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Insect Detection Using Image Processing and IoT

Sanket Kasturiwala[1], Smriti Banode[2], Harsha Bhansali[3], Riya Bhajan[4], Aayushi Khandelwal[5]

Assistant Professor[1], Undergraduate Students[2,3,4,5], Electronics and Communications Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur, India

Abstract: We propose a software technique to automatically identify the insect infesting the plant. We have particularly chosen the region of Vidarbha (Maharashtra, India) and insects associated with the crops of this region. It is an improvement in existing technology as it provides faster and more accurate solution. The developed scheme consists of 3 main phases. The first phase is training. The first stage is segmentation which uses saliency mapping, which is followed by Feature extraction. In feature extraction we extract component values of colour map, texture map and edge map. Then the extracted values are then fed to the database for further comparison. Training is followed by Testing where we give the input to our program and test if it recognises the object (in our case, insect). And the third and the last phase includes the introduction of server to upload images, hence making it accessible at any part of the world at all times.

Keywords: Insect Detection, Selective Rendering, Saliency Mapping, Support Vector Machine, Internet of Things, Image Processing

I. INTRODUCTION

Plant diseases have caused major havoc as it can cause substantial diminution in both quality and quantity of agricultural products. It causes massive damage. It is estimated that in India, crop loss due to pests ranges from 10-30 percent a year, out of which 26 % is due to the insect pests (Sriharan,1991). The changing agro-climatic conditions contributed largely to the infestation of various insect pests in different parts of the country. The naked eye observation of experts is the main approach adopted in practice for detection and identification of insects of plant. Automatic detection of insects is an essential research topic as it may prove benefits in monitoring large fields of crops.

In conclusion, the aim of this work is threefold: 1) identifying the infested insect(s) using saliency mapping procedure; 2) extracting the features set of the insects using colour co-occurrence methodology for texture analysis; 3) detecting and classifying the type of insect using SVM

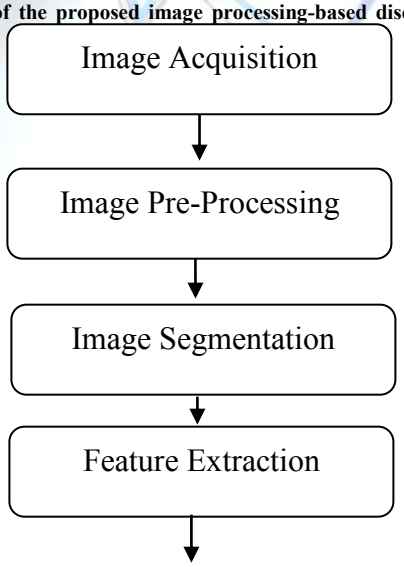
II. RELATED WORK

Work has been done for leaf disease detection as mentioned in [1] but our project emphasises on detection of insects that infest on the plant

III. PROPOSED METHODOLOGY AND WORKING

The general concept, which is the framework for any image related algorithm of image classification is almost similar. First, the digital images in need of identification is uploaded on the server. Then image-processing algorithms are used on the acquired images to extract informative features that are necessary for further analysis. After that, several analytical discerning techniques are used to categorize the images according to the specific problem at hand.

Fig 1: procedure of the proposed image processing-based disease detection solution



