STUDY AND COMPARISON ANALYSIS OF DIFFERENT IMAGE PROCESSING TECHNIQUES FOR PLANT DISEASES

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Abstract - *A country's economy is highly dependent on Agricultural Productivity. This productivity further depends on the diseases that affect the plants. Affected plants generally do not produce a desired output and hence are not favorable. If proper care is not taken in this area then it causes serious effects on plants due to which respective product quality, quantity or productivity is affected. Taking for example, a disease named Powdery Mildew has a characteristic symptom of a white superficial growth of some powdery substance or some fungal growth on the leaves. The affected plants generally drop pre-maturely from the plant thereby reducing the crop produce or in some worst cases might also prevent the entire fruit set. Since the conventional method for disease detection i.e. by the naked eye can be cumbersome and non-effective, detection of plant disease through some mobile device is beneficial as it reduces the mountainous task of monitoring in crops in the entire farm. Additionally, this also helps to detect the symptoms of the diseases at an early age, like when they are to appear on the leaves. With the help of this paper, we present an algorithm on image processing technique which is used for automatic detection and classification of plant leaf diseases. It also covers a study of various diseases.*

Key Words *– Image Processing, Plant Diseases, Image Processing Algorithm, Bitmap.*

1. Introduction

Disease detection just by using our naked eyes is cumbersome and time consuming and thus is less effective. By using a widely available and affordable device like an android phone, we bring this latest technology to even the lower income groups of our society. Since India is a developing country, there are various farmers who fall in the lower income group. For them, purchasing high end electronic devices to monitor their crops and fields would be too expensive and thereby increasing the cost of the crop which eventually affects the general masses. Android mobile phones are nowadays available in the market at pretty affordable cost (around Rs. 3000 or 50$). Using the android application, the disease detection in plants is efficient and is not time consuming. The process of diagnosis used in plants (i.e. recognition of symptoms and signs of diseases) is completely based on the use of algorithms. On the basis of symptoms of particular diseases and with the help of agricultural scientists, identification of diseases becomes easier. This application uses digital image processing to accurately identify the disease in the plant and provide the general remedies. Detection and recognition of diseases in plants using machine learning is very fruitful in providing symptoms of identifying diseases at its earliest. The android application guides the user to capture the image of an affected plant within some boundaries which are drawn on the User Interface. The captured image is then analyzed using our image processing algorithm which gathers the RGB data from the desired pixels and stores them into a Bitmap. This bitmap data is then matched with a standard data set. The data set includes different diseases the plant may have with their respective bitmaps which contain the data of an image of the plant having that particular disease. Both the bitmaps are coalesced and then compared within error limits. If the sample bitmap matches the bitmap present in the database, the application returns the remedy for the disease. The system which has been proposed, consists of an artificial vision system (camera), a combination of classifier and image processing algorithms. A software prototype system is described for disease detection based on the infected images of various plants. They used image analyzing, image segmentation techniques to detect infected parts of the plants.

2. Literature Review

- ADVANCES IN IMAGE PROCESSING FOR DETECTION OF PLANT DISEASES, 2011[1] used image processing with PCA & Probabilistic Neural Network (PNN).
- DIGITAL IMAGE PROCESSING TECHNIQUES FOR DETECTING, QUANTIFYING AND CLASSIFYING PLANT DISEASES, 2013[2] used This paper presents a survey on methods that use digital image processing techniques to detect, quantify and classify plant diseases from digital images in the visible spectrum

TECHNIQUES, 2017[8] uses image segmentation to separate and group images into different parts. But unlike the earlier work in 2015, here soft computing techniques are used. It presents a genetic algorithm which is used to optimize both variables efficiently, continuous or discrete. All the experiments were performed in MATLAB. For input data disease, samples of rose with bacterial disease plant leaves, beans leaf with bacterial disease, were considered.

