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Development of an Efficient Image Processing Technique for Wheat Disease Detection

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Abstract **-**The image processing is the technique which can propose the information stored in the form of pixels. The plant disease detection is the technique which can detect the disease from the leaf. The plant disease detection algorithms has various steps like pre-processing, feature extraction, segmentation and classification. The KNN classifier technique is applied which can classify input data into certain classes. The performance of KNN classifier is compared with the existing techniques and it is analyzed that KNN classifier has high accuracy, less fault detection as compared to other techniques

Keywords -GLCM, KNN, K-means, Plant Disease Detection

I. INTRODUCTION

Agriculture helps to create wealth, improvise farmer's livelihood and decrease the rate of hunger and poverty especially in the remote areas. Agriculture plays an important role to improve the food and life security. But nowadays farming is suffering from various diseases, parasites, shortage of irrigation facilities and lack of best suited fertilizers. Diseases are not the only reason for the downfall of farm marketing but unhygienic and improper sanitation at farms are also the major issues for the diseases to human. Various methods are used for the detection of plant diseases in which a vast image processing techniques are used. The plant diseases can be analyzed by the texture, color and structure of the leaf [1]. The information regarding the diseases and species of any plant or crop is given by the leaves, by studying the structure of a leaf researcher can generalize about the diseases of any crop. Since there are huge impacts of plant disease detection on the quality and quantity of the agricultural products, there is a need to study this field and present improvements such that the issues that are being faced can be eliminated. Agriculture is the field on which around 70% of the population of India relies. Appropriate fruit and vegetable crops to be grown can be chosen by the farmers from diverse choices available.Depending upon the high resolution multispectral and stereo images, the leaf diseases are to be detected and classified automatically and to do so several researchers have proposed various techniques. Providing a direct economical optimization of the agricultural products is not the only requirement here [2]. There is a need to ensure that the living beings or the environment is not harmed due to them. The crop production particularly needs to reduce the level at which the water, soil and food resources are being contaminated due to the pesticides. Further, the proposed methods also need to have higher speed and accuracy to provide efficient results as per the technology advancements. The plant disease detection process includes some basic steps which are:

Input Image: Capturing a sample image using a digital camera is the initial step of this process. Further, the features are extracted from the image to perform operations. The important features are stored initially within the database and the further processing will be performed in the next steps.
b. Image Database: In the next step, an image database is generated that includes all the images which will further be used to train and test the extracted data. The application is clearly the most important factor on which the image database is constructed. The efficiency of the classifier is responsible to decide the robustness of an algorithm and it completely relies on the image database.

Image Pre-processing: The operations that are performed on the images at the lowest level of abstraction are collectively known as image pre-processing. The image data is improved and the distortions that are unnecessarily present are suppressed within this process [3]. The processing and task analysis are performed with the help of image features which can be improved through this process. The information content on the image is not increased due to this process. Sufficient amount of redundancy is provided in the images with the help of this method. The brightness value, of neighboring pixels that belong to the same real object, is also same. In the form of an average value of the neighboring pixels, it is possible to restore a pixel that has been distorted within an image. The

image that has been stored within the image database is captured with the help of image pre-processing techniques as well.

Feature Extraction: The features that help in determining the meaning of a given sample are used for the identification and extraction of features from it. Color, shape and texture features are mainly included as image features in case of image processing.

Recognition & Classification: Training and classification are the two broader phases in which the complete recognition process is divided. The numerical characteristics of several image features are analyzed using image classification. Further, the data is categorized in an organized way through this process [4]. Training and testing are the two phases that are used by classification algorithms. The isolation of properties of basic image features is done within the initial training process. Further, a training class is introduced with the help of these isolated features, which has a unique description for each classification category. The image features are classified within the further testing phase with the help of these feature-space divisions created here. A non-linear classifier that is used to solve several pattern recognition issues is known as Support Vector Machine (SVM). For achieving better performance of classification, mapping of non-linear input data is done to the linearly separated data within certain high dimensional space in SVM. The marginal distance present amongst various classes is increased through SVM [5]. Various kernels are used to divide the classes. Only two classes are used by SVM and to partition them, a hyper plane is defined by it. To do so, the margin that exists between the hyper plane and the two classes is maximized. Support vectors are known as the samples that are nearest to the margin and were chosen such that the hyper place could be determined.

Rest of the paper is organized as follows , Section I contains the introduction of plant disease detection , Section II contain the literature review, Section III explain the Research methodology with flow chart, Section VI describes results and discussion implemented on MATLAB ,Section VII concludes research work with future directions.

II. LITERATURE REVIEW

Channamallikarjuna Mattihalli, et.al (2018) proposed a novel approach for detecting the diseases from leaves [9]. Here, the leaf images are taken such that few important features can be extracted which can further be used in this proposed work. A device named as Beagle bone black is used in this work which also consists of a web camera that helps in identifying diseases from the leaf samples. The device includes a database in which there are few pre-stored leaves images. This paper compares the pre-stored images with the images captures from the Beagle bone black device. GSM is used to transmit the information related to detect the diseases and operate the valves. As per the simulation results, it is seen that the proposed approach provides very low cost, user friendly and highly efficient results.

