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MULTISPECTRAL IMAGE ENHANCEMENT THROUGH HISTOGRAM

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ABSTRACT

Plants are among the earth's most useful and beautiful products of nature. Plants have been crucial to mankind's survival. The urgent need is that many plants are at the risk of extinction. About 50% of Ayurveda medicines are prepared using plant leaves and many of these plant species belong to the endanger group. The identification of disease on the plant is a very important key to prevent a heavy loss of yield and the quantity of agricultural product. The detection of plant leaf is a very important factor to prevent serious outbreak. Automatic detection of plant disease is essential research. Most plant diseases are caused by fungi, bacteria, and viruses. There are so many classification techniques such as k-Nearest Neighbor Classifier, Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, Artificial neural network, Fuzzy logic. Selecting a classification method is always a difficult task because the quality of result can vary for different input data. Plant leaf disease classifications have wide applications in various fields such as in biological research, in Agriculture etc..

Keywords- *K-NNC, Fuzzy logic, PNN, ANN, SVM.*

I. INTRODUCTION

Plants form an essential part of life on Earth and provides with oxygen, food, medicine fuel, and much more. There are two main characteristics of plant disease detection machine-learning methods that must be achieved. **They are: speed and accuracy.** There is a need for developing technique such as automatic plant disease detection and classification using leaf image processing techniques. These techniques will be useful for farmers and will alert them at the right time before spreading of the disease over large area. Depending on the applications, many systems have been proposed to solve or at least to reduce the problems, by making use of image processing, pattern recognition and some automatic classification tools. In the next section this paper tries to present those proposed systems in meaningful way. The leaf area monitoring is an important tool in studying physiological features related to the plant growth, photosynthetic & transpiration process. Also being helpful parameter in evaluating, damage caused by leaf diseases and pastes, to find out water and environmental stress, need of fertilization, for effective management and treatment. This paper also presents an automated system integrated with machine vision techniques that will assist the farmers get the accurate information about their crops using their mobile phone. The uploaded pictures of paddy captured by the mobile phones will be processed in the central server and the analysis report will be presented to an expert group for their opinion, who will then be able to send proper recommendations through a simple notification using the system, according to the severity of the situation.

II. PROPOSED APPROACH

A. Basic Diseases

Disease fungi take their energy from the plants on which they live. They are responsible for a great deal of damage and are characterized by wilting, scabs, moldy coatings, rusts, and blotches and rotted tissue.

1. **Fungi** are identified primarily from their morphology, which emphasis and placed on their reproductive structures**.**
2. **Bacteria** are considered more primitive than fungi and generally it have simpler life cycles. With few exceptions, bacteria exist as single cells and increase in numbers by dividing into two cells during a process called binary fusion.

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3. **Viruses** are extremely tiny particles consisting of protein and genetic material with no associated protein. The term disease is usually used only for the destruction of live plants.
4. **Spots** a small round or roundish mark, differing in color or texture from the surface around it.
5. **Rust** Most often found on mature plants where symptoms appear primarily on the surfaces of lower leaves.
6. **Downy mildew** is a disease of the foliage, caused by a fungus-like (Oomycete) organism. It is spread from plant to plant by airborne spores. It is a disease of wet weather as infection is favored by prolonged leaf wetness.

B. Sample Plant Leaf Diseases are Identified

Fig 1: Identification of Leaf Diseases

Fig 2: Identification of Leaf Diseases

C. The Developed Processing Scheme Consists of Four Main Steps

- First a color transformation structure for the input RGB image is created; this RGB is converted to HSI because RGB is for color generation and this for color descriptor.
- the green pixels are masked and removed using specific threshold value, after that
- the image is segmented and the useful segments are extracted, finally the texture statistics is computed
- From SGDM matrices.
- Finally the presence of diseases on the plant leaf is evaluated.

D. The Basic Procedure of the Proposed Approach

First, the images of various leaves are going to acquire using a digital camera. Then image-processing techniques are applied to the acquired images to extract useful features that are necessary for further analysis.

