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Detection of Plant Leaf Diseases using Image Processing and Soft-Computing Techniques

Namita M. Butale[1], Dattatraya V. Kodavade[2]

[1]*Department of Computer Science, DKTE Society's Textile & Engineering Institute, Ichalkaranji, India*
[2]*Department of Computer Science, DKTE Society's Textile & Engineering Institute, Ichalkaranji, India*

Abstract – *Agriculture is the most important sector in Indian economy. Therefore, in the agriculture field, detection of plants disease plays a main role. If proper care of plants is not taken then it causes serious effects on plants and due to which respective product quality, quantity or productivity is affected.*

In some countries farmers don't have proper facilities or even idea that they can contact to experts. Due to this consulting experts costs high. Manual monitoring the plant leaf disease is very critical task and also time consuming too .The results obtained are also not satisfactory.

Automatic disease detection technique is beneficial at initial stage for detecting disease. If automatic disease detection technique is used then it will take less effort, less time and also gives more accurate results. Disease detection system involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification.

Key Words: **Image processing, Image segmentation, Feature extraction, Support Vector Machine** etc.

1. INTRODUCTION

The Indian economy depends heavily on the productivity of agriculture. Therefore, the detection of plant disease plays a major role in the agricultural field. If adequate plant care is not taken, it creates severe plant impacts and affects the quality, amount or productivity of the corresponding item. Unhealthy region of plant leaves is the area on leaf which is affected by disease, which will reduces the quality of plant. Automatic disease detection technique is beneficial at initial stage for detecting disease. The existing method of detecting disease in plants is simply expert naked eye observation. This requires a huge team of specialists and continuous monitoring of the plant, which for big farms costs very high. Farmers in some nations do not have adequate equipment or even the concept of contacting professionals.

Due to which consulting experts even cost high and it is time consuming too. In such conditions the suggested method is beneficial for monitoring large fields of crops. Detecting diseases in an automatic manner by just looking at the symptoms on leaves makes it easier and cost effective. This provides support for machine vision to give image based automatic process control, inspection and robot guidance. Detection of plant disease by visual way is difficult as well as less accurate. Whereas If Automatic disease detection is used then it will give more accurate results, within a less time and less efforts. Image segmentation can be done in various manners ranging from simple threshold method to advanced color image segmentation method. This corresponds to something that human eye can easily separate and view as individual object. Computers are not able to recognize the objects, several techniques are developed for image segmentation [1].

2. LITERATURE SURYE

Mrunalini R et.al[1] introduces the method for classifying and identifying the various diseases affecting crops. A identification scheme based on machine learning will prove very useful. It also saves human effort, money and time. The Color Co-occurrence technique is used to extract the feature. Neural networks are used to automatically detect diseases. The suggested strategy can considerably promote precise leaf detection and, in the case of steam and root illnesses, appears to be an significant strategy that puts less effort into computing.

Prof. Sanjay, B. Dhaygude& et al [2] The implementation of texture statistics to detect plant leaf disease was clarified Firstly by converting RGB's color conversion structure into HSV room as HSV is a useful color descriptor. Masking and removing pre-computed threshold amount of green pixels. Then segmentation is carried out using 32X32 patch size in the next step and helpful sections have been acquired. These sections are used by color co-occurrence matrix for texture analysis. The texture parameters are finally likened to ordinary leaf texture parameters.

Sachin D. Khirade & et al [3] Plant disease identification is the key to stopping losses in agricultural product output and amount. It needs tremendous job, plant disease knowledge, and excessive processing time as well. As a result, image processing is used for plant disease detection. Detection of diseases includes measures such as image acquisition, pre-processing of images, image pre-processing, image segmentation, feature extraction and classification. This paper used images of their leaves to discuss the techniques used to detect plant diseases. This paper addressed different methods for segmenting the plant's disease portion. This article also addressed some methods for extracting the characteristics of infected leaf and classifying plant illnesses. For effective crop cultivation, accurate plant disease detection and classification is very essential and this can be achieved using image processing. This article addressed different methods for segmenting the plant's disease portion.

