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Automatic Detection and Classification of Plant Disease through Image Processing

Mr. Pramod S. landge, Sushil A. Patil, Dhanashree S. Khot, Omkar D. Otari, Utkarsha G. Malavkar.
Computer Science and Engineering Department,
Sanjeevan Engineering and Technology Institute, Panhala.
Kolhapur, India

Abstract: ***We propose and experimentally evaluate a software solution for automatic detection and classification of plant diseases through Image Processing. Farmers in rural India have minimal access to agricultural experts, who can inspect crop images and render advice. Delayed expert responses to queries often reach farmers too late. This paper addresses this problem with the objective of developing image processing algorithms that can recognize problems in crops from images, based on colour, texture and shape to automatically detect diseases or other conditions that might affect crops and give the fast and accurate solutions to the farmer with the help of SMS. The design and implementation of these technologies will greatly aid in selective chemical application, reducing costs and thus leading to improved productivity, as well as improved produce.***

Keywords: HSI, Color Transformation, Neural Network.

1. Introduction

India is an agricultural country; wherein about70% of the population depends on agriculture. Farmers have wide range of diversity to select suitable crops for their farm. However, the cultivation of these crops for optimum yield and quality produce is highly technical. It can be improved by the aid of technological support. The management of perennial crops requires close monitoring especially for the management of diseases that can affect production significantly and subsequently the post-harvest life. The image processing can be used in agricultural applications for following purposes. Predict plant disease from image of plants, Predict pest's attacks from image of plants. In case of plant the disease is defined as any impairment of normal physiological function of plants, producing characteristic symptoms. A symptom is a phenomenon accompanying something and is regarded as evidence of its existence. Disease is caused by pathogen which is any agent causing disease. In most of the cases pests or diseases are seen on the leaves or stems of the plant. Therefore identification of plants, leaves and finding out the pest or diseases, symptoms of the pest or disease attack, plays a key role in successful cultivation of crops. Hence to conduct high throughput experiments, plant biologist need efficient computer software to automatically extract and analyze significant content. Here image processing plays important Role [2]. The system provides the facility to upload image, process it and get result through SMS. At the processing side there are two Algorithms used first is colour transformation for extracting HSI values. And Second is Momentum back propagation for NN. There are three modules as Website, Server for backend and SMS for sending results. This paper provides a wide survey carried to study advances in different image processing techniques used for studding plant diseases & pests. Data set is a named collection of data that contains individual data units organized (formatted) in a specific, prescribed way and accessed by a specific access method that is based on the data set organization. In our system, we are using the data set as maize plant images for Classific ication. We've collected images from District Agriculture Research Officer. The data set is mainly deals with the both infected and uninfected leaf images. The input from the user is compared with both kind of images and the result is displayed to the user.

2. Literature Survey

Now a day the Government of Maharashtra is working on the project named as the Crop Pest Surveillance and Advisory Project **(**Cropsap) , It consists of three parts i.e. Pest monitoring-cum-surveillance based advisory system, Awareness creation, Supply of chemical and biological pesticides in critical situations on 50% subsidy as a plant protection measures.

2.1. Pest Scouts: They collect data as per pest/disease wise from selected fixed and random plots in field. Every week one Pest scout collects the data from 8 villages allotted. Every week observations are recorded on Monday, Tuesday and Thursday, Friday from 16 fixed and 16 random plots. These observations are recorded on data sheets, are submitted to pest monitor on every Wednesday and Saturday.

2.2. Pest monitor: They collect the data of scouts on every Wednesday and Saturday. Apart from that they also monitor the activities of pest scouts through surprise checks and conduct a roving survey @ 5-8 villages /day.

2.3. Data Entry Operators: They feed the data and upload it on website (www.ncipm.org.in).

The existing system mainly deals with the paper work. The employees working on this project generates the manual reports during their field work on they feed data manually and the messages are sent to the farmers. The Cropsap project is relatively slow because the messages are sent at the end of the week even if the survey of the field is done at the beginning of the week. Suppose if one of the fields needs the fast and quick treatment for the crop and the system gives the preventive measures vary late then it is the loss of that farmer and the current system also.

3. Implementation

The overall concept that is the framework for any vision related algorithm of image classification is almost the same. First, the can be converted from one space to another easily. After the transformation process, the. digital images are acquired from the environment using a digital camera. Then image-processing techniques are applied to the acquired images to extract useful features that are necessary for further analysis. After that, several techniques are used to classify the images according to the specific problem at hand. H component is taken into account for further analysis. S and I are dropped since it does not give extra information[6]. Figure 3.1 shows the H, S and I components.

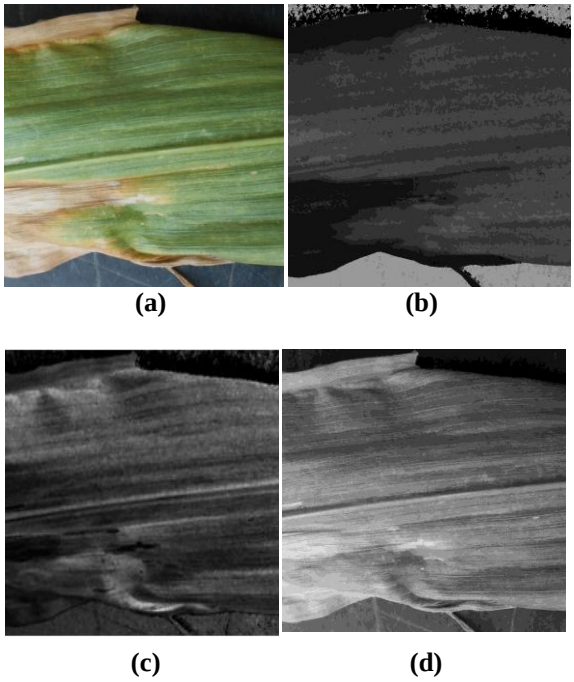


Figure3.1: a) Input infected image b) Hue Component. c) Saturation Component. d) Intensity Component.

