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EFFICIENT FUNGI DISEASE DETECTION AND GRADING FOR LEAFY VEGETABLES USING OPTIMIZED IMAGE PROCESSING TECHNIQUES

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ABSTRACT

The image processing techniques can be used in the plant disease detection. In most of the cases disease symptoms are seen on the leaves, stem and fruit. The plant leaf for the detection of disease is considered which shows the disease symptoms. Disease fungi take their energy from the plants on which they live. They are responsible for a great deal of damage and are characterized by wilting, scabs, mouldy coatings, rusts, blotches, and rotted tissue. Figure 1 explains the conceptual diagram that pre-processing stage used conventional methods of filtration like median filter, wiener filter and Gaussian filter and we have proposed new methods of filtration like Mean Square Error (MSE), Peak signal to Noise Ratio (PSNR) & Mutual Information (MI). The segmentation stage used conventional methods of filtration like Ostu, Watershed and Region growing and we have proposed new methods like Structural Similarity Index Motion (SSIM), Peak signal to Noise Ratio (PSNR), Accuracy and time. The feature extraction method used conventional methods for different parameter like shape, colour and texture so for that we have come up with the hybrid method which can be used to measure parameter like accuracy, precision, sensitivity and specificity. Figure 2 explains the pre-processing outcomes which is stage-I which used median filtering, Gaussian filtering and Weiner filtering. Figure 3 explains the segmentation outcome. Figure 4 explains the final outcome according to method we have used. Figure 5 shows the performance analysis of different feature extraction methods.