- DETECTION OF RICE LEAF DISEASES USING CHAOS AND FRACTAL DIMENSION IN IMAGE PROCESSING, 2014[3] used this article will present an algorithm developed using chaos theory and fractal dimension in image processing. It will focus on recreating fractals of rice leaf disease patterns for identification and early detection. This algorithm may be used as preliminary information or model in creating early disease detection systems or automated systems to identify or detect rice plant diseases.
- DETECTION OF UNHEALTHY REGION OF PLANT LEAVES USING IMAGE PROCESSING AND GENETIC ALGORITHM, 2015[4] uses image segmentation which is a process of separating and grouping an image into different parts. It presents genetic algorithms which generate solutions for optimization problems.
- PLANT DISEASE PREDICTION USING IMAGE PROCESSING TECHNIQUES- A REVIEW, 2016[5] uses Digital Image Processing (DIP) along with some computer algorithms to perform image processing and disease detection in plants on digital images.
- A BRIEF REVIEW ON PLANT DISEASE DETECTION USING IN IMAGE PROCESSING, 2017[6] again uses Digital Image Processing but for a variety of applications like - to detect leaf, stem of plants and fruit diseases, to quantify the area affected by any disease, to determine the change in colour of the affected area and to determine size & shape of fruits which may be affected or unaffected.
- PLANT DISEASE DETECTION IN IMAGE PROCESSING USING MATLAB, 2017[7] uses digital high resolution images. Using k-means clustering method, these captured leaf & fruit images are segmented to form clusters. Before applying K- means and SVM algorithm for training and classification all the features are extracted. Finally, the system recognizes the diseases.
- DETECTION OF PLANT LEAF DISEASES USING IMAGE SEGMENTATION AND SOFT COMPUTING

3. Proposed Algorithm

In this paper an effective image segmentation algorithm has been implemented for color and texture analysis. The following steps are implemented in the algorithm for plant disease detection:

1. Images for detection

   The samples of affected are collected using the mobile phone camera. The sample image for the affected disease is present in the database.

2. Separation of RGB Components

   The format for color images is the RGB. Each matrix corresponds to one segment of the red, green or blue and gives an indication of how much of each of these colors a certain pixel contains. A bitmap is a simple black and white, two- dimensional image stored as an array of bits.

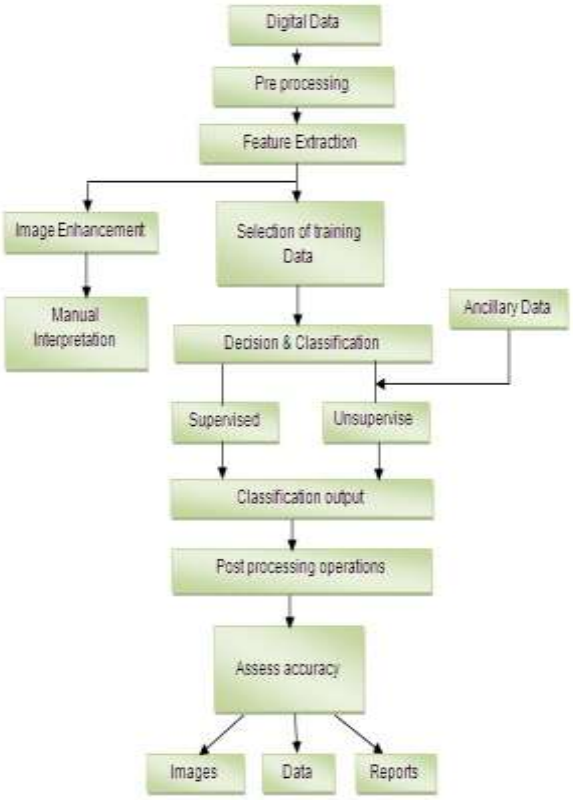
3. Comparing sample and database bitmaps

   The sample bitmap is compared with multiple bitmaps representing different diseases in the plant. If the sample bitmap data is found to be within the error limits of a particular bitmap, the disease is detected

