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Identification of Cotton Crop Diseases and Provide their Remedies using Kmeans Clustering

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Abstract: Best quality Best quality cotton produces best fiber. Hence it is important that cotton produced in farms is of best quality. Nowadays crops face many diseases. This project mainly focuses on detection of diseases. Since only detection is not sufficient and hence possible remedies are also provided. In this we are mainly using K-means clustering algorithm for Image segmentation technique for processing images and feature extraction for detecting diseases. The diseases are identified with the help of features extracted by machine learning approach. The Extracted features are going to help to find out diseases. Mainly two types of diseases focused over here viz.:- leaf based diseases and diseases due to pest. This work descries that how can we do the automatic detection of Crop diseases as this can gives much benefits in monitoring large fields of crops and detect the symptoms of diseases. Fast, Automatic, Less Expensive and accurate method to detect, classify, identify the crop diseases.

Keywords: Feature extraction, K-means clustering, image processing, segmentation.

I. INTRODUCTION

Cotton is one of the principal crops of the country which plays an important role in the economy of the country by providing substantial employment and making significant contributions to export earnings. India is the second largest producer of cotton in the world after china accounting for about 22 percent of the world cotton production. Maharashtra is the important cotton growing state in India with 41.46 lack hector area and production of 79.00 lack bales (2013-14), the 2nd largest producer of cotton in the world. About 3 million farmers are engaged in cotton cultivation in the state mostly in backward region of Marathwada and Vidarbha.

In Vidarbha region, cotton is the most important cash crop grown on an area of 13.00 lacks hectors with production of 27 lack bales of cotton (2008-09). Disease on the cotton is the main problem that decreases the productivity of the cotton [1],This decreases the productivity upto 25% of total production

The diseases can be easily identified with the help of the infected area of the crop. Generally through the naked eyes the observations taken by the Experts ancient time for the detection and identification of crop diseases. But for this the continuous monitoring is required by the Experts and it is too expensive in large fields. So in many under developed countries in agricultural area, farmer needs to take lots of efforts.

If we are using the machine vision then the identification and the classification of the plant will be done faster at every stage [2]. The machine vision system now a day is normally consists of computer, digital camera and application software. Various kinds of algorithms are integrated in the application software. Image analysis is one important method that helps segment image into objects and background. One of the key steps in image analysis is feature detection [1]. Transforming the input data into the set of features is called feature extraction [2].

The image processing now a day's become the key technique for the diagnosis of various features of the crop, providing new approach to explore the field of agriculture.

The image processing can be used in the agricultural applications for the following purposes.[3]

a. To detect diseased leaf, stem, fruit.
b. To determine affected area by disease.
c. To find shape of affected area.
d. To determine the size and shape of fruits.

II. LITERATURE REVIEW

Ajay A. Gurjar, Viraj A. Gulhane in Detection of Diseases on Cotton Leaves and Its Possible Diagnosis [1] proposed that, The features could be extracted using self organizing feature map together with a back-propagation neural network is used to recognize color of image. This information is used to segment cotton leaf pixels within the image, now image which is under consideration is well analyzed and depending upon this software perform further analysis based on the nature of this image.

In Infected Leaf Analysis and Comparison by Otsu Threshold and k-Means Clustering[2] , Prashant R. Deshmukh and Mrunalini R. Badnakhe has compaired two main techniques used for image processing that is ostu threshold and k-means and concluded that k-means is better technique as compared to ostu threshold asDifference extracted for Otsu threshold are more than the same extracted value for k-means clustering.

P. Revathi and M. Hemalatha in "Homogenous Segmentation based Edge Detection Techniques for Proficient

Identification of the Cotton Leaf Spot Diseases"[3] proposed a system that use smobile captured symptoms of cotton leaf spot images and classify the diseases using neural network. The major objective of their 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.

In Leaf Disease Detection Using Image Processing Techniques [4] , Hrushikesh Dattatray Marathe and Prerna Namdeorao Kothe proposed a system which detects disease by calculating leaf area through pixel number statistics, the proposedalgorithm will help to detect amount of disease present onthe leaf, by means of presence of holes & changes in thecolor. It will be easy to go for the severity measurement of disease.