DRAWINGS

Descriptive Drawing Of Conceptual Diagram

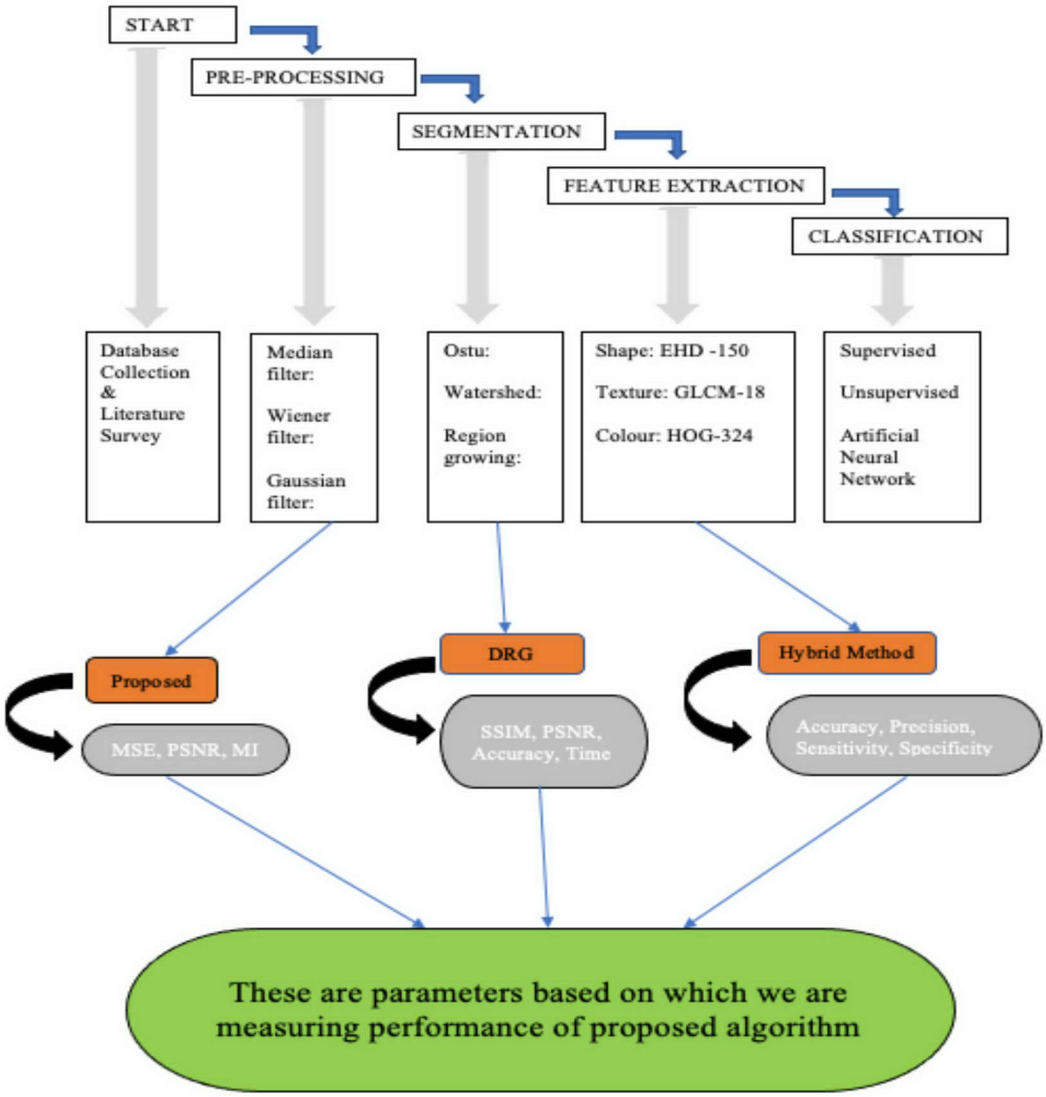

Figure-1

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EFFICIENT FUNGI DISEASE DETECTION AND GRADING FOR VEGETABLES USING OPTIMIZED IMAGE PROCESSING TECHNIQUES

FIELD OF THE INVENTION:

[0001] In this invention, we are presenting the robust and efficient framework for automatic detection and grading of diseases like fungi, bacterial etc. on crop like vegetables, crop identification is also important for proper treatment of disease affected leafy vegetables, hence we are designing method for crop identification as well. Particularly, the proposed methodology designing is based on image processing terminologies such as pre-processing, segmentation, feature extraction and classification.

BACKGROUND OF THE INVENTION:

[0002] Agriculture plays an essential role in India's economy. Today India ranks second worldwide in farm output. This is one of the reasons that disease detection of plants plays an important role. The productivity of farm is affected by the plant diseases. Different plant diseases resulting to reduction in quality and quantity of plants. Now a day's study of plant disease means the study of visually observable patterns seen on the plants. It is difficult to monitor the plant disease manually, so it requires tremendous amount of hard word, specialized in plant disease as well as excessive processing time. This project presents an algorithm for image segmentation technique. Image segmentation is the method for conversion of digital image into several segments and rendering of an image into something for easier analysis.

[0002a] The problems in present scenario and other electronic appliances of similar kind in particular include the following:

1- It is difficult to monitor the plant disease manually, so it requires tremendous amount of hard word, specialized in plant disease as well as excessive processing time.

2- The traditional approach for the plant disease identification is simply done through naked eye observation by experts through which identification and detection of plant diseases is done.

3- For doing so, a large team of experts as well as continuous monitoring of experts is required, which costs very high when farms are large.

4- At the same time, in some countries, farmers don't have proper facilities or even idea that they can contact to experts. Due to which consulting experts even cost high as well as time consuming too.

As the goal of this invention is to present automated computer aided diagnosis framework based on image processing for early fungi disease detection caused on leafy vegetables and disease grading with crop identification.

PRIOR ART:

[0003] There are number of images processing based techniques already introduced for disease detection from the different crops, but they have concern on accuracy of detection, robustness of detection and efficiency. The existing methods are having the limited scope on detection. This becomes another motivation for this research.

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[0003a] Along with leaf disease detection for crops, crop detection and grading of disease is also important for automated system. To our knowledge, there is no optimized system proposed so far for automatic crop detection and then disease grading for that crop leaf disease detected. This becomes our last motivation. The present invention is easy to install and simple in use. System will be operated instantly on button click.

