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Extraction Of Texture And Color Features For The Identification Of Diseased Herbal Medicinal Leaves Using A Raspberry Pi Processor.

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ABSTRACT

Plants play a vital role in current scenario. Identification of plants, leaves, stems and finding out the pest or diseases, percentage of the pest or disease incidence, symptoms of the pest or disease attack, plays a key role in successful cultivation of crops. The main disease of plants is viral, fungal and bacterial. Automatic detection of plant diseases is an important research topic as it may prove benefits in monitoring large field of crops, and thus automatically detect diseases from symptoms that appear on plant leaves. This paper mainly concentrates on the detection of disease in leaves using image processing technique. The affected leaves mainly show variation in color, texture and shape. Using these parameters for feature extraction the database is created with 18 parameters. Classification is done by Support Vector Machine (SVM) the background and the leaves are separated using multi layer perceptron neural network. The samples are tested with test image and the output displays the affected leaf with the accuracy and the disease present in it. Later the database is stored in Raspberry pi processor for real time detection. Raspberry pi uses Raspbian Wolfram Mathematica software where Mathematica is the programming tool. In order to make the system a real time application oriented cloud computing is used.

Keywords: Plant disease, feature extraction, SVM, Wolfram Mathematica, cloud computing.

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INTRODUCTION

Plants disease are due to many reasons such as cloimatic condition, soil erosion, fertilizers and so on. Disease and insect's pests are major problems in agriculture. In plants, disease is found in various parts such as fruit, stem and leaves. The main disease of plants is viral, fungal and bacterial.The work carried out b various authors are discussed in this section. Shital Bankar et.al. [1] identifies diseased plants using histogram matching. Jagdish D. Pujari et.al. [2] reports the results of experiments in improving performance of leaf identification system using PCA. The system involved combination of features derived from shape, vein, color, and texture of leaf. Lakhvir Kaur et.al [3] classified based on morphological feature. Prakash M. Mainkar [4] many techniques are used to determine the diseased leaves. Major techniques are K-means clustering, GLCM, NN classification and BPNN. S. Arivuazhagan et.al. [5] used SGDMA and classified by square distance technique it is a statistical way to describe shape by sampling gray level occur in relation to other gray levels and co-occurrence features and output achieved is 86.77%. The detection accuracy is improved to 94.74% by SVM classifier. Prajakta S. Garud et.al [6] proposed a stand-alone system which will help to analyze plant disease very accurately within less time and fewer effort by raspberry pi steps involved feature extraction technique, NN, diseases k-means algorithm to detect plants using image processing technique. Sujeet Varshney et al. [7] used SVM to increase the accuracy of detection. Sushil R. Kamalapurkar [8] Thresholding and Back propagation network along with ANN were used. Manjeet Kaur et al. [9] used KNN algorithm for comfortable cost and time consuming. Sandesh Raut et.al. Vijay Singh et al. [10] presents the technique to classify and identify the different disease. The approach given in this for feature set extraction is the color co-occurrence method. For automatic detection of diseases in leaves, neural networks are used. The approach proposed can significantly support an accurate detection of leaf, and seems to be important approach, in case of steam, and root diseases, putting fewer efforts in computation. Smita Naik wadi et.al. [11] constructed a hybrid(composite) classifier by combining two classifiers in common use— classification trees and k-NN. k-NN rulegave a better result. Rakesh Chaware et.al [12], used three folds detected the leaf disease using k-means clustering, color co-ccurrence methodology for texture analysis and detection and classifying the type of disease using NNs. Daniel Stanley Tan et.al. [13] used k-means clustering algorithm to group the pixels into healthy and infected clusters. The clusters were then labeled and used to train an SVM classifier for automatically determining which clusters contain infected pixels. Harshal Waghmare et.al. [14], used Applications of Multiclass SVM are formulated for classification of disease identification which is observed in Grapes plants to make DSS automated and easily available for farmers. Pydipati et al. [15], compared two different approaches to detect and classify three types of citrus diseases based on a Mahalanobis minimum distance classifier, using the nearest neighbor principle followed with RBF neural network classifiers trained with the back-propagation algorithm. Classification approaches performed equally well when using the best of the four subsets, which contained ten hue and saturation texture features. Jian et.al [16], proposed a method to recognize three kinds of cucumber leaf diseases healthy and diseased regions is made by a simple thresholding procedure. Abdullah et al. [17], discriminates a given disease (corynespora) from other pathologies that affect rubber tree leaves. The first two principal components are then fed to a MLP Neural Network with one hidden layer, whose output reveals if the sample is infected by the disease of interest or not. H. Al-Hiary et al [18], have presented Otsu segmentation, K-means clustering and back propagation feed forward neural network techniques. Texture features could be extracted using CCM. They have tested on five diseases which are early scorch, Cottony mold, ashen mold, late scorch, tiny whiteness. Prof. Sanjay B. Dhaygude [19] used NN algorithm must improve the recognition and classification process. Lili N.A [20] proposed an image noise detection and filtering algorithm-based Bayesian classification of combined with kernel regression framework that remove fixed value impulse noise of gaussian noise while preserving then recognition and classification algorithm modified hierarchical dynamic artificial neural network.