- Image Acquisition
- Image Preprocessing
- Image Segmentation
- Color Features/Moments
- Texture Analysis

1. Image Acquisition

Image Acquisition is the process in which acquired and converted to the desired output format. For this application an analog image is first captured and then converted to the digital image for further processing. Leaf images are collected from variety of plants with a digital camera. These leaf images come in with different of size, shape and class. Image acquisition in image processing can be broadly defined as the action of retrieving an image from some source, usually a hardware-based source, so it can be passed through whatever processes need to occur afterward. Performing image acquisition in image processing is always the first step in the workflow sequence because, without an image, no processing is possible. The image that is acquired is completely unprocessed and is the result of whatever hardware was used to generate it, which can be very important in some fields to have a consistent baseline from which to work`

2. Image Pre-processing

Image Pre-processing noise gets added during acquisition of leaf images. So we use different types of filtering techniques to remove noise. We create device independent color space transformation structure. Thus we create the color transformation structure that defines the color space conversion. The next step is that we apply device-independent color space transformation, which converts the color values in the image to color space specified in the color transformation structure. The color transformation structure specifies various parameters of transformation. A device independent color space is the one where the resultant color depends on the equipment used to produce it as dependent.

3. Image Segmentation

Image Segmentation is the process used to simplify the representation of an image into something that is more meaningful and easier to analysis. K-means clustering is a partitioning method. The function ‘k-means’ partitions data into k mutually exclusive clusters, and returns the index of the cluster to which it has assigned each observation.

4. Color Features/Moments

Color Moments are measures that can be effectively used to discriminate images based on their features of color. Color moments are also very helpful to distinguish Color based image analysis techniques. The information of Color distribution in an image can be extracted by using the low order moments. Let P_{ij} is the i^{th}Color channel at the j^{th} image pixel.

5. Texture Analysis

Texture can be considered as a similarity grouping in an image. Texture analysis are categorized into

- **Structural:** Provides a good symbolic description of image. Powerful tool for structural texture is provided by mathematical morphology.
- **Statistical:** It is a quantitative measure of arrangement. The approach is based on multidimensional co-occurrence matrix.
- **Model based:** It is not suitable for describing local image structure.
- **Transform method:** It uses Fourier descriptors, Gabor descriptors and wavelet transform. Gabor filter provides better spatial localization.

E. Feature of Leaf

- **Shape:** The best feature for identifying a leaf. By means of a highly developed algorithm for identification of shape is possible through image processing.
- **Venation:** It varies in all leaves. It plays the major role for identification of leaves.
- **Texture:** The other feature for identifying leaf is its texture. It is a powerful regional descriptor that helps in retrieval process. It does not have the capability of finding similar images.
- **Color:** It is a good identification parameter when there is a variation in color in leaves of different species. But while using color as a feature, it may change due to loss of chlorophyll

III. RELATED WORKS

[1]Anand.H.Kulkarni and AshwinPatil R. K described a methodology to accurately detecting plant diseases. This methodology includes image processing techniques along with artificial neural network (ANN). They also discuss about the dramatic problems of farmers and present a work aimed to develop diseases detection system for plant. This system first capture raw image of plants. Then, Filter and Segment it by Gabor filter. Then, extract the color information from segmented image. Now well trained ANN is used to distinguish between healthy and diseased plant sample. Color and texture are two precious parameters for ANN based classifier. This system runs with real time constraints and shows 91% accuracy on implementation.

[2]Ajay A. Gurjar, Viraj A. Gulhane describes 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 is detected..

[3]Muhammad Faisal Zafar et al. proposed the grape leaf diagnosis system. It has three main parts: firstly complex back ground color extraction, secondly color extraction diseased part of leaf and at last disease classification. Color analysis has been done with the help of self-organizing feature map with back propagation neural network. GA and MSOFM are employed for leaf disease segmentation further SVM is deployed for classification. After these processes filtration of image has been done through Gabor Wavelet and applied to SVM for classification of final disease. Grapes leaf diseases are classify into three categories in this system: Rust disease, Scab disease and No disease. This system shows wide performance for agricultural implementation.

[5]P.Revathi M. Hemalatha detected Cotton leaf spot diseases in 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.

Classification Techniques

This section will discuss some of the popular classification techniques that are used for plant leaf classification. In plant leaf classification it is classified based on its different morphological features. Some of the classification techniques are used is neural curl. In these work symptoms of cotton leaf spot images are captured by mobile and classification is done by using neural network. Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, k-Nearest Neighbor Classifier. Plant leaf disease classification has wide application in agriculture.[7]

1. General Algorithm

Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, Artificial neural network, Fuzzy logic based on the existing work I am planning to implement the following algorithm for my research. To compare with existing I have taken a two samples of the leaf tested with equipment. Based on the analysis of the diseases are displayed I want to take the sample data to implement in the MATLAB. Comparing with the above Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine, and Principal Component Analysis, Artificial neural network, Fuzzy logic and also I trained the data to get through Support Vector Machine in the form of automatic genera tic procedure based on the diseases.

