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An Android Application for Plant Disease Detection

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Abstract: *Agriculture is one of the foundations of the Indian economy. It not only contributes to GDP but also serves as a source of income for a larger chunk of the population. The farmers detect diseases based on their past experiences, which is very time consuming and require lots of expertise. Sometimes, the disease cannot be diagnosed with naked eyes. This paper uses the image processing technique for detecting the disease in plants. For feature extraction, OpenCV libraries along with SURF algorithm are used. The proposed system will identify the bacterial and fungal diseases in a plant at an early stage in a short span of time.*
Keywords: *OpenCV, SURF, Image Segmentation*

I. Introduction

India is an agricultural based country in which 70 percent of people are farmers[1]. The early detection of plant diseases is very important in order to avoid the damage of crops and also helps to decrease the cost involved in the production. The symptoms of a pathogen can be expressed as fungal or bacterial leaf spots, vein banding, mosaic appearance, the leaves can be distorted or powdery mildew can appear.

The main reason behind the late identification of the disease is the non-accessibility of experts close to the farmers. Disease detection by humans is neither objective nor efficient. Hence, the computer-based expert systems would be a boon to the farmers. Diseases and insect pests are the major problems for plant cultivation. It is found that diseases cause heavy crop losses amounting to several billion rupees annually. So it is very important to detect disease in plants in the early stages so that we can eliminate them and improve the quality of plants.

II. Literature Review

Following are some of the search which has been reviewed for the proposed system: -

Jaskaran Singh et al. has reviewed and discussed various plant disease detection techniques in terms of various parameters like speed, accuracy etc. It showed that the plant disease detection techniques consist of common three steps which are pre-processing, segmentation and feature extraction, classification. With better image processing techniques and dataset, accuracy can be increased[1].

Chan-ho Lee et al. implemented the FAST and BRIEF algorithms as hardware on Zynq-7000 SoC Platform. It reduces approximately 57% of internal memory usage and 70% of hardware cost compared to SIFT or SURF accelerator. FAST and BRIEF accelerator has less recognition level and takes longer execution time. Recognition level will be improved depending on direction by adding orientation[2].

Mei-Ping Song et al. implemented AKAZE algorithm. The AKAZE-FREAK algorithm effectively solves the defect which the FREAK algorithm does not have the scale invariance and enhances the matching effect of solar images with illumination difference and rotation difference. The algorithm showed advantages over SIFT- FREAK and SURF-FREAK algorithm in image matching speed and solar image matching accuracy.[3].

Zhang Huiqing et al. proposed an image registration method based on the MIC-SURF by combining the advantages of improved MIC and SURF algorithm. SURF algorithm is used because the number of features points detected by the improved MIC is less than the MIC. It has better real-time performance and improves the image matching speed[4].

Monzurul Islam et al. had presented an approach that integrates image processing and machine learning to allow diagnosing diseases from leaf images. The author has used Image segmentation with multiclass SVM to develop an automated and easily accessible system [5].

Mrunmayee Dhakate et al. proposed an approach which consists of the image database collection, preprocessing of those images, feature extraction from those images using k-means clustering based color

segmentation technique, Feature extraction using GLCM method and finally the training the artificial neural network using Backpropagation Algorithm. This approach is used only for the detection of four diseases in pomegranate plant [6].

Vijai Singh et al. presents the image processing technique which is done using a genetic algorithm to classify and identify the different disease through which plants are affected. This approach has a low recognition rate in the classification process. Banana, beans, jackfruit, lemon, mango, potato, tomato, and sapota are the species used for testing this proposal. Since all experiment are performed in MATLAB software, it is not a portable application [7].

Minesh Chaudhary et al. have designed such a system which detects disease in plants, which saves farmer's time and cost, which has more accuracy. The author has used Genetic Algorithm which is relatively simple to implement and can be used in image segmentation, image classification, and image reconstruction. It can work easily during the global optimization which poorly behaves with the objective function. This approach uses genetic algorithm using MATLAB software, hence outcomes can be slow and poor [8].

YU Hai-yan et al. performed Image Retrieval based on Improved SURF for an embedded system. Improved SURF is applied to the binary image feature extraction which is used to map the 64-dimensional descriptor. Then, the LSH algorithm is used to establish the feature index of the image in the dataset. The proposed algorithm improves the speed and accuracy of the previous SURF algorithm[9].

