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AGRICULTURAL PEST DETECTION AND CLASSIFICATION TECHNIQUES: A REVIEW

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ABSTRACT
In agriculture research of automatic pest detection and disease detection is essential research topic as it may prove benefits in monitoring large fields of Cotton crops and thus automatically detect symptoms of disease as soon as they appear on Cotton plant. The studies of plant disease refer to the studies of visually observable patterns of a particular plant. Nowadays crops faces many diseases such as damage of the insect/pest is one of the major disease. A common practice for Cotton plant scientists is to estimate the damage of plant (leaf, stem) because of pest by an eye on a scale based on percentage of affected area. It results in subjectivity and low throughput. This paper provides a advances in various methods used to study plant diseases/traits because of pest using image processing. The methods studied are for increasing throughput and reducing subjectiveness arising from human experts in detection of plant diseases.

Key Words—Leaf disease, Pest Detection.

I. INTRODUCTION

Computer vision techniques have great significance on the automatic identification of the images of Cotton insect pests. Those techniques not only can decrease the labour, but also can improve the speed and precision of the identification and diagnosis, when compared to manual method. In this regard, recognition of paddy field insect pests is challenging because the insect pests are highly articulated, they exhibit a high degree of intra-pest variation in size and colour, and some insect pests are difficult to distinguish visually, despite prominent dorsal patterning. The manual classification of such insect pests in paddy fields can be time consuming and re-quires substantial technical expertise. The task becomes more challenging when insect pests are to be recognized from still images using an automated system. Images of one insect pest may be taken from different viewpoints, cluttered background, or may suffer transformation such as rotation, noise, etc. So it is likely that two images of the same insect pest will be different. To address these challenges, we have adopted the gradient-based features in classifying images of Cotton crops insect pests. The primary advantage of this approach is that it is invariant to changes in pose and scale as long as the features can be reliably detected. Furthermore, with an appropriate choice of classifier, not all features need to be detected in order to achieve high classification accuracy. Hence, even if some features are occluded or fail to be detected, the method can still succeed.

In this paper various techniques to identify the diseases and pests using infected images of various

symptoms and leaf spots and pests on crops were studied. Images are captured by digital camera mobile and processed using image growing, then the part of the leaf sport has been used for the classification purpose of the train and test. The technique evolved into the system is both Image processing techniques and advance computing techniques. Image analysis can be applied for the following purposes:

1) To detect diseased leaf, stem, fruit and pests on Cotton crops.
2) To detect quantity of affected area by disease and pests. 3) To find the boundaries of the affected area.
3) To determine the color of the affected area.
4) To determine size and shape of leaf and pests.
5) To identify the Object correctly.

The rest of this paper is organized as Section II provides short review of agricultural pest detection and classification techniques. Section III provides short summery of revived classification techniques. In end of paper we conclude about revived techniques.

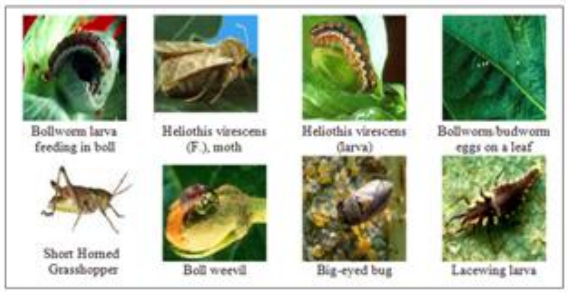

Figure 1: Selected species of cotton insect pests.

II. REVIEW OF AGRICULTURAL PEST DETECTION AND CLASSIFICATION TECHNIQUES

In this section different pest detection techniques implemented by different researchers from all over the world are summarised. P. Revathi et. al[7] detected Cotton leaf spot diseases in [7] by using Homogenous Segmentation based Edge Detection Techniques. This system is analyzed with eight types of cotton leaf diseases they are Fusarium wilt, Verticillium wilt,Root rot,Boll rot,Grey mildew ,Leaf blight ,Bacterial blight,Leaf curl.In these work symptoms of cotton leaf spot images are captured by mobile and classification is done by using neural network. In this work a homogeneity operator can take the difference of the center pixel and a pixel that is two or three pixels away. The main aim Research work is to use Homogeneity-based edge detector segmentation, which takes the result of any edge detector and divides it by the average value of the area. This work has been implemented in the real time software and produces best results. The software is very fast and time intense, low cost, automatically identify the diseases and pest recommendation to farmers through a mobile phone. Ajay A. et. al [5] presented Eigen feature regularization and extraction technique by this detection of three diseases can be done. This system is having more accuracy, than that of the other feature detection techniques. With this method about 90% of detection of Red spot i.e. fungal disease on cotton leaves is detected. Dheeb Al Bashish and et. al 2010[6] proposed image processing based work is consists of the following main steps, In the first step the acquired images are segmented using the K-means techniques and then secondly the segmented images are passed through a pre-trained neural network .The images of leaves taken from Al-Ghor area in Jordan. Five diseases that are prevalent in cotton leaves were selected for this research; they are: Early scorch, Cottony mold, Ashen mold, late scorch, tiny whiteness. The experimental result indicates that the neural network classifier that is based on statistical classification support accurate and automatic detection of leaf diseases with a precision of around 93%.