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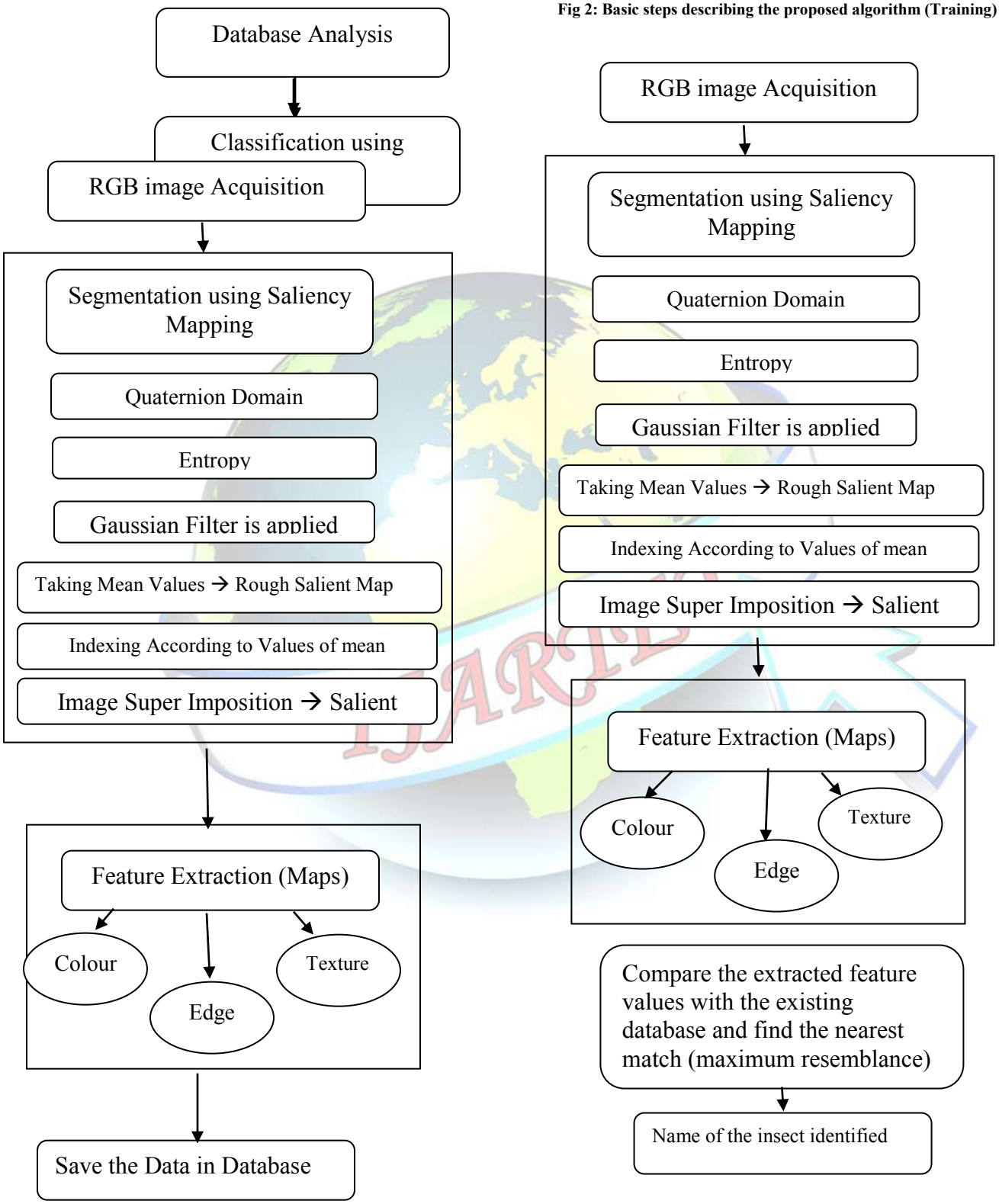

Fig 2: Basic steps describing the proposed algorithm (Training)

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Fig 3: Basic steps describing the proposed algorithm (Testing)

Saliency Map

A saliency Map shows unique quality of each pixel though an image. Its goal is to represent an image in such a way that it is informative and easier to analyse

Formulae Used in the above mentioned algorithm:

Input Feature Maps

R = r-(g+b)/2;G = g-(r+b)/2;B = b-(r+g)/2;Y = (r+g)/2-abs(r-g)/2-b;Y(Y<0) = 0;