3.1. Colour Transformation Structure:

First, the RGB images of leaves are converted into Hue Saturation Intensity (HSI) colour space representation. The purpose of the colour space is to facilitate the specification of colours in some standard, generally accepted way. HSI (hue, saturation, intensity) colour model is a popular colour model because it is based on human perception [6]. Hue is a colour attribute that refers to the dominant colour as perceived by an observer. Saturation refers to the relative purity or the amount of white light added to hue and intensity refers to the amplitude of the light.

3.2. Masking green pixels:

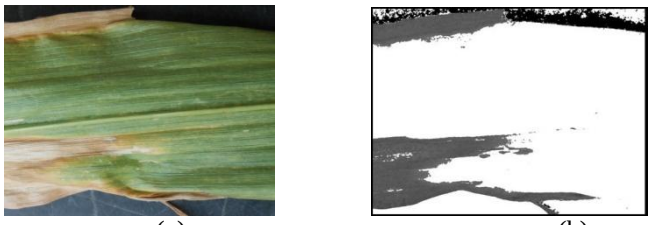
In this step, we identify the mostly green colored pixels. After that, based on specified threshold value that is computed for these pixels, the mostly green pixels are masked as, if the green component of the pixel intensity is less than the pre-computed threshold value, the red, green and blue components of the this pixel is assigned to a value of zero[3]. This is done in sense that the green colored pixels mostly represent the healthy areas of the leaf and they do not add any valuable weight to disease identification and furthermore this significantly reduces the processing time.

3.3. Removing the masked cells:

The pixels with zeros red, green, blue components were completely removed and the other remaining pixels are stored in binary image as shown in figure3.2. This is helpful as it gives more accurate disease classification and significantly reduces the processing time[2].

3.4. Matrix Generation:

The new binary image is taken into consideration which has pixels with value of 0 and 1. From this binary image we can generate the matrix which contains values of 0 and 1 and this matrix is transferred to Neural Network.



(a) (b)

Figure3.2: a) Infected Image b) Binary Image with Infected part

3.5. Neural Network:

The neural networks are used in the automatic detection of leaves diseases. Neural network is chosen as a classification tool due to its well known technique as a successful classifier for many real applications[5]. The speed of convergence of a network can be improved by momentum backpropagation; most standard backpropagation algorithms employ a momentum term in order to speed convergence while avoiding instability[1].

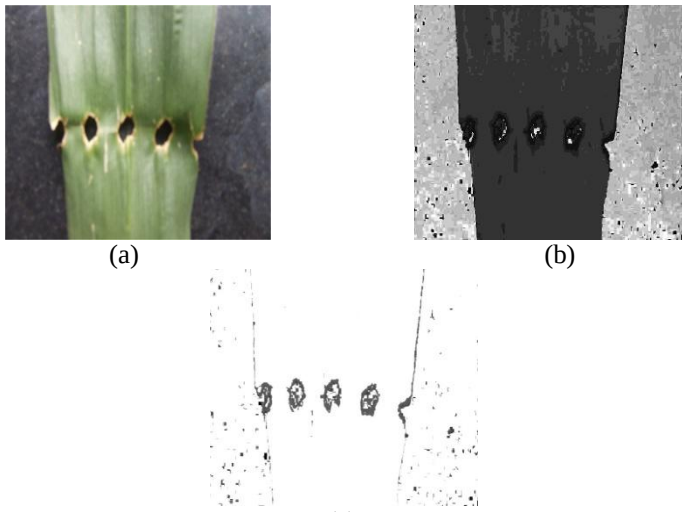
4. Experimental Results :

The Plant of Maize is considered for this experiment and has successfully classified various diseases. The acquired leaf images are converted into HSI format. From the hue content, binary image is generated. The feature sets are used for analysis of disease type of particular dataset using neural network. Samples of leaves with various diseases like Stem borer, Brown stripe downy mildew etc. diseases are shown in Figure4.1

(a) (b)

Figure4.1: a) Stem Borer Pest Attack b) Brown stripe downy mildew disease.

As a sample, a Maize leaf that is infected by Stem borer is taken as input to the algorithm. Fig 4.2(a) shows the input image. Colour transformation structure on the input image is performed. The hue content of the input image is shown in Fig 4.2(b). Then the green pixels are masked and removed using a specific threshold value. The binary image is shown in Fig 4.2(c).



(a) (b)

(c)

Figure4.2: a) Maize Leaf. b) H component image. c) Binary image without green pixels.

Further this binary image is given to neural network for classification, it is inferred that the leaves which are affected by diseases shows significant differences in their neural output when compared to the normal leaf. Furthermore, the disease categories can also be easily categorized. Hence we have successfully classified the disease and pest attack on maize plant.

5. Conclusion

In this paper, respectively, the applications of colour transformation and Neural Networks (NNs) have been formulated for classification of diseases that affect on plant leaves. Recognizing the disease is mainly the purpose of the proposed approach. Thus, the proposed Algorithm was tested on various diseases which influence on the plants; they are Stem borer, Brown stripe downy mildew etc. The experimental results this algorithm will work. An extension of this work will focus on developing algorithms such as genetic algorithms and NNs in order to increase the recognition rate and severity of the detected disease.

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