Disease Detection of Crops Using Hybrid Algorithm

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Abstract

The studies of plant trait/disease refer to the studies of visually recognizable patterns of a particular plant. Currently crops face many traits/diseases. Harm of the insect is one of the major trait/disease. Insecticides are not always proved resourceful because insecticides may be noxious to some kind of birds. A common observe for plant scientists is to estimate the damage of plant (leaf, stem) because of disease by an eye on a scale based on percentage of affected area. It results in strong views and low throughput. This paper provides a advances in various methods used to revise plant diseases/traits using image processing. The methods studied are form increasing throughput & reducing subjectiveness arising from human being experts in detecting the plant diseases.

1. Introduction

India is an agricultural country; wherein about 70% of the people depends on agriculture. Farmers have broad range of diversity to select suitable Fruit and Vegetable crops. However, the development of these crops for optimum yield and quality produce is highly technical. It can be improved by the be of assistance of technological support. The management of perennial fruit crops requires close monitoring especially for the managing of diseases that can affect fabrication significantly and subsequently the post-harvest life. The image processing can be used in agricultural applications for subsequent purposes:

1. To detect diseased leaf, stem, fruit and roots.
2. To enumerate affected area by disease.
3. To find shape of affected area of plant.
4. To determine color of affected part of plant
5. To determine size & shape of fruitsand plant.
   Etc.

In rural areas it is complex to access these types of data and in India 91 % farmers are trivial farmers so the cost of these tools is not affordable to those farmers for farm

management. In this case the another solution is to use the CCD images as a data for crop management.

Image Processing*:*

Digital Image Processing is nondestructive method that can confine, process and evaluate information from images. Using currently available image collection equipments like cameras, computers, scanners and image study programs. It is possible to obtain hundreds of excellence images per hour, which can be analyzed later with a great degree of mechanization at the observer‘s convenience. Other than these, digital images can be stored and used as and when required for a possible prospect application [2, 3]. Farmers in general are aware that their fields have different yield across the land space. These variations can be traced by management practices, soil properties and environment characteristics. The factors that have an effect on the yield are input parameters akin to seed quality, irrigation water, fertilizer and environmental parameters includes weeds, insects and diseases. Finally by testing the development of crop it sends to market. In market there is tremendous variation in rate, depends on the quality and quantity of crops [4]. To provide the good understanding of application of image processing in agricultural, the article presents the recent development of agricultural, specifically; the discussion is focused on wide literature survey of importance of leaf area, leaf disease severity, leaf chlorophyll measurement of the crops.

A.Leaf area measurement: In overall development of the plant, leaves are treated as photosynthetic engines of the plant, producing the food that is stored in the stalks. In plant leaves are attached to the nodes and forms two alternative ranks on either side of the stem, branches and leave . Leaf size, length,color and number depend on variety and generation of the plant and it is different in plant to plant [5]. The leaf area monitoring is an important tool in studying physiological features related to the plant development, photosynthesis and transpiration process. Also being helpful parameter in evaluating, harm caused by leaf diseases and pastes, to find out micronutrients deficiencies, water and environmental stress, need of fertilization, for effective management and treatment [6]. Leaf area determination can be done by direct methods, which involves the measuring of all the individual leaf areas or indirect methods, which are based on the relation of some plant characteristics with the right leaf area obtained in destructive tests. Precision agriculture production adapting rapid and accurate methods to measure plant leaf area. Present leaf area measuring methods are grid counting method. In this method leaf is placed on standard grid area and consequent grids are counted to determine the leaf area. This has straightforward principals and high accuracy, but time consuming.

In Paper weighing method leaf sketch is cut out from graph paper, which is called paper sample weight (W) is weighed in electronic analytical balance. Standard graph paper weight is weighed in electronic analytical balance and it is known (S), so paper weight per unit area is D=G/S then the area formula of paper weighing method is S=G/D, this is also time consuming method.

In Leaf area meter method leaf area, leaf maximum length width is measured, but its final is the standard of five measure values. Means repetitions of readings are important. The plani-meter offers less time consuming technique, but the precision is limited and high cost. Particularly in sugarcane leaf, size of midrib creates a difficulty in measuring by all these methods. In leaf area measurement of coffee plants by using digital image analysis, used two models, one based on the height and width of the canopies and other based on the area of digital image of a tree. Here the images were corrected by frequency histograms and for segmentation thresholding was done by Otsu method the results were compared with real area of the leaves using digital scanner, they found 0.82 and 0.91 correspondence [6]. In other non destructive leaf area measurement, used Hough Transformation to acquire the coordinates of courtyard corner points in distorted image and thresholding was used for image segmentation. To reduce the effect of holes in the leaf, contour extraction approach was used where pixel scanning from one side to opposite side was implemented in four directions to extract contour and leaf area was measured by pixel number statistic, they found absolute error 2.88 [7]. In leaf area measurement of cucumber using image processing method they used point of reference object and picture pixel number statistic to calculate the leaf area ,found coefficient of variation of 3.99 [8]. In two new leaf area determination methods by digital photographs processed in Matlab and computer Aided software they found 99% accuracy [9]. The shape of leaf is also important parameter affecting the leaf area measurement and to calculate environmental stress [10]. In leaf area measurement of sugarcane by digital image processing, the results of the experiments are compared with graphical area measurement method. The calculated accuracy in this experiment is 99 percentage. [11]