PROPOSED METHODOLOGY

The proposed methodology is shown in figure 1. The image is captured using a high resolution camera. Image preprocessing is done where the image is converted into gray and then edge detection is done. Image segmentation uses region-based segmentation to segment the image into partition. Region based segmentation uses edge or threshold based segmentation. The mean and standard deviation of pixel intensities in a region attempt to quantify the texture of the region. Texture segmentation is based on using measures of texture in predicates. The features are extracted using texture and color parameters. The database is created with the extracted features. Later it is then interfaced with Raspberry pi processor. It uses Raspbian Wolfram Mathematica software, for inputting the real time image. Raspberry pi uses a four USB port for camera, mouse,

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keyboard and pen drive. The database image and test image are compared with the features extracted and the output is displayed in the display.

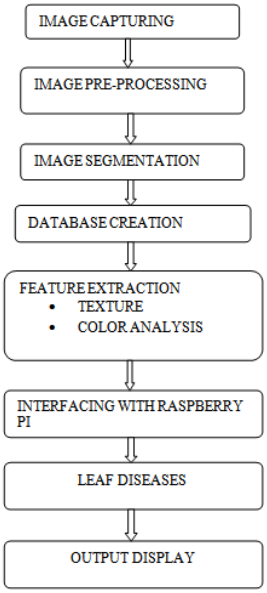
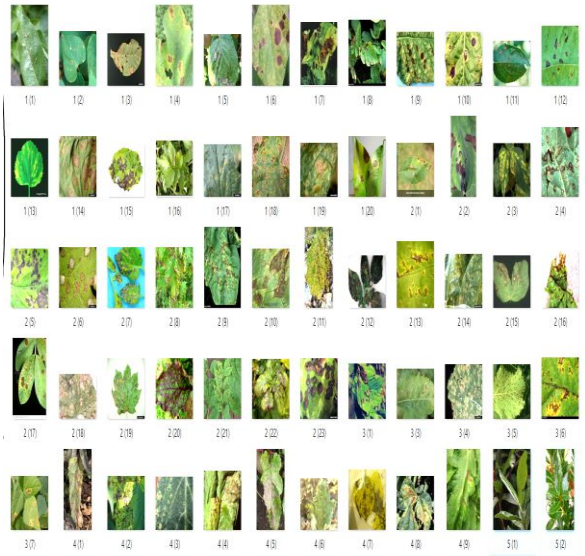


Fig 1: Proposed Methodology

EXPERIMENTAL RESULTS & DISCUSSION

The database images are shown in the figure 2. It includes 120 herbal leaf images with diseased and unaffected one.



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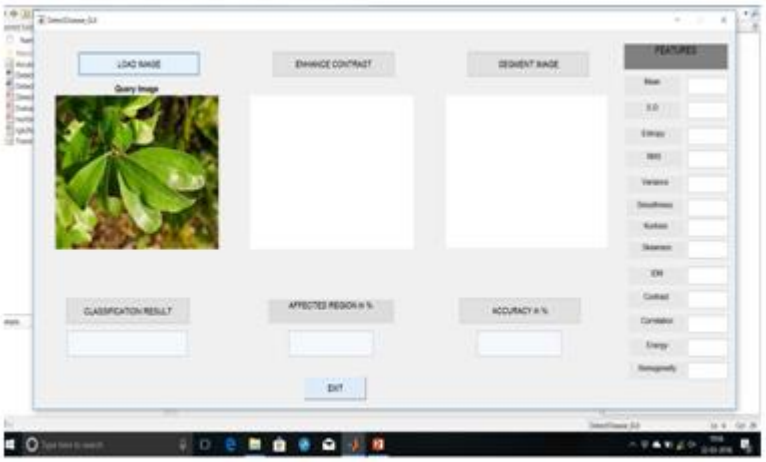

Fig 3: Output display

The test image is shown in figure 3. The right hand side of the figure shows the 13 feature parameters which includes texture and color parameters. The left side of the image contains load image, enhance contrast and segment image at the top and classification result, affected region and accuracy % at the bottom. The test image is loaded using the load image push button, which is nothing but the query image. Image enhancement is use for determining the fine details of the image. Contrast stretching transformation is applied for better range of intensity levels in an image. The next step is segmenting the image, Here segmentation is done by k-means clustering methods by assigning various weighting functions for better output. The clustering techniques are shown in figure 4, the better segmented image can be chosen for best comparison. The features are then extracted, the result is then classified to which class the leaf belongs to. The affected region % is determined and the accuracy is calculated and displayed, shown in figure 5&6.