This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases. The use of ANN methods for classification of disease in plants such as self-organizing feature map, back propagation algorithm, SVMs etc. can be efficiently used. From these methods, we can accurately identify and classify various plant diseases using image processing technique.

VijaiSingh,A.K.Mishra et.al[4], proposed plant leaf disease detection using genetic algorithm. Genetic Algorithm (GA) is optimization algorithm. The algorithm starts with population that is set of solutions. From one population solutions are selected and new population is created. This is done with expectation that the new population will be enhanced than the old one. According to the fitness offsprings are selected. The fit solution has more probability to reproduce. The classifier used in this is Support Vector Machine (SVM).SVM is a very potential method to solve classification problems.

3. PRAPOSED WORK

Fig no.1 shows system architecture of proposed plant leaf disease detection system. Image acquisition is the very first step which is depends on hardware device. Digital camera or similar devices are used to capture images of leaf, also the images from datasets are used as input to the system to identify infected area of leaf.

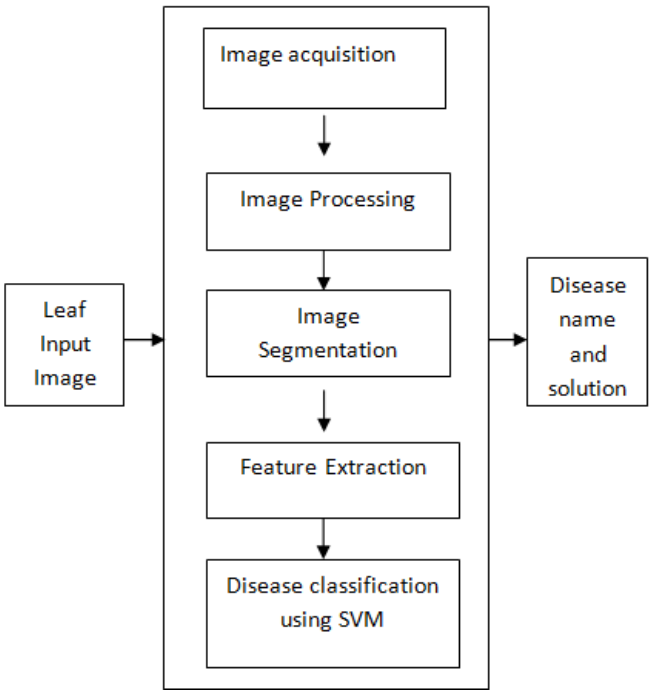


Fig1. System Architecture

3.1 Modules

1. Image acquisition

2. Image Preprocessing

3. Image Segmentation

4. Feature extraction

5. Disease classification

3.1.1 Image acquisition

Image acquisition means acquiring an image by means of camera from any real life scene. In today's world, commonly used method is capturing photo by using digital camera. But other methods can also be used. In this project, images are taken from plant village dataset through which the images will be fetched and the algorithm will be trained and tested

3.2.2 Image preprocessing

Image pre-processing is used to increase the quality of image necessary for further processing and analysis. It includes color space conversion, image smoothing and image enhancement. The quality of input image is achieved by removing undesired distortion from the image. Image enhancement is performed to increase the contrast of image. Image clipping is done to get interested region .Smoothing filter is used for image smoothing.

3.3.3 Image Segmentation

Image segmentation is the process of separating or grouping an image into different parts. Image segmentation are divided in to 3 categories

1. Edge based

2. Region based

3. Clustering based

In this paper image segmentation is done based on clustering. Clustering divide the data in to specific number of groups which are homogeneous. The segmentation process in based on various features found in the image. This might be color information, boundaries or segment of an image. The most popular method for image segmentation is K-means clustering method. It is used to segment interested area from background. In this paper K-means algorithm is used for image segmentation. Genetic algorithm is optimization algorithm, which is used after the k-means segmentation to obtain optimized result. GA was proven to be the most powerful optimization technique in a large solution space. Genetic algorithm is heuristic search method works in following steps:

1. Initialization of population

2. Fitness function

3. Selection crossover and mutation Operations

Genetic algorithm gives optimized results.