OBJECTIVES OF THE INVENTION:

[0005] Following are the key objects of the proposed system:-

1. To design image segmentation algorithm based on improved region growing method for leafy vegetable crops.
2. To design feature extraction algorithms by contributing the hybrid feature extraction techniques like Grey level co-occurrence method (GLCM), Edge Histogram Descriptor (EHD) & Histogram of oriented gradient (HOG).
3. To design Artificial Neural Network (ANN) based Novel classification method for leafy vegetable disease detection and grading
4. To evaluate the performance in terms of accuracy, precision, recall and processing time.

SUMMARY OF INVENTION:

[0006] The productivity of farm is affected by the plant diseases. Different plant diseases resulting to reduction in quality and quantity of plants. To minimize the

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damage from plant diseases, early detection is vital. The manual plant disease detection is poor, time consuming, uncertain and costly.

[0006a] From the literature survey study it has revealed that there is fair amount of scope for plant disease identification in the area of agriculture and horticulture. There is a need for design and development of a machine vision system that automatically recognizes, classifies, and quantitatively detect plant disease symptoms. The recent computer vision and image processing based methods are quite primitive. Efficient image processing based method targeting towards better accuracy is a need of hour.

[0006b] Reliable, Robust and scalability factors needs to be considered while designing method for detecting plant diseases. A total solution using novel CAD approach is proposed in this research using image processing on commonly used vegetables like Potatoes, Fenugreek (Methi) , Spinach (Palak) etc..

[0006c] Computer aided diagnosis framework using image processing methods is proposed for efficient detection and grading of leafy vegetables disease detection and analysis.

DETAIL DESCRIPTION:

[0007] The system comprises of:

- ☐ Image pre-processing
- ☐ Image Segmentation
- ☐ Features Listing and Training
- ☐ Classification and Detection
- ☐ Disease Grading
- ☐ Performance Measurement

Computer aided diagnosis framework using image processing methods is proposed for efficient detection and grading of leafy vegetables disease detection and analysis. The main contributions of research are discussed here. The features of extraction methods and features of computation are presented. Crops considered for this research are different vegetables. The grading of disease will be done using disease affected area measurement in percentage (%). Grading of disease will be evaluated in 1 to 4 grades based on % of disease area. It is fully efficient and easy to operate.

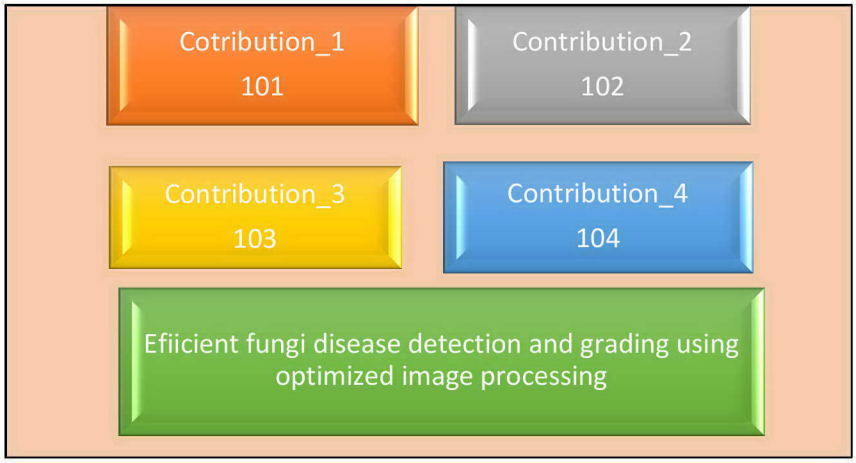

FIGURE-1- Proposed System

[0007a] Detailed description below is with reference to the accompanying figure. These same numbers are used throughout the drawings to refer like features and components. Figure 1 shows proposed system which consist of controlling mechanism. It consists of four major contributions like: -

Referring to the figure 1 implementation

101 Comprises Contribution _1: Data collection and pre-processing.

102 Comprises Contribution_ 2: Efficient Segmentation of Leaf Image.

103 Comprises Contribution_ 3: Feature Extraction of Segmented Leaf Image.

104 Comprises Contribution_4: Disease Identification and Grading.

- An application 101, **Contribution 1:** Preprocessing efficiency, novel technique is designed in this research work using combined approach for getting better result.