In, Identification of nitrogen deficiency in cotton plant by using image processing[5], by Swapnil Ayane, M. A. Khan and S. M. Agrawal considered the pattern that appeared on the leaf for detection of disease. The various feature of image of leaf are extracted using different image processing techniques. These extracted feature are used determinethe occurrences of particular deficiency related to primary nutrient of cotton leaf. Nitrogen deficiency can be detected by two preliminary steps, histogram analysis and measurement of leaf area. The leaf with deficiency has compared to that normal leaf , The leaf with deficiency has reduced area compared to that of normal leaf.

In Cotton Leaf Spot Diseases Detection Utilizing Feature Selection with Skew Divergence Method[8] P. Revathi, M. Hemalatha proposed a system in which Enhanced PSO feature selection method adopts Skew divergence method and user features like Edge ,Color, Texture variances to extract the features. Set of features was extracted from each of them. The extracted feature was input to the SVM, Back propagation neural network (BPN),Fuzzy with Edge CYMK color feature and GA feature selection. The obtained features has been classified using SVM, BPN and Fuzzy classifiers. The proposed EPSO feature method gives better perfsormance when combined with fuzzy classifier.

An Application of K-Means Clustering and Artificial Intelligence in Pattern Recognition for Crop Diseases [9],Mrunalini R. Badnakhe and Prashant R. Deshmukh2 , the proposed system to classify and identify the different disease affected plant.The proposed system makes use of neural network and fussy logics in the classification process.

In An Improved Cotton Leaf Spot Disease Detection using Proposed Classifiers[10] , P. Revathi1 and M. Hemalatha proposed a machine learning approach based on digital cotton leaf disease classification and retrieval are achieved by extracting features from its leaf image. Various approaches has been used to classify the class of leaf diseases based on the crops features. In this investigation crops are classified on the basis of shape, color and texture with SVM, BPN, Fuzzy along with Edge, CMYK features and GA feature selection are combined for training and testing the cotton diseases dataset. Then extract edge, color and texture features using proposed Enchance Particle Swarm Optimization (EPSO) feature selection method adopts Skew divergence features. Variance has been used to recognize the wounded leaf part. After that Proposed classifiers are Cross Information Gain_Deepforward Neural Network, Cross Information Gain_Minimal Resources allocation used to predict the disease.

In [11] comparison between data clustering algorithms osama Atbu Abbas had compared various data clustering algorithm , which are widely used in image processing for classification , concluded that k-means gives the better result as compare to other imeage processing technique.

III. DISEASES ON LEAVES AND PESTS AFFECTING COTTON CROP

Various diseases are found on the cotton crop that are viz.

a. Bacterial disease: e.g. Bacterial Blight, Crown Gall, Lint Degradation.
b. Fungal diseases: e.g. Anthracnose, Leaf Spot.
c. Viral disease: e.g. Leaf Curl, Leaf Crumple, Leaf Roll.
d. Diseases Due To insects: e.g. White flies, aphides, pink bollworm, bollworm, boll weevil, semiloopers, red cotton bug ect.

Various diseases are found on the cotton plant out of this we discuss some of the major diseases which are often found on cotton, that are viz.

For the limited length of paper we are considering following diseases only:

a) Pink bollworm
b) Aphids
c) Red cotton bug
d) Bacterial blight

A. Pink Bollworm (Pectinophora Gossypiella):

Initial instars are white bearing pinkish ting, which subsequently change to pink colour. Larvae are found inside flower buds and the bolls of cotton. The pest remains active during July to October-November and passes the winter season hibernating in the cotton seeds. Larval stage damages the floral buds, flowers and bolls. Rosetted flowers are formed upon the damage done by pest. Entry hole is closed and larva continues feeding inside the bolls. The attacked bolls fall off prematurely and the others, which remain on plant, don't produce good quality lint. Double seeds are formed due to its damage. [12]

Figure 1: Pink Bollworm on the cotton boll

B. Aphids (Aphis Gossypii):

Aphis gossypii is extremely variable in colour (dirty green, dark green, blackish brown, orange/dirty yellow). Aggregating populations are seen at the terminal buds and largest populations are found below the leaves of the lower third of plants, where they are partially protected from high temperature. (11 government) Nymphs and adults of this

pest cause damage by sucking the cell sap from twigs and leaves. Aphids also secrete the honeydew, which covers the upper surface of the leaves. Due to which development of sooty mould takes place ultimately hampering the photosynthetic activity. Lint quality is also affected due to development of sooty mould on open bolls. [12]