B.Leaf disease severity measurement: Plant disease symptoms can be estimated in various ways that put a figure on the intensity, prevalence, incidence and severity of disease. a. Disease intensity is a general phrase used to describe the amount of disease present in population. b. Disease occurrence is the proportion of fields, countries, states etc. where the disease is detected and reveals disease at grander scale than incidence. c. Disease incidence is the proportion of plants diseased out of a total number assessed. d. Disease severity is the part (relative or absolute) of the sampling unit (leaf or fruit) showing symptoms of disease. It is most often expressed as a percentage or proportion [12]. In general plants are attacked by a number of diseases. Fungi-caused diseases are the most predominant diseases which appear as spots on the leaves. These spots prevent the vital process of photosynthesis to take place, hence to a large extent affects the development of the plant and consequently the yield. In case of severe infection, the leaf becomes totally covered with spots. If not treated on time, a whole plantation can become infected; the plant completely withers down and eventually dies resulting in severe loss. Excessive uses of pesticide for plant diseases treatment increases the danger of toxic residue level on agricultural products and also pesticides are among the highest components in the production cost. The use of pesticides must be minimized by finding severity of disease and target the diseases places, with the appropriate quantity and concentration of pesticide. The naked eye observation method is generally used to in the production practice but results are subjective and it is not possible to measure the disease extent precisely. Grid counting method can be used to improve the accuracy but this method has cumbersome operation process and time consuming. Image processing expertise in the agricultural research has made important development. To recognize and classify sugarcane fungi disease an automated system has been implemented using algorithm such as chain code technique, bounding box method and moment analysis [13].To measure severity of Rust disease on Soybean, disease spot have segmented by Sobel operator to find out spot edge and plant disease severity has measured by calculating the quotient of disease spot area and leaf area [14]. Many researchers have been conducted on this. Rust and infected area due to rust on soybean can be find out by using multispectral CCD Camera. Under natural light collect infected plant images and develop three steps, like seperation of the infected leaflets using image processing, lesion color identification and rust severity quantification as shown in Figure 1.[15]. Earlier severity of attack of herbivorous insects on leaves have been calculated using video digitizer for pesticide application [16].Extent of color patches due to micronutrient deficiency or fungal disease on leaves have calculated by color thresholding method [17]. Color image processing used to count the insects on a leaf, image enhancement techniques viz. Red – Green - Blue to hue saturation, intensity conversion, adaptive histogrammedian filtering, thresholding and morphological operation these operation are used to count the insects on the leaf [18]. These operations are as shown in Figure 2. In particular disease color as well as shape of leaves also changes that have measured by using HSV color space, Speeded Up Robust Features (SUFR), Scale Invariant and Feature Transformation (SIFT)[5].By choosing color difference due to fungal infection and lookup table it is possible to distinguish the healthy area from diseased one [20].

Disease severity can be measured in three different ways that are Visual Rating, It is found that

diseases cause heavy crop losses amounting to several billion dollars annually. Following two examples shows that how some diseases have shattered the economies of nations. i)Late blight of potato[1,2]: It occurred in 1845- 1847 in Ireland. Approximately 1.5 million people died from starvation and another 1.5 million were displaced and forced to emigrate from Ireland to other regions of the world

Fig1: potato leaf affected by late blight

Fig2: Late blight stem lesions

Fig3: leaf symptoms of canker on top and bottom leave .

Mostly diseases are seen on the leaves or stems of the plant. Precise quantification of these visually observed diseases, pests, traits has not studied yet because of the complexity of visual patterns. Hence there has been increasing demand for more specific and sophisticated image pattern understanding. In biological science, sometimes thousands of images are generated in a single experiment. These images can be required for further studies like classifying lesion, scoring quantitative traits, calculating area eaten by insects, etc. Almost all of these tasks are processed manually or with distinct software packages. It is not only tremendous amount of work but also suffers from two major issues: excessive processing time and subjectiveness rising from different individuals. 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. This paper provides a wide survey carried to study advances in different image processing techniques used for studding plant diseases/traits & pests.

CONCLUSION Thus going through different research papers it is over and done with that image processing play vital role in Precision Agricultural. It helps to farmer from selection of seeds, caring of crops from weed, biotic and Abiotic stresses, insects, detecting nutrient scarcity. Particularly, monitoring of leaf area and measurement of the chlorophyll content is useful for fertilizer and irrigation rate control. Leaf disease severity measurement is very useful to decide the quantity and concentration of pesticide that reduces the production cost and environmental dilapidation. Thus, image processing technique can be effectively implement with elevated accuracy, low cost and less technical expertise in Precision Agricultural and hence it is adore to farmer.

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