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Paddy Disease Detection and Pesticide Recommender System for Farmers Using Multi SVM Technique

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ABSTRACT

India is a cultivated country and about seventy percentage of the population depends on Agriculture. Farmers have large range of diversity for selecting various suitable crops and finding the suitable pesticides for Rice. Disease on Rice leads to the significant reduction in both the quality and quantity of agricultural products. The studies of Rice disease refer to the studies of visually observable patterns on the Rice. Monitoring of health and disease on Rice plays an important role in successful cultivation of crops in the farm. In early days, the monitoring and analysis of Rice diseases were done manually by the expertise person in that field. This requires tremendous amount of work and also requires excessive processing time. The image processing techniques can be used in the Rice disease detection. In most of the cases disease symptoms are seen on the leaves, stem and fruit. The Rice leaf for the detection of disease is considered which shows the disease symptoms.

Keywords: Multi SVM, Paddy Disease, Image Processing.

I. INTRODUCTION

In recent years, agriculture has become much more important than it used to be some years back where plants were only used to feed humans as well as animals. This is due to the fact that plants are now used to generate electricity and other sources of energy to improve upon the living conditions of mankind. However, there are so many diseases that affect plants that can cause great harm to various economies and societies. It can even lead to great ecological losses. For this reason, it is better to diagnose diseases accurately and timely to avoid such loses. Plant diseases can be detected through several means including manual and computer based systems. Most plant diseases appear as spots on the leaves which are more visible to human eye. On the other hand, there are some diseases that do not appear on the leaves and others appear in the later stages when they have already caused great harm to the plants. In such instances, it is recommended that computerized systems would be the only option to detect the situation timely using some kind of complex algorithms and analytical tools, preferably through the use of powerful microscopes and other machines. In some other instances, the signs can only be detected through the electromagnetic means which produces more images that are not visible to the human eye. Another means of achieving this is through technique known as Remote Sensing Technique (RST) that examines and diagnoses using multi and hyper spectral image captures. All the methods that use the RST approach usually fall on digital image processing tools to achieve their desired results. Most of the diseases that affect plants are caused by fungi which appear as spots on plant leaves. These spots make it very difficult for such plants to prepare their food by means of photosynthesis since they affect the green pigments in the leaf, hence to a large extent affects the growth and the yield of such plants. In circumstances where the fungi infection becomes severe, the spots cover the entire surface area of the 9 leaf. The diseases in plants do not only reduce the yield but can also deteriorate the variety of such plants and its withdrawal from cultivation. Plant diseases especially leaf diseases are usually curbed using insecticides, fungicides and pesticides. However, excessive application of these chemicals for the treatment of plant diseases can result in poisoning their produce as well as causing other harms to humans and animals. The danger of toxic residue on crops due to the application of pesticides on plants that have been affected by various forms of diseases has been identified as a major contributor to ground water pollution and contamination. Again, too much application of pesticides by farmers increase cost of production which can lead to greater loss. Therefore, there is the need to minimize their use due to the above reasons. One major way of achieving this is by estimating the severity of the affected area of the plant severity focusing on the diseased area, with the appropriate quantity and concentration of pesticides. The use of naked eye observation and manual methods are generally used to decide disease severity in the production practice but that may result in several errors and inaccurate results. Other methods such as Grid counting can be used to improve the accurate level however, this approach is difficult to use and also consumes a lot of time. The application of image processing techniques in conducting research in the agriculture sector has helped in diverse ways to improve upon the development of the agricultural sector. There are so many approaches used by some researchers to detect, measure and classify leaf diseases on plants. Some of these methods include the Bounding Box, Moment Analysis, Colour Analysis, Support Vector Machine and Neural Networks. However, none of these methods have adopted by the various researchers has been outstanding. This paper seeks to detect measure and quantify the severity of fungi caused disease on leaves that it is simple, easy to use and provides accurate result.

II. METHODOLOGY

Three principal stages are involved in undertaking this project(Figure 2.1). These include image acquisition, image segmentation and finally leaf region segmentation. However, other principles like conversion of image into various forms were also considered.