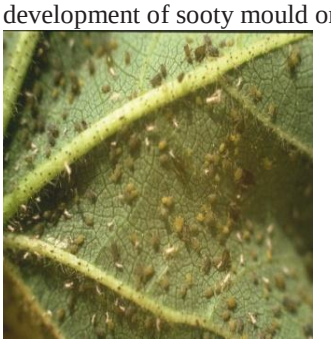

Figure 2: Aphids

Figure 3:Aphids(close preview)

C. Red Cotton Bug (Dysdercus Cingulatus):

Adults are slender crimson red with white bands across the abdomen. Membranous part of the fore wings, antennae, and scutellum is black. Nymphs are crimson red without wings. Damage by the pest is done by sucking the cell sap from leaves and green bolls of cotton. The lint from the affected bolls is of poor quality[12]. Eggs are laid in shallow depression in soil or under debris in batches. The nymphal instars are gregarious and feeding is in congregation[13].

Figure 4: Red Cotton bugs

Figure 5: Red cotton bug on cotton boll

D. Bacterial Blight (Xanthomonas Axanopodis):

This disease is caused by a bacterium *Xanthomonas axanopodis* pv. *malvacearum.* In northern region infected seeds are the primary source of infection while in southern region plant debris is the main source of infection. The disease attacks at all stages of the crop growth. The losses in yield and quality of lint result due to heavy drop of leaves, young bolls and squares, and rotting of bolls. Defoliation causes shedding of young bolls and thus leads to reduction in yield.[13].

Figure 6: Bacterial Blight

Figure 7: Bacterial Blight

IV. ANALYSIS OF PROBLEM

In modern agricultural system, numerous computational methods have been developed to help farmers to monitor the proper growth of their crops. In the ancient agricultural system, during harvesting process of the crops, the naked eye adopted in practice for detection and identification of crop diseases under microscopic conditions in laboratory. Further, in some developing countries, farmers may have to go long distances to contact experts, this makes consulting experts too expensive and time consuming. The basic problems regarding with crop is on the field, a fast and accurate recognition and classification of the diseases is required by inspecting the infected leaf images also recognize the severity of the diseases.

Many systems are developed in order to find the various diseases on the leaf of cotton crop. The proposed system provides the classification of diseases along with the remedy. Also the system has more focus on pest as pests lowers quality of cotton as well as production of crop.

V. PROPOSED SYSYEM

For fast and accurate calculation and classification of the diseases on the cotton crop we need to work on this concept. Approch chosen to solve any problem must be modular. So we have chosen the modular approach. The step wise representation of the approach chosen is as follows.

Step 1:-Image acquization.
Step 2:-Image segmentation.
Step 3:-Feature extraction.
Step 4:- classify the image on the basis of the features.
Step 5:- After classifying the diseases provide appropriate remedy of particular type.

A. Step 1:- Image acquization:

The digital images are acquired from the environment referring different sites. Many ways to collect the images, means we can visit the agricultural research units or actual fields.

B. Step2:- Image segmentation:

The acquired image is converted into gray scale image. The image will be segmented into different parts according to our region of interest, such as infected part or pest. Purpose of image segmentation is to divide the image into some meaningful regions. Simply to say, image segmentation means to separate the object from background. Hence, the remaining portion of the image except infected part or pest is now converted to black. Convert this segmented image into black and white i.e. output the segmented image by making background portion as zero.

C. Step3:- Feature extraction:

Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input.

Various features are extracted such as eccentricity, area, maximum area, and other, now depending on this classification is done.

D. Step4:-Classification:

Depending upon the features extracted, the input image is classified into particular category of diseases according to the nearest matching done by k-means clustering. The extracted features of the input image are studied and compared with the images and their features stored in the database. The category of the disease it is giving maximum amount of matching , the image is classified into that category.

E. Step5:-Provide remedy:

According to the type of disease classified the particular remedy is provided. For the pest the most effective one remedy is chemical treatment, i.e. pesticides.

VI. CONCLUSION

After analyzing we recognized the different diseases from crop. This proposed work is giving of the better and easy technique to do the classification of crop disease. We can easily develop an application. Using the image segmentation method to exact features of various diseases accordingly it is then possible to analyze the n no of cotton diseases and it works very efficiently. After analyzing the diseases appropriate remedy can be provided.

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