Shivani K. Tichkule, et.al (2016) reviewed various techniques through which plants diseases can be detected [10] Image processing technique is used for the detection and identification of diseases caused by bacteria, fungi, virus and excessive use of insecticides. Therefore, this method is used to classify the diseases caused in agricultural field. The authors accurately detected and classified diseases on various plants using all above techniques. K- Means Clustering method is used to detect infected plants and Neural Networks provides the accuracy in detection and classification of diseases. So, these methods have ability to be used in Agrobot system.

Boikobo Tlhobogang et.al (2018) proposed the study that investigated the problems related to unavailability, irrelevant and less accurate farming information [11]. The main objective was to deal with infected plants and to diagnose them. Image analysis, convolutional neural networks and the knowledge of machine learning offer a stable and movable solution. A Science Research Methodology was used in framing the prototype. Proper and systematic studies on farmers' agricultural techniques and effect of recently on-going projects are used to understand the benefits of mobile based agricultural services. The contribution of ICT in agricultural fields, collecting, storing and disseminating the development are required by the farmers to increase their market value.

Rutu Gandhi et.al (2018) presents an image related classification which identifies the plant diseases [12]. As, there are many datasets used in other countries but none of them are connected to India. So, there is a need to develop a local dataset for the benefits of Indian farmers. Generative Adversarial Networks (GANs) are used to limit the number of local available images. A Convolutional Neural Networks (CNN) is employed on the smart mobile applications. This application can be easily installed in any smart phone and the farmer needs to move through the field and capture the images. This could capture the several images which can be further send to the server through which the model runs and gives the classification.

Zia Ullah Khan et.al (2018) presented multilevel segmentation method in which initial segmentation is performed using expectation maximization algorithm [13]. In this method, there is a very few chances of information loss. Finally, a region is taken out from the quantized image by empowering the binary partitioned tree which is further used in principle Eigen vector. Post processing methods are used to

eradicate the useless fragments and to resolve the image labeling problem. When the salient region of the image belongs to single class this technique is mostly used. The new cascaded design in primary color segmentation with the confirmation of infected regions extractions gives the experimental analysis.

III. RESEARCH METHODOLOGY

This research work is based on the detection of plant disease. To detect plant disease with the proposed technique following steps are followed:-

1. Pre-Processing :- The image is taken as input on which disease need to detect. The image is converted to the grayscale for the feature extraction

2. Feature Extraction :- In the second phase the algorithm of GLCM is applied which can extract features of the input image and store in the database . A tabular description which shows the number of times various combinations of pixel brightness values occur within an image is known as Gray Level Co-occurrence Matrix. The locations of pixel that has alike gray level values are presented by GLCM [7]. The pairs of gray level values are provided as input from GLCM calculation units. When the original and predictive images are compared, the deviation present in them is presented here. The relationship amongst two neighboring pixels is considered within GLCM. The initial pixel is called the reference pixel whereas the neighbor pixel is known to be the second one. A two dimensional array in which a set of possible image values are presented in rows and columns is known as a co-occurrence matrix.

3. Segmentation :- The k-mean segmentation algorithm is applied which can segment input image into certain parts. K-means is the data clustering algorithm in which the numbers of clusters within the data are pre-specified is known as k-means algorithm. A trial-and-error method in which appropriate numbers of clusters for particular data set are identified has made it difficult to define correct clustering method [8]. Through the selection of K value, the performance of a clustering algorithm is affected. Thus, there is a need to adopt a set of values instead of using a single predefined K. For reflecting the special properties of data sets, the consideration of large number of values is important. Further, in comparison to the number of objects present in the data sets, there need to be less number of selected values.

4. Classification: The classification detects the name of the disease with which plant is affected. The system is training with the number of images and test set is given as input after extracting image features. The KNN classifier is applied to detect the disease name. A classifier, that performs classification through the recognition of neighbors that are closest to the query examples, is known as k-Nearest Neighbor. The class of query is determined with the help of these identified neighbors. In this algorithm, on the basis of the least distance present between the given point and other points is calculated which is then used to perform classification that helps in determining the class within which a particular point belongs [6]. There is no training process involved within this classifier. Since, the robustness to noisy data for this classifier is zero it is not applied within very large number of training examples. The calculation of Euclidean distance between the test and training samples is done which is further used within plant leaf classification. Thus, similar measures are identified in this manner which further helps in identifying the class for test samples as well.