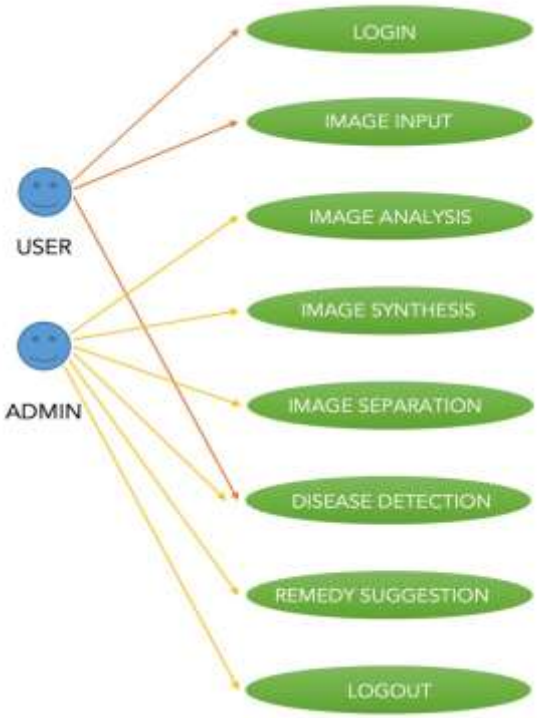
4. Detecting disease and providing remedies

   The detected bitmap is thus returned with the disease name and some remedies are provided to the user along with some links on the internet.

4. Working of Algorithm



5. Use Case Diagram



6. Comparison with Other Image Processing Techniques

Table – 1: Comparison Table with different Image Processing Techniques and their accuracy (0.3-5 Megapixels)

Image Processing Technique	Independent Component Analysis	Neural Networks	Principal Component Analysis	Self-Organizing Maps	Partial Differential Equation	Wavelets	Bitmap
Percent Accuracy	37-88%[9]	96.64%[10]	47-70%[11]	88.5-97.6%[12]	72.55-88.10%[13]	69.01-91.19%[14]	95-98%*

Table – 2: Comparison Table with different Image Processing Techniques and their accuracy (>5 Megapixels)

Image Processing Technique	Independent Component Analysis	Neural Networks	Principal Component Analysis	Self-Organizing Maps	Partial Differential Equation	Wavelets	Bitmap
Percent Accuracy	37-88%[9]	96.64%[10]	47-70%[11]	88.5-97.6%[12]	72.55-88.10%[13]	69.01-91.19%[14]	97-99.9%*

Major techniques used for Image Processing are as follows:

- **Image Editing - process** of altering images with the help of computer software**.**
- **Image Restoration** – get back the lost information from a corrupt image and estimate it into a clean original image.
- **Independent Component Analysis** – separation of multivariate signal into additive sub-components.
- **Neural Networks** - computational templates widely used in AI/ML for solving a variety of jobs.
- **Pixelation** – a form of character reading process and turning written pages to digital ones.
- **Principal Components Analysis** – process used to extract features from the image.
- **Partial Differential Equations** – used to reduce/remove noise from images.
- **Wavelets** – mathematical function used to compress images.
- **Self-organizing Maps** – a technique used to classify images into classes.

7. Conclusion

This paper presents a comparison of different image processing techniques used to identify diseases in plant leaves and an algorithm is suggested for processing images of leaves of affected plants automatically. Since, India is a developing nation and the farmers are not well equipped with resources and have meagre sources of income alongside, we have proposed to use Android Mobile Phone applications to help them. We propose an idea to use Bitmap technique of Image Processing to process the images captured with the help of the embedded camera in the Android phone. These devices are pretty cheap when compared to the traditional image processing devices and cost around Rs.3000(45$). Even if a slight higher investment of about Rs.7000($100) is made, a far better image capturing device is available and even better results can be provided. With meagre computational efforts, desirable results can be obtained. Another advantage of this proposal is that the Android phones are very handy and can be carried around easily in one's pocket and hence regular monitoring of plants can be done to check for affected one's. The application could also provide various links for the remedy of the disease detected and hence it could be tackled at an early stage. This method could really help the farmers in various other developing agricultural nations with minimal investment and exceptional benefits and value for money.

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