Fig 4: Clustering Techniques of Enhancement techniques

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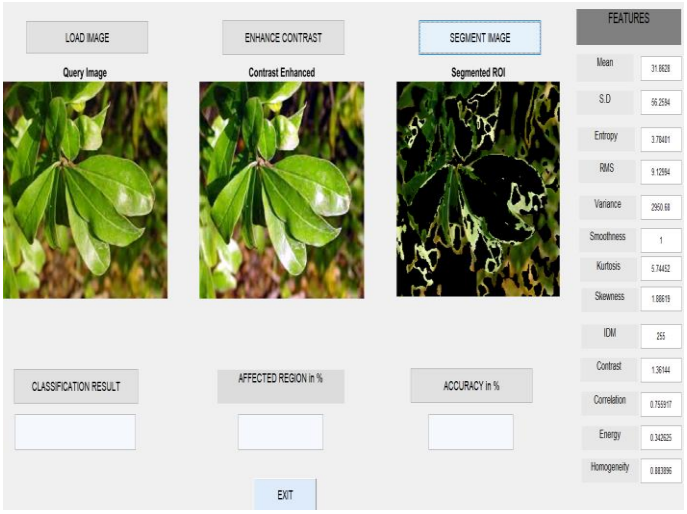

Fig 5: Feature Extraction

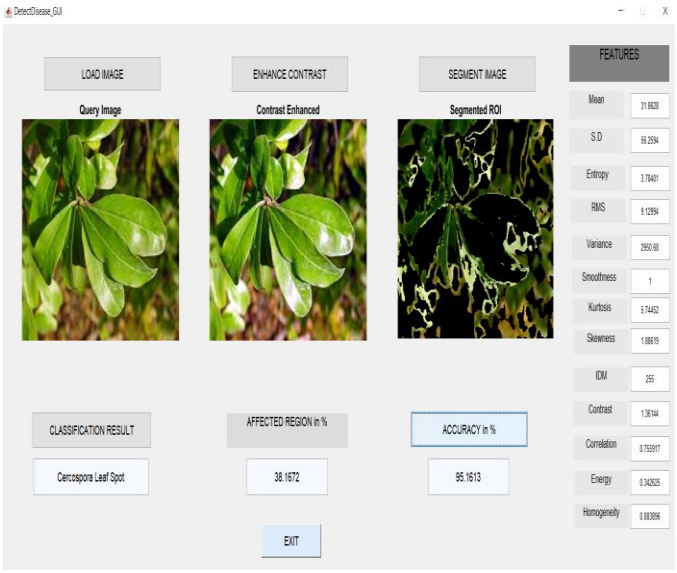

Fig 6: Output Display

Figure 7, shows the interface of Raspberry pi processor with the laptop. Using Ethernet cable the interfacing is done, as described in the proposed methodology it uses four ports. The connections are made as shown. The image is captured using a camera which is connected to the processor. The image preprocessing technique, feature extraction are done and stored in the database. The test image or the real time image is taken for comparison. It is compared with the test image and the output is displayed with the medicinal use in the display. Here the display is the Laptop monitor, the display can either be a monitor or LCD display.

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Fig 7: Raspberry pi processor

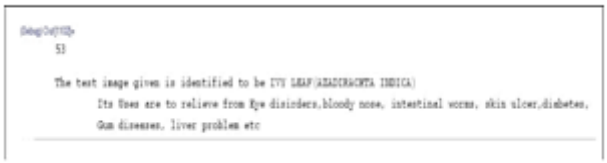

Fig 8: Processor Output

The processor output is shown in figure 8. The test image taken is the IVY leaf. The medicinal use of the leaf is displayed in the output. It is used to relieve from Eye disorders, bloody nose, skin ulcer, liver problem and so on.

CONCLUSION & FUTURE WORK

The classification of the Indian herbal medicinal leaves was classified based on texture and color parameters. The disease on the infected leave was determined and accuracy was calculated. The databases consist of 120 images of diseased leaves, 240 images of various Indian herbal medicinal leaves. The total images in the database include 360, out of which 356 images where correctly identified, 2 images were wrongly identified, 2 images were not identified. The sensitivity and specificity of the method was determined using the table 2.

Table 2: Sensitivity and Specificity

Outcome positive	TP=356	FP=0
Outcome negative	FN=2	TN=2

Sensitivity is defined as to determine the leaves correctly,

Sensitivity = True Positive/(True Positive+False Negative)

The sensitivity is 99.44%, specificity is 100%. The overall accuracy of the system is determined to be 98.89%. Using Raspberry pi real time images can be determined. It was carried out with 50 leaves, out of which 5 leaves were not included in the database. The images correctly identified was 42, 5 images not included in database and 3 images were not correctly identified. The accuracy obtained was 84% and the sensitivity was 93.33% considering only the texture and color parameters.

In future work the accuracy has to be improved by including the shape parameters. The work has to be implemented using a cloud computing network for larger database and to apply it in IoT.

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