2. Support Vector Machine:

Support Vector machine (SVM) is a non-linear Classifier. This is a new trend in machine learning algorithm which is used in many pattern recognition problems, including texture classification. In SVM, the input data is non-linearly mapped to linearly separated data in some high dimensional space providing good classification performance. SVM maximizes the marginal distance between different classes. The division of classes is carried out with different kernels. SVM is designed to work with only two classes by determining the hyper plane to divide two classes. This is done by maximizing the margin from the hyper plane to the two classes. The samples closest to the margin that were selected to determine the hyper plane is known as support vectors .Fig below shows the support vector machines concept. Multiclass classification is also applicable and is basically built up by various two class SVMs to solve the problem, either by using one-versus-all or one versus-one. The winning class is then determined by the highest output function or the maximum votes respectively.

Main Advantages of SVM are

- Its prediction accuracy is high.
- Its working is robust when training examples contain errors.
- Its simple geometric interpretation and a sparse solution.
- Like neural networks the computational complexity of SVMs does not depend on the dimensionality of the input space.

Drawbacks of SVM are

- This classifier involves long training time.
- In SVM it is difficult to understand the learned function (weights).
- The large number of support vectors used from the training set to perform classification task.
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3. Fuzzy Logic

Fuzzy Logic classifiers are classification systems that make use of fuzzy sets or fuzzy logic (Kuncheva, 2000) which convert real-world data values into membership degrees through the use of the membership functions (Zadeh, 1965) so that these rules then can be used for the classification process. This is done by defining "categories" for each one of the attributes. As Fuzzy logic classifier's 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. Fuzzy image processing is the collection of all approaches that understand, represent and process the images, their segments and features as fuzzy sets. The representation and processing depend on the selected fuzzy technique and on the problem to be solved. Fuzzy image processing is divided into three main steps: image fuzzification, modification of membership values, and, if necessary, image defuzzification. Because of the uncertainties that exist in many aspects of image processing like additive and non-additive noise in low level image processing, imprecision in the assumptions underlying the algorithms, and ambiguities in interpretation during high level image processing, fuzzy processing is desirable. The main 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.[8]

4. Probabilistic Neural Networks

Probabilistic Neural Networks (PNNs) is a feedforward neural network, based on Parzen windows. In a PNN, the operations are organized into a multilayered feedforward network with four layers. PNN is mainly used in classification problems. The first layer is input layer which calculates the distance from the input vector to the training input vectors. The second layer sums the contribution for each class of inputs and produces its net output as a vector of probabilities. Third Pattern layer contains one neuron for each case in the training data set. It stores the values of the predictor variables for the case along with the target value. The pattern neurons add the values for the class they represent. The output layer compares the weighted votes for each target category accumulated in the pattern layer and uses the largest vote to predict the target category. As PNNs are much faster than multilayer perceptron networks their training phase requires only one pass through the training patterns. PNN can be accurate than multilayer perceptron networks also relatively insensitive to outliers. To improve the overall performance

PNNs output can be later processed by another classification system and as this happens very fast, PNNs are used in on-line applications where a real-time classifier is required.
The main disadvantage of PNN is requires large storage space.

IV. CONCLUSION

The target is to find the most efficient combination of texture features for quick and reliable identification. A larger database will ensure better reliability. For texture analysis shape, texture, feature and venation of leaf are to be tried. The main aim is to give a result of 100 % accuracy.After reviewing above mentioned techniques and methods we can conclude that there are number of ways by which we can detect disease and nutrient deficiency of plants. Each has some pros as well as limitations. On one hand visual analysis is least expensive and simple method, it is not as efficient and reliable as others are Image processing is a technique most spoken of very high accuracy and least time are major advantages offered, but it backs away when implementing practically. In SVM computational complexity is reduced to quadratic optimization problem and it's easy to control complexity of decision rule and frequency of error.[6]

V. FUTURE WORK

The future work to be carried out is the formation of database. After the formation of database the features are to be extracted using gray-level co-occurrence matrix (GLCM) or principal component analysis (PCA) method or using any technique. Then the test samples are taken and compared with the database to identify the closest match. The identified leaf is to be labeled. Using Arduino the identification is to be implemented which makes the system even more user friendly. The work is started to form the database in Arduino also simultaneously. Particularly the vein parameter is to be concentrated for which is the signature parameter of any leaf. The process is started and it will be carried out in future.

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