3.2.4 Feature extraction

Extraction of features is the significant component of predicting the infected region graciously. Extraction of feature involves reducing the amount of resource needed to describe large dataset. It is a method of identifying image characteristics and set of characteristics that will meaningfully represent significant classification and analysis data. It is expected that the extracted features will contain appropriate information from the input data, using this decreased representation instead of the full original data that the required job can do. Texture content counting is in main approach for region description. In the texture analysis Gray Level Co-occurrence Matrix (GLCM) of the leaf are calculated.

Texture oriented feature extraction like contrast, energy, homogeneity are calculated.

3.2.5 Disease classification

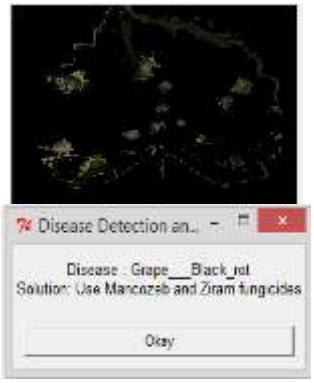
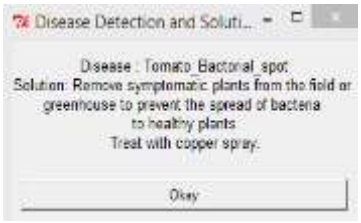
In the classification phase extraction and comparison of the co-occurrence features for the leaves with feature values are stored in feature dataset. Image classification is done by using Support Vector Machine. Support vector machines (SVMs) are a set of related supervised learning methods used for classification and regression. The data is divided into train and test parts from the train 80% of images are taken for training the SVM and 20% images are testing purpose which is unknown to SVM.

Based on the trained images SVM compare the features of input image and perform classification. The output produced by SVM is disease name and the solution for that disease.

4. RESULT AND DISCUSSION

In this paper K-means algorithm is used for image segmentation and SVM for classification. The result obtained is disease name with solution for disease.

The following table shows the output of the system. The system accepts the input images from test folder, these images are unknown to SVM the classifier compare the images features based on previously trained image features and produces the output. The input leaf images for the system taken are Corn cercospora-leaf-spot, corn common rust, grape black rot, grape leaf blight, peach bacterial spot, pepper-bell bacterial spot, tomato bacterial spot and tomato late blight. The result for these above plants is produced by system with 63% accuracy.

Input Image	Results
	
	 

5. CONCLUSIONS

The plant leaf disease detection using image processing helps to find disease at early stage. Automatic disease detection reduces the work of monitoring and identifies the disease at early stage. Infected leaf image dataset is identified for tomato, corn, grape, peach, pepper bell.

The proposed algorithm is tested on these above five classes of plant leaf images. With very less computations optimum results are obtained.

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Authors Profile

Namita M. Butale has completed Bachelor of Engineering in Computer Sc. & Engineering in year 2017, She is currently pursuing Master of Technology in Computer Sc. & Engineering at DKTE Society's Textile & Engineering Institute, Ichalkaranji. MS. India.Her research area is AI & Machine learning, Computer Vision.

Prof Dr. D. V. Kodavade , Professor of Computer Science & Engineering, at DKTE Society's Textile & Engineering Institute, Ichalkaranji ,India. He is a member of Board of Studies in Computer Sc. & Engineering at Shivaji Unviersity, Kolhapur, MS. India. He is member of ISTE, CSI, ACM, USA. His area of research includes AI, Deep Learning, IoT, High Performance Computing, Parallel Programming.