Edge/texture map

Energy formulation

Overall energy

$$E(M) = \sum_{i=1}^{K} w_i^{m_i} + \sum_{\{i,j\} \in N} w_{i,j}^{m_i, m_j}$$

Naturally, if mi = mj then w mi,mj i,j equals zero (texturing from the same view does not produce seams). N denotes a set of pairs of adjacent faces, as in[8]

Entropy

$$\sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} -P_{ij} * logP_{ij}$$

As in [5]

Correlation

$$\frac{\sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} (i,j)p(i,j) - \mu_x \mu_y}{\sigma_x \sigma_y}$$

Where i, j are the spatial coordinates of the function p (i, j), Ng is grey tone, as in [5].

Support Vector Machine

SVM classification is based on the concept of decision hyperplanes that ascertain decision boundaries in input space or high dimensional feature space. SVM creates linear functions from a set of categorized training dataset. This hyperplane will try to separate the positive samples from the

Negative samples. The linear separator is generally structured with maximum distance from the hyperplane to the closest negative and positive samples. This causes precise classification for training data which is near, but not equal to the testing data. All through the training phase SVM takes a data matrix as input data and labels each and every samples as either fitting to a given class (positive) or not (negative). SVM considers each sample in the matrix as a row in a input space or high dimensional feature space, where the number of traits classifies the space dimensions. SVM learning procedure construes the best hyperplane which divides each positive and negative training sample. The trained SVM can be used to predict about test samples.

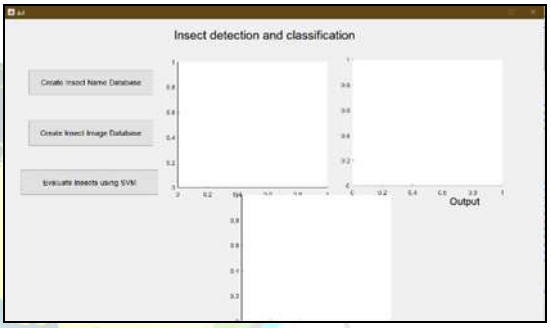

Fig. 4. Input Interface

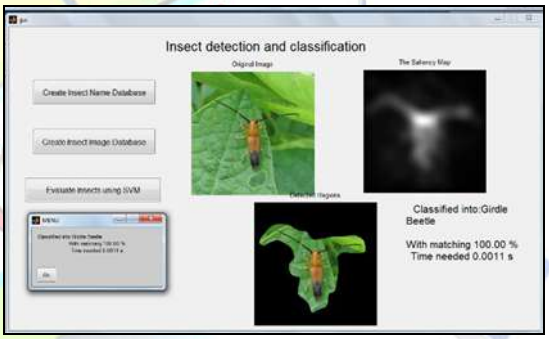

Fig. 5. Output Interface

Fig. 6. Server

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IV. CONCLUSION

This project is made in such a way that it uses IoT in the form of server to make this product accessible to anyone in any part of the world at any time. It is very accurate and quick as compared to other solutions available out there [7] (apps name). It uses the latest technology and algorithm such as SVM [6] and saliency mapping .It is very handy as information is available to you with the click of a button.

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BIOGRAPHY

Dr. Sanket Kasturiwala -Assistant Professor, Electronics and Communication Department, Shri Ramdeobaba College of Engineering and Management.

Miss. Smriti Banode pursuing her Bachelor's Degree in Electronics and Communication Engineering from Shri Ramdeobaba College of Engineering and Management.

Miss. Harsha Bhansali pursuing her Bachelor's Degree in Electronics and Communication Engineering from Shri Ramdeobaba College of Engineering and Management.

Miss. Riya Bhajan pursuing her Bachelor's Degree in Electronics and Communication Engineering from Shri Ramdeobaba College of Engineering and Management.

Miss. Aayushi Khandelwal pursuing her Bachelor's Degree in Electronics and Communication Engineering from Shri Ramdeobaba College of Engineering and Management.