- An application 102**, Contribution 2:** Next contribution of this thesis is used of efficient segmentation method.

- An application 103, **Contribution 3.1:** Feature extraction methods, this is another area in which it is required to have efficient technique in order to get improved recognition accuracy etc.

- An application 104, **Contribution 3.2:** In this contribution, artificial neural network-based classifier is designed for purpose of input leaf disease detection. After disease detected, its grading should be done based on area measure method.

METHODOLOGIES

[0008] As the goal of this thesis is to present automated computer aided diagnosis framework based on image processing for early fungi disease detection caused on leafy vegetables and disease grading with crop identification.

Number	Methodologies
Contribution 1	Data collection and pre-processing using combination of filters.
Contribution 2	Efficient Segmentation using improved region growing method.
Contribution 3.1	Feature Extraction efficient algorithms by contributing the hybrid feature extraction techniques.
Contribution 3.2	Novel classification method for crop disease detection and grading

Table 1

Table 1 is giving the information on core contribution and methodologies for this research work. Above listed are three main contribution of this thesis work. As showing above table, three novel methods proposed in this thesis in order to overcome the research challenges of existing automated methods of plant disease identification and grading.

Claims

1- Novel technique is designed in this research work. This preprocessing step is combination of filters like Laplace filter, smooth filter and then binarization and finally smoothing operations. This improves the quality of input raw image more as compared to previous basic preprocessing steps.

2- This project improved region growing method for image segmentation. This method is based on existing region growing method. This research work contributed with novel robust and efficient segmentation method introduced for leaf segmentation for early detection of disease.

3- Feature extraction methods, this research work is contributed the hybrid feature extraction technique which is combination of Grey Level Co-occurrence Matrix GLCM, Edge Histogram Descriptor method (EHD) & Histogram of oriented gradient method (HOG).

4- ANN (artificial neural network) based classifier is designed for purpose of input leaf disease detection. After disease detected, its grading should be done based on area measure method.