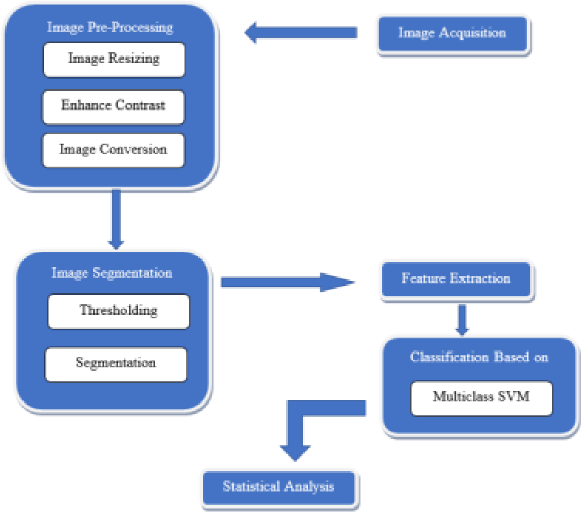

Figure 2.1. Flow Diagram

A. Image acquisition

Suspected plant leaves are used to carry out this project. The digital camera was used to capture images in controlled environment with the dark background. The images were stored in either JPEG or PNG format.

B. Image Collection

The sample images of the diseased leaves are collected and are used in training the system. To train and to test the system, diseased leaf images and fewer healthy images are taken. The images will be stored in some standard format

C. Pre-Processing

Image pre-processing is significant for genuine data that are frequently noisy and uneven. During this phase, the transformation is applied to convert the image into another image to improve the quality that better suits for analyzing.

D. Image Segmentation

During image segmentation, the given image is separated into a homogeneous region based on certain features. Larger data sets areput together into clusters of smaller and similar data sets using K-means clustering method.The RGB image is transformed into LAB form (L-luminous, a*b-chromous).

E. Feature Extraction

From the input images, the features are to be extracted. To do so instead of choosing the whole set of pixels we can choose onlywhich are necessary and sufficient to describe the whole of the segment.The co-occurrence takes this analysis to next level wherein the intensityoccurrences of two pixels together are noted in the matrix, making the co-occurrence a tremendous tool for analysis.From gray-co-matrix, the features such as Contrast, Correlation, Energy, Homogeneity' are extracted.

F. Classificaion

The binary classifier which makes use of the hyper-plane which is also called as the decision boundary between two of the classes is called as Support Vector machine (SVM). Some of the problems of pattern recognition like texture classification make use of SVM. Mapping of nonlinear input data to the linear data provides good classification in high dimensional space in SVM. The marginal distance is maximized between different classes by SVM(Fig 2.2) . Different kernels are used to divide the classes. SVM is basically binary classifier which determines the hyper plane in dividing two classes. The samples that are nearest to the margin will be selected in determining the hyper plane are called as support vectors. . In the classification stage, a voting strategy is used where the testing point is designated to be in a class having the maximum number of votes. The voting approach is called the “Max Wins” strategy.

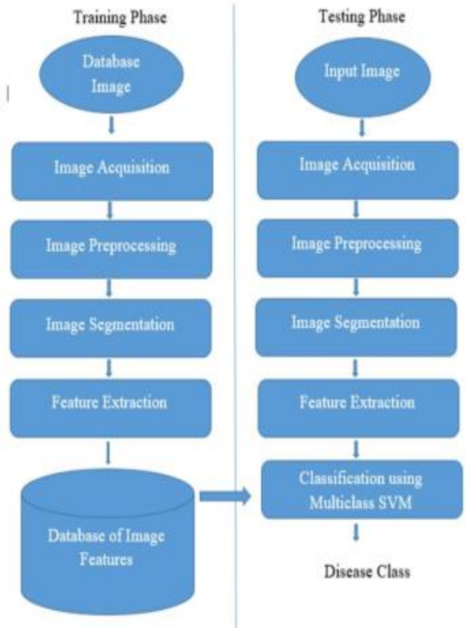

Fig 2.2. System Design

G. Proposed System

The use of naked eye observation and manual methods are generally used to decide disease severity in the production practice but that may result in several errors and inaccurate results. The application of image processing techniques in conducting research in the agriculture sector has helped in diverse ways to improve upon the development of the agricultural sector. In this we are using Multi SVM (Figure 2.3) to identiy the affected crops through image processing. Depending upon the severity the classification was done.

