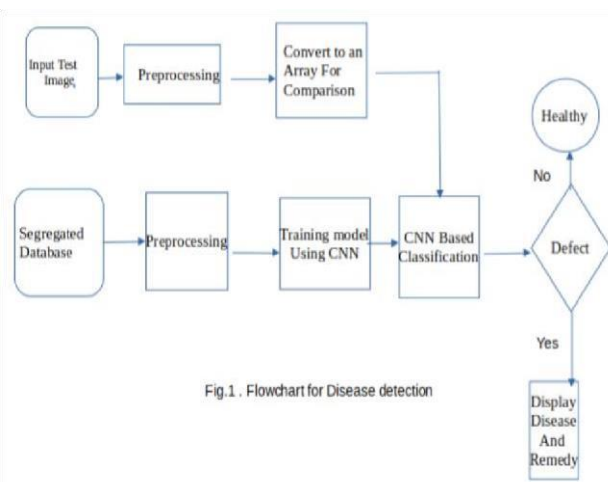
2] Artificial neural network (ANN) [2], [5]:-

ANN is a representation of human brain neurology. ANN has ability to solve complex, non-linear problems. After feature extraction, feature vectors are considered as neurons. The collection of neurons is used in ANN. Information is stored in these neurons. Weighted sum of inputs is considered as output of neurons. ANN is a layered structure. It consists of interconnected neurons. Layers are input layer, output layer and hidden layer (in between input and output layer). Weights of interconnection are adjustable. They can be adjusted according to need. Zero weight represents no connection between neurons. As ANN takes numerical information only, problems have to be converted into numerical values before being introduced to ANN so become difficult to show problems to the network.





3] Convolutional neural network (CNN) [6]:- CNN is deep learning algorithm. It is hierarchy of visual representation for a specific task. It consist of neurons which are trained according to requirement . Trained database is used to detect the disease and healthy leaves. It has different layers that are dropout, Activation, Convolution2D, MaxPulling2D . After the model is trained, captured image is compared with data base and result is shown accordingly



LIMITATIONS

1]Large data sets are not suitable for SVM algorithm. It does not perform well when distortion is high.As increase in sample size performance of SVM degrades 2]ANN algorithm does not provide information about various parameters. It also requires large diversity of training for operation.

Due to slow conversion speed, less performance, it is difficult into real time application.

III. PROPOSED METHODOLOGY

To recognise diseased leaf or healthy leaf, CNN is used. This process, taking the form of convolutions, make it easier to extract relevant information at low computational cost. CNN is preferred over ANN and SVM because of its automatic feature extraction for given problem. Weight sharing is also main feature of CNN so it becomes less complex and saves memory compared to other neural networks.

Digital camera is used to capture images. Images of various leaves are taken and then they are used to identify the affected area. Algorithm written below gives the idea of proposed model for image recognition and segmentation.

- 1] Images are taken for image acquisition and database is formed.
- 2]Preprocessing of input images to remove the noise and to improve the quality and distortion is removed.
- 3]Segmentation of leaves is performed to get the desired portion of leaves.
- 4]For feature extraction ,color co-occurrence method is used where color of the leaves are checked by masking.Another feature is texture ,which includes contrast colouring,clusters are checked by image enhancement process.

IV. EXPECTED RESULT

We have proposed the movable Robot that is recognizing healthy and unhealthy plants and provide needed amount of fertilizers and pesticides. So proposed system will be able to save farmers time and wastage of fertilizers and pesticide.

V. CONCLUSION

This paper presents different classification techniques used for leaf disease detection and different algorithms for extraction. To improve recognition rate in classification process, convolutional neural netowrk algorithm can be used.

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