DRAWINGS

Descriptive Drawing Of Conceptual Diagram

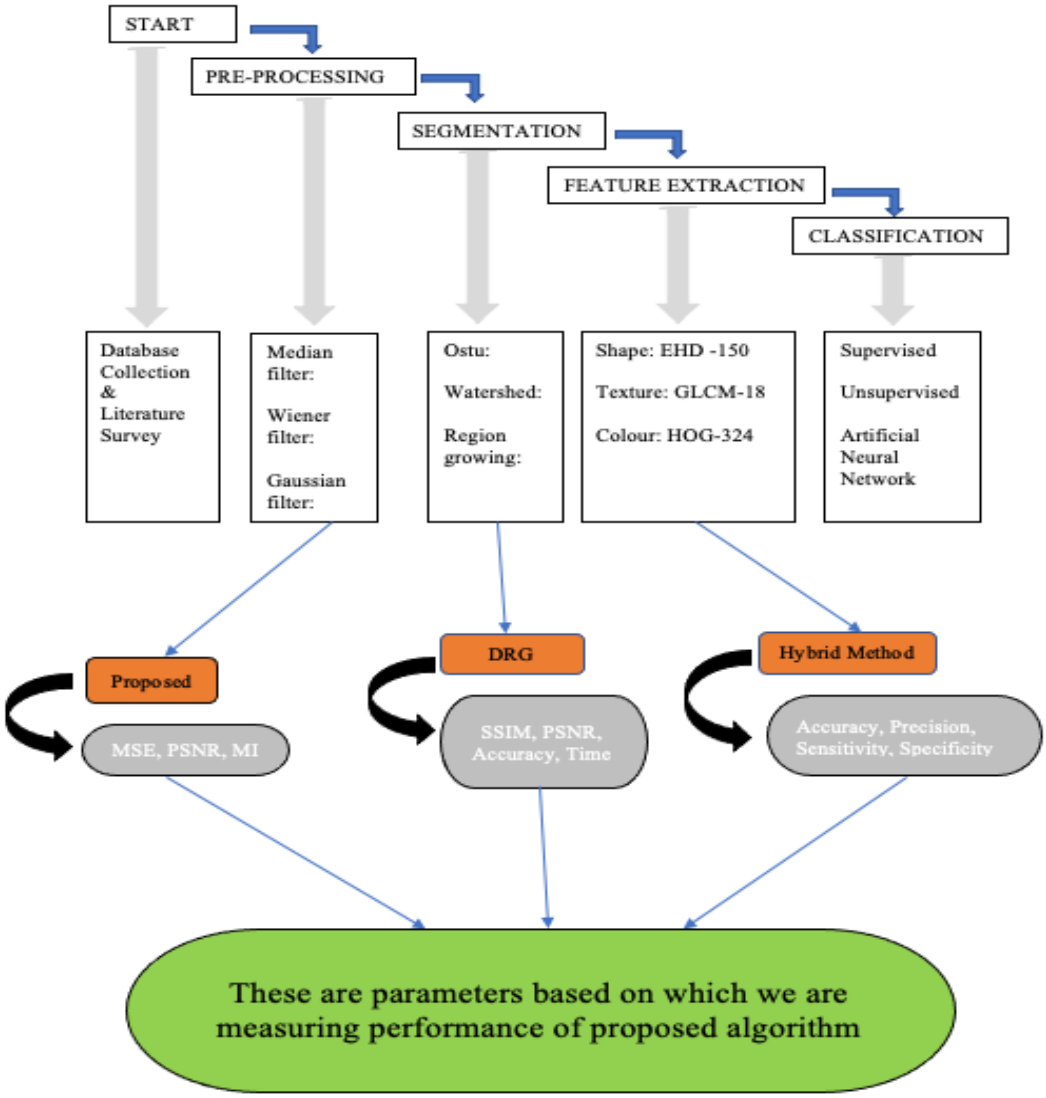

Figure-1

Descriptive Drawing Of Pre-Processing Out-come

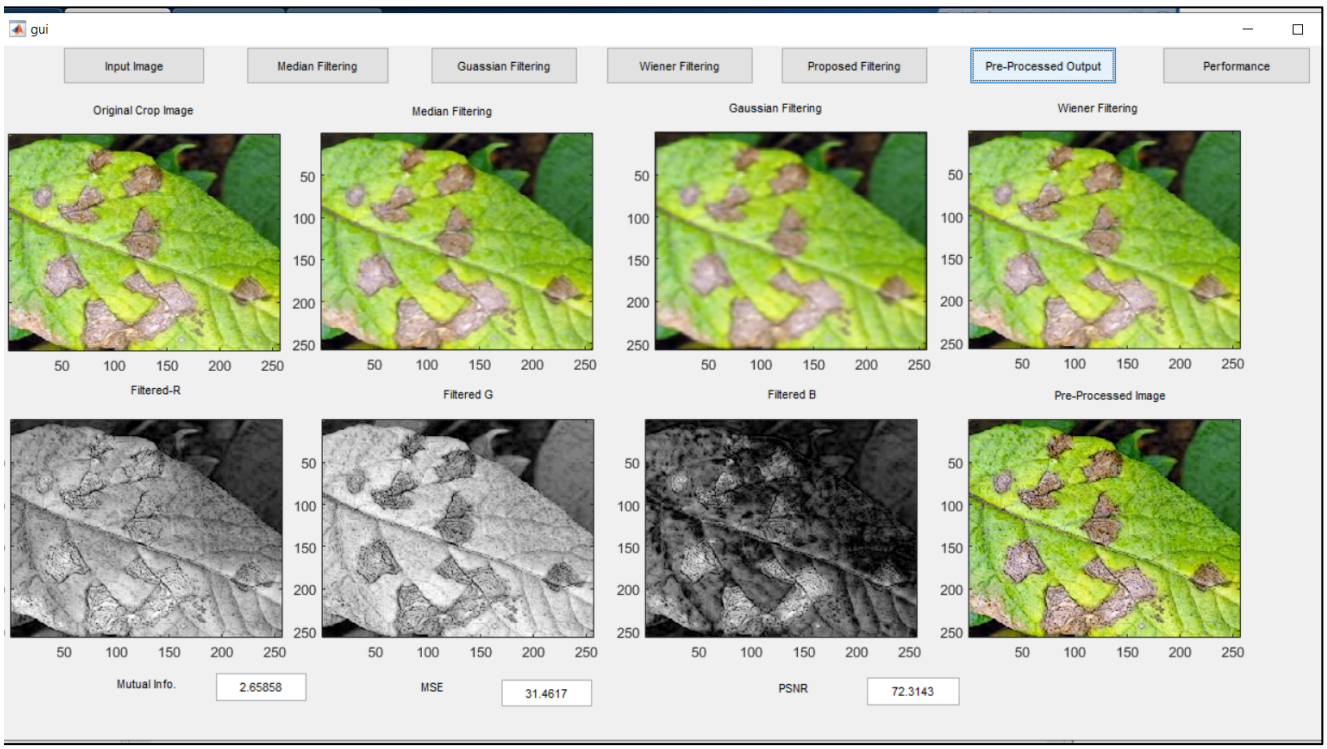

Figure-2