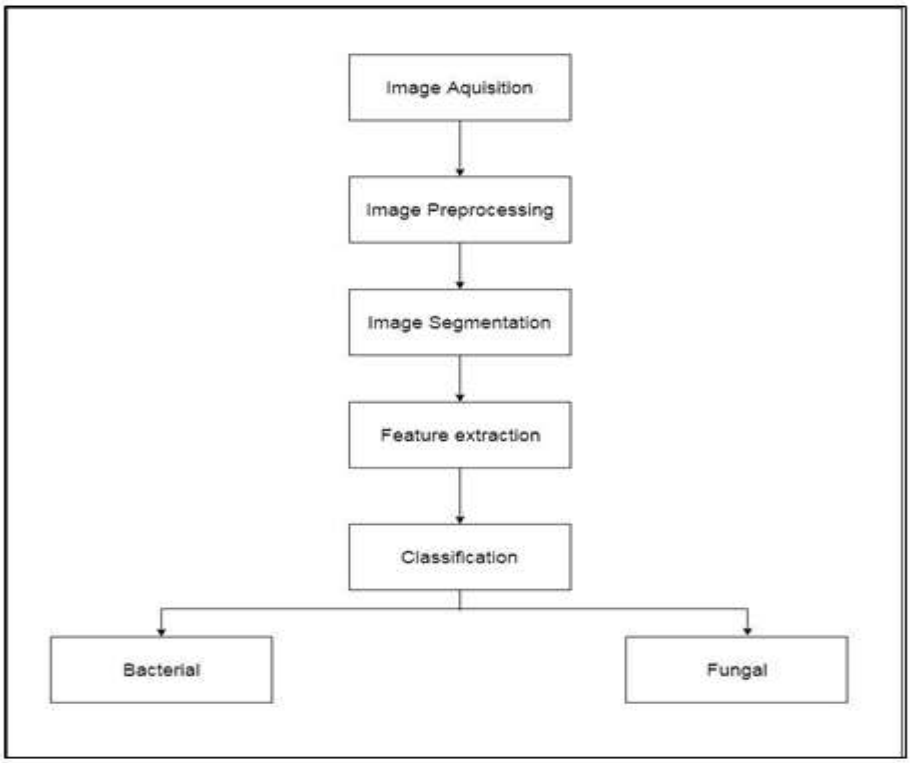
Nikos Petrilli's proposed a system which is based on the facts that are described by a user or plant photos. An application is described here is capable of identifying only vineyard diseases with the help of any plant leaf that has been affected by the disease with an accuracy higher than 90%. This application can only be used in windows phone [10].

III. Proposed Method

The Objective of our project is to build a system which can detect the disease in infected plants. We have used the OpenCV library which includes all the libraries required for the image processing technique. The process will start by capturing an image of a leaf by the user, then this image will be processed. This process is divided into two phases:

01. Training Phase
02. Testing Phase

Fig 1 : Proposed System Block Diagram



01. TRAINING PHASE:
The steps used in the training phase are :

i) Input Image :
In this step, the image of an infected leaf is captured through a mobile camera for further procedure.

ii) Image Pre-processing :
After capturing the image, preprocessing is done. In this, the image is filtered through median filters and converted into a binary image. The main aim of this step is to improve the image or enhance the features that will be required in the future process, but this will not change the image information content. E.g. Noise reduction is done, an image is smoothened, clarity is checked, etc.

iii) Segmentation :
Segmentation divides the image into multiple sub-parts. It is required to focus on the area of interest or the part in which disease is detected. For that, OpenCV library functions are used which provides various style of thresholding. Thresholding converts the grayscale image into pixels.

iv) Feature Extraction :
In this step, different patterns of objects are defined as vectors and different features are extracted from the images using SURF algorithm. Speeded-UP Robust Features(SURF) is made of three steps i.e feature extraction, feature description, and feature matching. SURF allows accepting an 8-bit RGB or an 8-bit grayscale image as the input. The output will be in the form of an array of extracted interest points. After this step, for enabling fast computation on the GPU the 8-bit grayscale image is converted into 32- bit floating-point representation. After extracting the features from an image, the results are evaluated.

v) Image Database :
A database contains all the images needed for training purpose and will be used for doing the analysis and comparison.

02. TESTING PHASE:
The steps in the training phase will be similarly followed in the testing phase until the feature extraction.

- Analysis :

Followed by all these steps, the images are analyzed in the focused area of interest and their diseases detected.

- Comparison :

After analyzing, we compare the images to the existing or original image which is present in the database. The disease will not be detected for non-existing images.

IV. Conclusion

Our proposed system develops a user-friendly automated system for the farmers that will help them in determining diseases of leaves without bringing an expert in the field. This work will not only detect plant disease but also give the proper solution for the treatment of that disease. The main benefits of this application will be, it will consume less time and also will take less manual analysis. Based on the analysis, grayscale images are easy to process and implement. For increasing the level of image recognition, SURF algorithm is used. So, these types of images will be used to analyze and diagnose the plant leaves diseases and determines the level of the disease of the plant leaves.

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