R. G. Mundada et. al[24] have proposed a system to detect white flies, aphids and trips on the infected crops in greenhouse. Images of the infected cotton leaf are captured by a camera and pre-processed by converting these images from RGB to gray scales and filtering in order to obtain an enhanced image set of pests. properties such as region properties and gray covariance matrix properties such as entropy, mean, standard deviation, contrast, energy, correlation and eccentric-ity were extracted from these images. The classification was performed by the use of support vector machines. proposed system is used for rapid detection of pests and exhibits the same performance level as a classical manual approach. R. K. Samanta et. al[25] presented system for tea insect pests classification using correlation-based feature

selection (CFS) and incremental back propagation learning network (IBPLN). The authors have created a database concentrating on eight major insect pests from the records of different tea gardens of North-Bengal districts of India. The database consists of 609 instances belonging to eight classes described by 11 attributes (signs and symptoms); all of which are nominal. The classification was performed using artificial neural networks. The classification results were compared with the original feature set and reduced feature set. Their study demonstrates that CFS can be used for reducing the feature vector and CFS+IBPLN combination can be used for other classification problems.

T. Jaware et. al[26] presented a Fast and accurate method for detection and classification of plant diseases. The proposed algorithm is tested on main five diseases on the plants; they are: Early Scorch, Cottony mold, Ashen Mold, Late scorch, tiny whiteness. Initially the RGB image is acquired then a color transformation structure for the acquired RGB leaf image is created. After that color values in RGB converted to the space specified in the color transformation structure. In the next step, the segmentation is done by using K-means clustering technique. After that the mostly green pixels are masked. Further the pixels with zero green, red and blue values and the pixels on the boundaries of the infected object were completely removed. Then the infected cluster was converted into HIS format from RGB format. In the next step, for each pixel map of the image for only HIS images the SGDM matrices were generated. Finally the extracted feature was recognized through a pre-trained neural network. The results show that the proposed system can successfully detect and classify the diseases with a precision between 83% and 94%. Y. Tian et. al[27] presented a method to monitor four main wheat plant diseases: Powdery Mildew, leaf rust Puccinia triticina, leaf blight, Puccinia striiformis and three features obtained are color feature, texture feature, and shape feature which further used as training sets for three corresponding classifiers. This system is mainly classified into three main steps: data acquisition, feature extraction, and classifier de-sign. Multiple Classifier System (MCS) includes number of classifiers which can provide higher classification accuracy. T. Rumpf et. al[28] presented a system for the detection

and differentiation of sugar beet diseases based on Support Vector Machines and spectral vegetation indices. They used Cercospora leaf spot, leaf rust and powdery mildew diseased leaves as study samples. The main aim was to identify these diseases before their symptoms became visible. In this pro-posed work nine spectral vegetation were used as features for an automatic classification. The experimental result indicates that the discrimination between healthy sugar beet leaves and diseased leaves classification accuracy up to 97%.

S. Phadikar et. al[29] presented an automated classification system based on the morphological changes caused by brown spot and the leaf blast diseases of rice plant. To classify the diseases Radial distribution of the hue from the centre to the boundary of the spot images has been used as feature by using Bayes and SVM Classifier. The feature extraction for classification of rice leaf diseases is processed in the following steps: firstly images acquired of diseased rice leaves from fields. Secondly preprocessing the images to remove noise from the damaged leaf and then enhanced the quality of image by using the [mean filtering technique. Thirdly Otsus segmentation algorithm was applied to extract the infected portion of the image, and then radial hue distribution vectors of the segmented regions computed which are used as feature vectors. Here classification performed in two different phases .In first phase uninfected and the diseased leaves are classified based on the number of peaks in the Histogram.In the second phase the leaf diseases are classified by Bayes classifier. This system gives 68.1% and 79.5% accuracies for SVM and Bayesclassifier based system respectively.

S. S. Sannakki et. al[30] in paper titled A Hybrid Intelligent System for Automated Pomegranate Disease Detection and Grading proposed a system not only identifies various diseases of pomegranate plant but also determines the stage in which the disease is. The methodology is divided into four steps:

1) The images acquisition where the images were captured by using digital camera.

2) The image preprocessing creates enhanced image that is more useful for human observer. Image preprocessing uses number of techniques like image resize, filtering, segmentation, morphological operations etc.
3) Once the image has been enhanced and segmented in image postprocessing noises like stabs, empty holes etc. are removed by applying morphological operations, region filling. Further the features are extracted like color , shape ,texture.
4) Once the features are extracted to which disease class the query image in belongs different machine learning tech-niques are used like Artificial neural networks, Decision tree learning, genetic algorithms, Clustering, Bayesian networks, Support Vector Machines, Fuzzy Logic etc.