Descriptive Drawing Of Segmentation Out-Comes

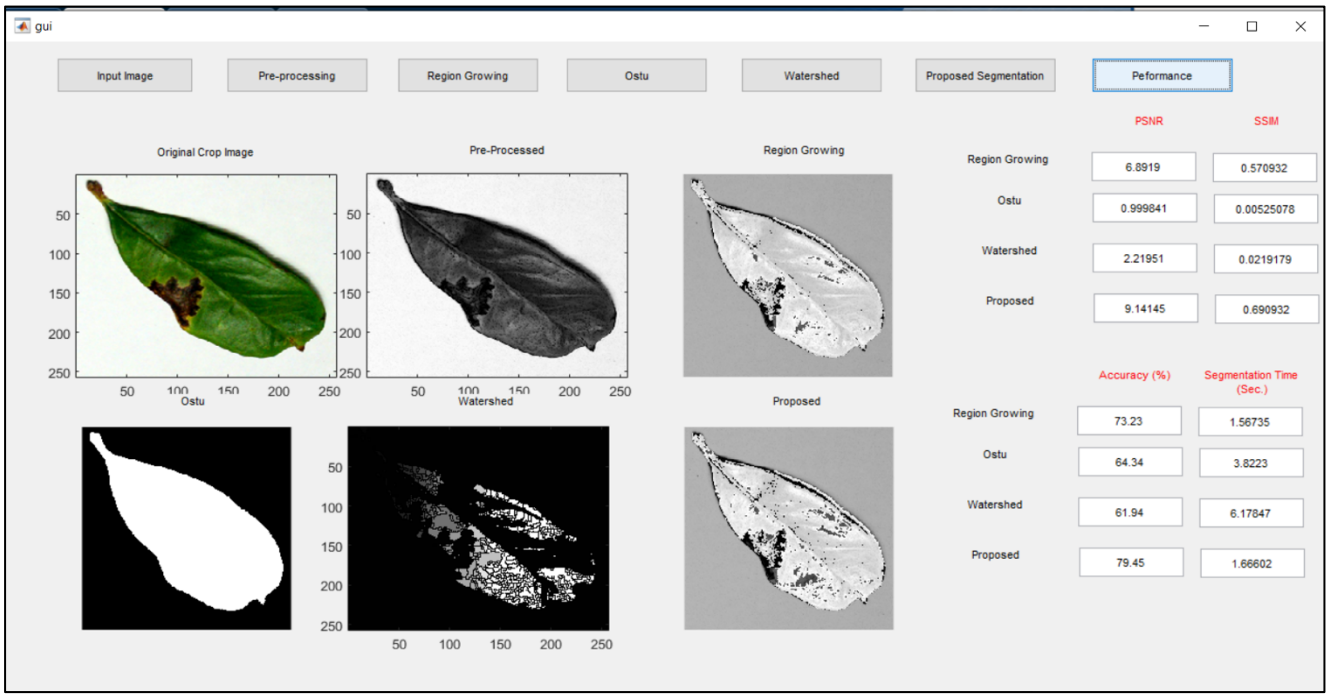

Figure – 3

Descriptive Drawing Of Final Out-Comes

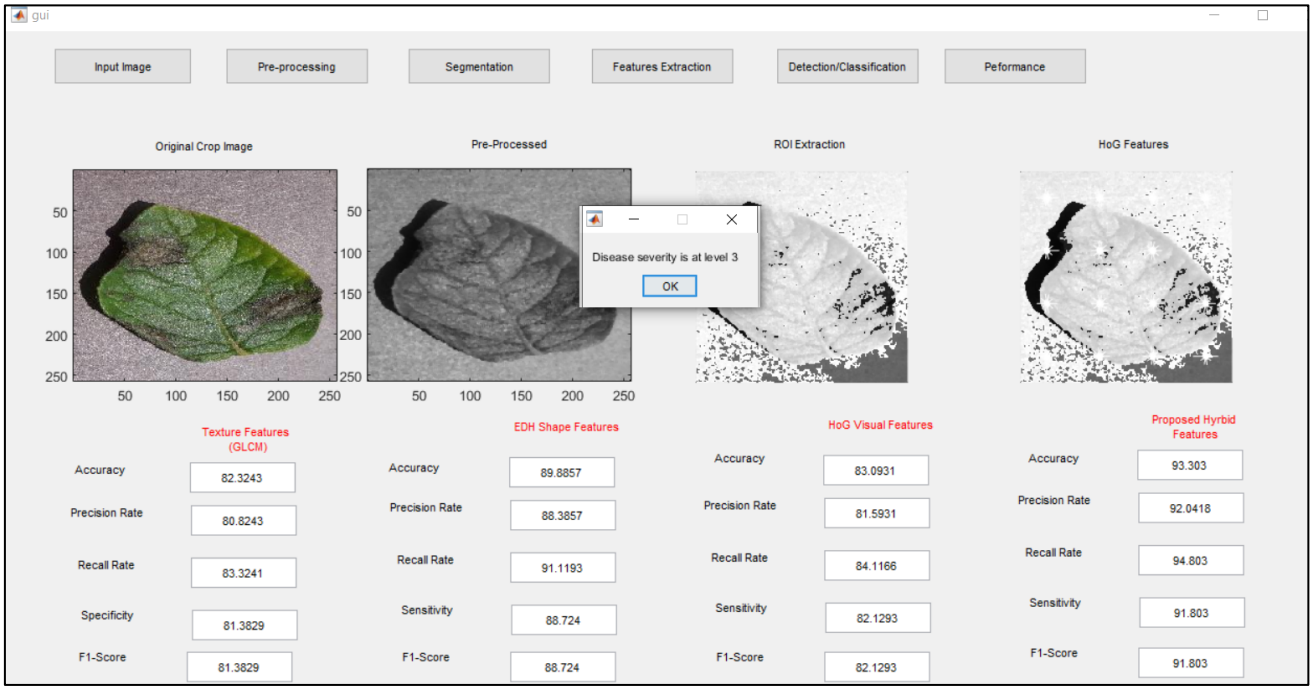

Figure – 4

Performance Analysis Of Different Feature Extraction Methods

Parameter	Texture	Shape	HOG	Hybrid
Accuracy	90.60	89.89	90.69	93.9
Precision	97.20	99.53	97.00	99.2
Recall	92.20	89.90	92.06	93.39
Specificity	46.20	26.30	44.73	57.20
Sensitivity	97.20	99.50	97.00	99.20

Figure - 5