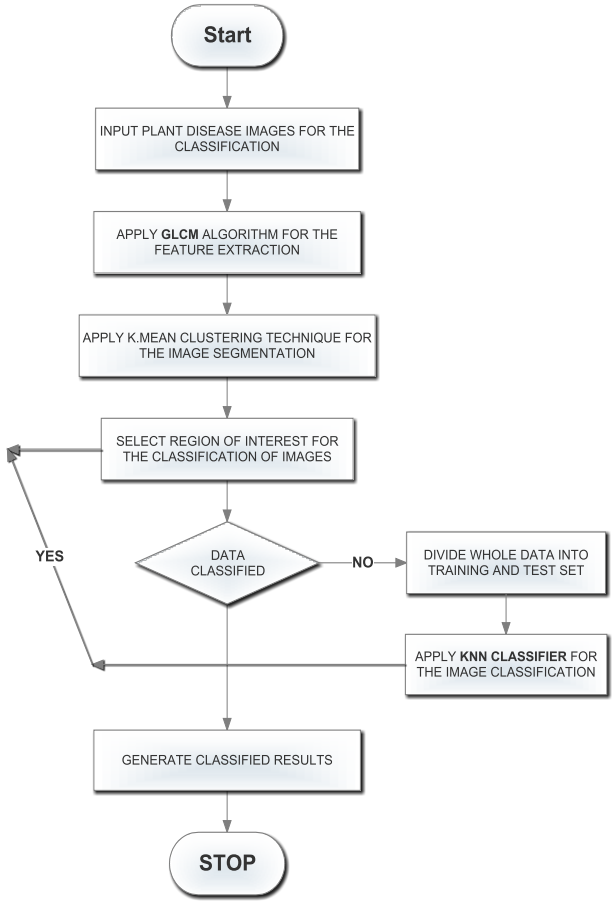

Figure 1: KNN-PDD Flow Chart

IV. RESULTS AND DISCUSSION

The technique is proposed for the plant disease detection based on feature detection and classification. The GLCM algorithm is applied for the feature extraction. The k-mean clustering is applied for the image segmentation and KNN algorithm is applied for the disease classification. The Data set of about 25 images is taken as input to prepare the training set. The results are analyzed in terms of certain parameters which are described below:-

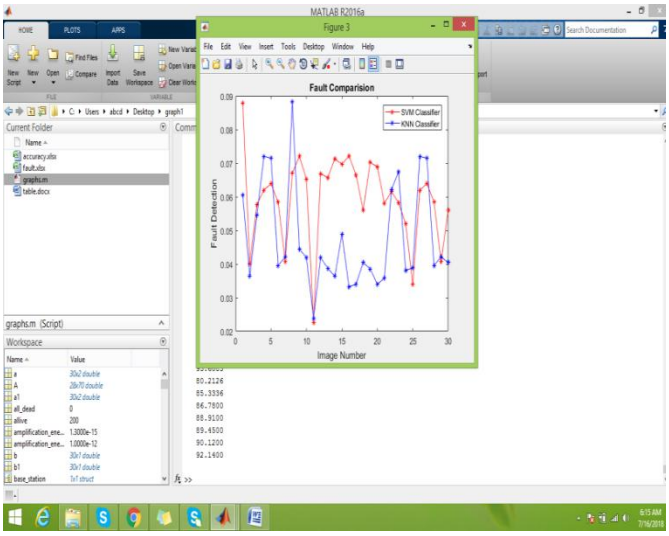

Figure 2: Fault Comparison

As shown in figure 2, the fault of the proposed and existing algorithm is compared for the performance analysis. It is analyzed that proposed KNN technique has less faults as compared to existing technique

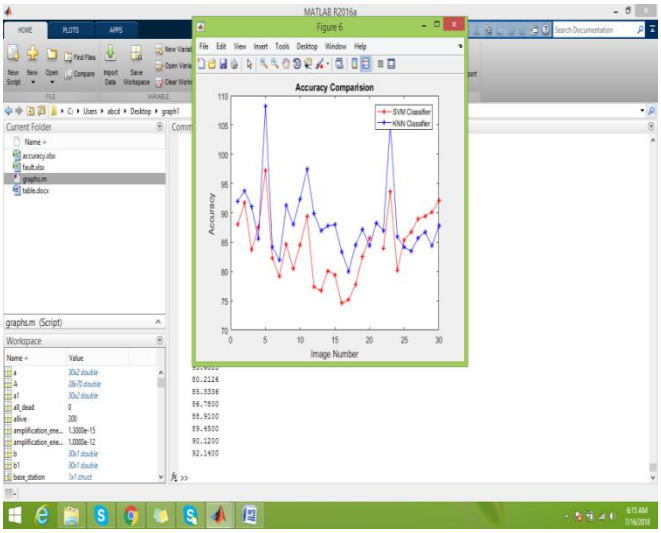

Figure 3: Accuracy Comparison

As shown in figure 3, the accuracy of the proposed KNN technique is compared with the existing SVM technique. It is analyzed that accuracy of the proposed algorithm is high as compared to existing algorithm.

V.CONCLUSION AND FUTURE SCOPE

In this work, it is concluded that plant disease detection is the technique which is applied to detect disease from the plants. The technique of plant disease detection has various steps like feature extraction, segmentation and classification. In this paper, novel technique is proposed based on the GLCM algorithm for the feature extraction , K-mean segmentation is applied for the image segmentation and KNN classification technique is applied for the disease classification. The performance of proposed algorithm is compared with the existing algorithm in terms of accuracy and fault rate. It is analyzed that KNN classifier has high accuracy and less fault rate as compared to existing technique.

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