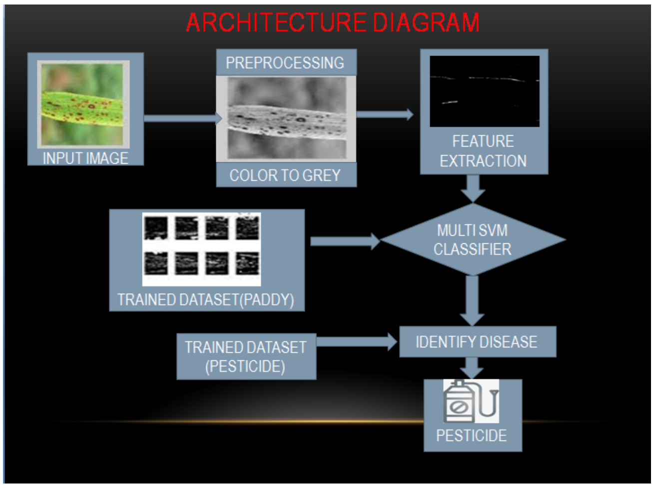

Figure 2.3. Architecture Diagram

We are using Multi Class SVM (Support Vector Machine) for classification diseases.

- Supervised binary classification algorithm is a classifier that partitions the vector space into separate zones. Depending on the severity pesticides will be recommended.

III. RESULTS AND IMPLEMENTATION

The purpose of this study is to measure the severity of diseases on leaves. To achieve the accurate results, samples of leaves affected by diseases were captured using a digital camera with a dark background. These samples were used for the initial experimentation. Later, several samples were used to test the system after it proved to be efficient. This was done to ensure proper and accurate results. These samples have been captured and represented in this paper. The selected image will then be used for further processing.

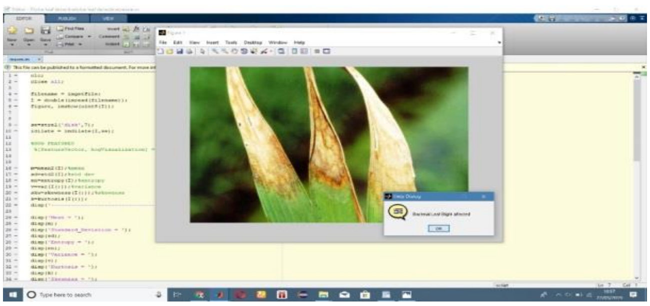

Figure 3.1. Classification of disease

In Figure 3.1 among the segmented images, one image is selected and classified based on the ROI. The classifier detects that the input leaf image belongs to the Bacterial Blight disease type. Using the statistical MATLAB commands the other properties are found out. Those are Mean Standard Deviation, Entropy, RMS,Variance, Smoothness, Kurtosis, Skewness, and IDM.Mean: Average or mean value of the array.

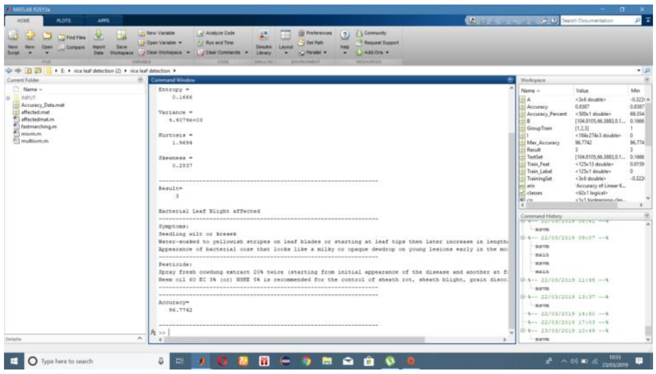

Figure 3.2. Accuracy Computation and Pesticide Recommendation

The computed Entropy, Variance, Kurtosis, Skewness, Disease, Symptoms, Pesticides and the accuracy will be displayed(Figure 3.2) .

IV. CONCLUSION

The world is moving more towards technology dependent era. Every day we keep hearing owes of farmers that even after using costly fertilizers the leaves were eaten away by various diseases. One of the most sensitive and costly treatments in India in terms of leaf concerned is that of pomegranate. The expertise in this field is rarely available. Since the opinion of an expert can vary from that of a novice, for the benefit of all it is advisory to make the most use of the technology available to infer or conclude for treatments.The machine learning methods bring this aspect to reality, by observing the database and helping the botanists in the diagnosis of diseases where a lot of precision is required. And one of the machine learning technique, SVM is used in this project for classification of leaf diseases.The accuracy results in an available range from mid-90 to top 90%. This can be bettered by increasing the database. However, the results obtained from real life images are very encouraging. SVM, though a binary classification technique, with a simple manipulation, can be used for a multiple class case. This provides more space not just to classify but to identify the diseases. Presently the system is semi automatic. This can be completely automatic by choosing ROI based on criterion such as principal components analysis, or choosing the cluster with larger disease area etc. With the proper database, this method can be applied to more diseases. Example: liver diseases, skin cancer, breast cancer identification and classification etc.

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