P. Keskar et. al[31] presented a leaf disease detection and diagnosis system for inspection of affected leaves and iden-tifying the type of disease. This system is comprised of four stages: To improve the appearance of acquired images image enhancement techniques are applied. The enhancement is done in three steps: Transformation of HSI to color space in first stage .In the next stage analyzing the histogram of intensity channel to get the threshold. Finally intensity adjustment by applying the threshold. . The second stage is segmentation which includes adaption of fuzzy feature algorithm parameter to fit the application in concern. The feature ex traction stage is comprised of two steps spot isolation and spot extraction. For identification of spot identification algorithm is used is called component labeling. In feature extraction phase three features are extracted namely color, size and shape of the spots. In fourth stage classification is performed by Artificial Neural Network.

A. Meunkaewjinda et. al[32] presented diagnosis system for grape leaf diseases is proposed. The proposed system is composed of three main parts: Firstly grape leaf color extrac-tion from complex background, secondly grape leaf disease color extraction and finally grape leaf disease classification. In this analysis back-propagation neural network with a self-organizing feature map together is utilize to recognize colors of grape leaf. Further MSOFM and GA deployed for grape leaf disease segmentation and SVM for classification. Finally filtration of resulting segmented image is done by Gabor Wavelet and then SVM is again applied to classify the types of grape leaf diseases. This system can classify the grape leaf diseases into three classes: Scab disease, rust disease and no disease. Even though there are some limitations of extracting ambiguous color pixels from the background of the image. The system demonstrates very promising performance for any agricultural product analysis.

L. Liu et. al[33] a system for classifying the healthy and diseased part of rice leaves using BP neural network as classifier. In this study rice brown spot was select as a research object. The images of rice leaves were acquired from the northern part of Ningxia Hui autonomous region. Here the color features of diseases and healthy region were served as input values to BP neural network. The result shows that this method is also suitable to identify the other diseases.

III. SUMMERY ON CLASSIFICATION TECHNIQUES

This section will discuss some of the popular classification techniques with their advantages and disadvantages that are used for plant leaf and pests classification. In plant pests and leaf classification leaf is classified based on its different morphological features. Some of the classification techniques used are Neural Network, Genetic Algorithm, Support Vec-tor Machine and Principal Component Analysis, k-Nearest Neighbor Classifier. Plant leaf disease classification has wide application in Agriculture.

1) k-Nearest Neighbor: The main disadvantage of the KNN algorithm is that it is a slow learner, i.e. it does not learn anything from the training data and simply make use the training data itself for classification. Another disadvan-tage is this method is also rather slow if there are a large number of training examples as the algorithm must have to compute the distance and sort all the training data at each prediction. Also it is not robust to noisy data in case of large number of training examples. The most serious disadvantage of nearest neighbor methods

is that they are very sensitive to the presence of irrelevant parameters.

2) Support Vector Machine: Main advantages of SVM are Its prediction accuracy is high, Its working is ro-bust when training examples contain errors, Its simple geometric interpretation and a sparse solution and Like neural networks the computational complexity of SVMs does not depend on the dimensionality of the input space. Drawbacks are this classifier involves long training time, In SVM it is difficult to understand the learned function (weights) and the large number of support vectors used from the training set to perform classification task.
3) Artificial Neural Network (ANN): it is simplest single layer networks whose weights and biases could be trained to produce a correct target vector when presented with the corresponding input vector and it can solve only linear problems
4) Probabilistic Neural Networks: The main disadvantage of PNN is it requires large storage space but PNNs are much faster than multilayer perceptron networks, PNNs are used in on-line applications where a real-time classifier is required
5) Fuzzy Logic: As Fuzzy logic classifiers has very high speed they are preferable in cases where there is limited precision in the data values or when classification is required in real time and Drawback of Fuzzy logic as classifier is dimensionality because of this classifier is inadequate for problems having a large number of features. Also it gives poor performance while there is a limited amount of knowledge that the designer can incorporate in the system.

IV. CONCLUSION

This paper provides the survey of different techniques for pests and leaf disease detection. Main aim of this work is to study various pest detection techniques, characteristics of pest and various diseases on cotton crops with the help of image processing techniques likes image segmentation, feature extraction, classification, with the help of these techniques we will be identifying various agricultural pests on various crops or specially cotton crops. which helps the farmer to take correct action to increase production. For the detection of pests speed and accuracy is important factor to be considered. Hence there is working on development of automatic, efficient, fast and accurate system which is use for detection pests and disease on unhealthy cotton leaf. speed and accuracy are the main factors keeping in mind and hence Work can be extended for development of hybrid algorithms with neural networks in order to increase the recognition rate of final classification process. In future we can development of real time implementation of this algorithm in farm for continuous monitoring and detection of plant diseases. In real time system, we can monitor and give exact solution to avoid various diseases on cotton plant.

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