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A Study on Various Image Processing Techniques to Identify the White Patches Syndrome of Penaeus Monodon

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Abstract: ***This paper presents a study on variousdigital image processing techniquesto detect, quantify and classify the white-patches syndrome of penaeus monodonimage. This study is to know the suitabletechniquetoidentifythe diseased part of an image using image segmentation with denoise by using various image filtering techniques.The input image has acquired through high resolution cameras and later it can be denoised using either Gaussian or Median filters whichever is suitable for the given image. The filtered image is further segmented by using region growing methods and segment the white patches in the image using suitable technique. This paper is useful to researchers working on finding various skin diseases of a shrimp.***

Keywords: Image Capturing, Image Filtering,Image Segmentation, White patches, Penaeus monodon

I. INTRODUCTION

White spot syndrome is a serious disease for shrimp in aqua industry in Asian countries. There are huge inconsistencies in Aqua industry due to this disease worldwide. Due to late identification of this disease at clinical labs, there is huge loss for farmers and losing their profits. Due to its significance, a design of classifier for the early identification of white spot syndrome with optimal cost and better performance is need of the age. White spot syndrome virus is found in shrimp farming areas in the world which causes economic losses in aquaculture. This kind of virus is a threat for all species of shrimp. The Black tiger shrimp so called peneaus monodon has introduced in the year 1990 and reach the peak stage. White spot syndrome is the main factor leading to the decline of production. Aqua farmers are suffering a lot because of this disease.

This paper highlights various image processing techniques that will be helpful in the detection of white spot syndrome disease in peneaus monodon which is penaeid prawn species.It presents a methodology in order with first step capturing an image, second step removing noise from the image using image filtering techniques and finally third step segmentation [7]. The proposed image segmentation techniques are Edge Detection Segmentation viz., GA[5], Otsu Method based on Thresholding Segmentation, and K-Means, Fuzzy C-Means based on Clustering Segmentation. The expected outcome of this paper is to provide the best technique among all other image processing techniques to find a solution for white patches syndrome of a penaeus monodon.

II. METHODOLOGY

To identify white-patches of an image, the proposed work is divided into three steps:

1. Capturing the Image
2. Filtering the Image
3. Segmenting the Image

The proposed work of the process flow is given in Fig. 1

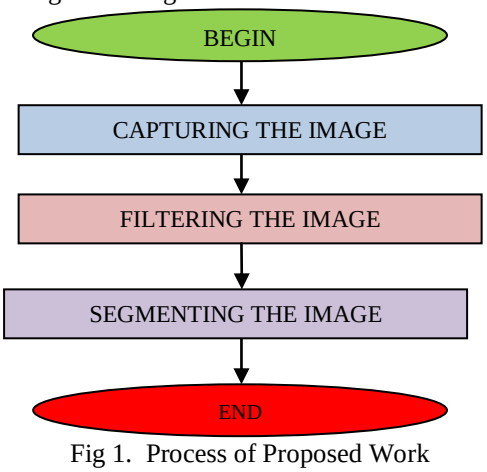


Fig 1. Process of Proposed Work

1. Capturing the Image

To gain the input image, it can be caught utilizing a tiny camera with 10 megapixels of determination to get great quality in the wake of keeping up an equivalent separation, edge and enlightenment to the article with same background. All the pictures are in formats like JPEG, TIF, BMP, PNG etc.,

2. Filtering the Image

Filtering of the image can be done by converting the image into digitized format and different mathematical operations are used to the data to further process. In images there may some noise due to various factors. This state of the image is called image noise. This noise must be removed before any further image analysis. Gaussian, Median, Linear etc., can be used to remove the image noise [11]. For this paper, some of filters are used to remove noise of an image in order to get the best quality to identify white-patches in the image.

Gaussian Filter

It is a linear smoothing filter. Here the weights are takenas per the shape of a Gaussian function. This filter is a good performed smoothing filter for removing noise which drawn from a normal distribution. The zero-mean Gaussian function in one dimension is

$$g(x) = e^{-\frac{x^2}{2\sigma^2}} \quad (1)$$

Here Gaussian spread parameter *(J)*finds the width of the Gaussian. For image processing, the 2 dimensional zeromean discrete Gaussian function,

$$g[i, j] = e^{-\frac{(i^2+j^2)}{2\sigma^2}} \quad (2)$$

is used as a smoothing filter.

Median Filter

In animage, the motivation noise which is called salt and pepper noise can expel through this median filter. It is nonlinear filter, which replaces the estimation of the inside pixel, by the median of the gray levels in the image region encased by the filter. The median of a numerical accumulation is such that a large portion of the qualities in gathering are not exactly or equivalent to medium, and half are more prominent than or equivalent to median [9].

Medianfilter can be executed as first window is moved and all the pixels encased by the window are shorted. After that median is processed and this worth is assigned to center pixel. On the off chance that the quantity of components in K*K window is odd, middle value is assigned as median value, else average of two middle values is assigned as median value.

3. Segmenting the Image

Segmentation is a procedure which isolates aimage into its segment parts or objects. Segmentation must stop when the segment parts of significance for an application have been difficult to reach. Segmentation on images depends on the intermittence and closeness of imageintensity values. Intermittence methodology is to split animage taking into account sudden changes in intensity. Comparability methodology depends on dividing aimage into locales which are comparable as indicated by an arrangement of predefined conditions [10].

Basically the segmentation of the image techniques shown in Fig. 2 is divided into two categories [7]

A. Region-based segmentation and
B. Edge-based segmentation

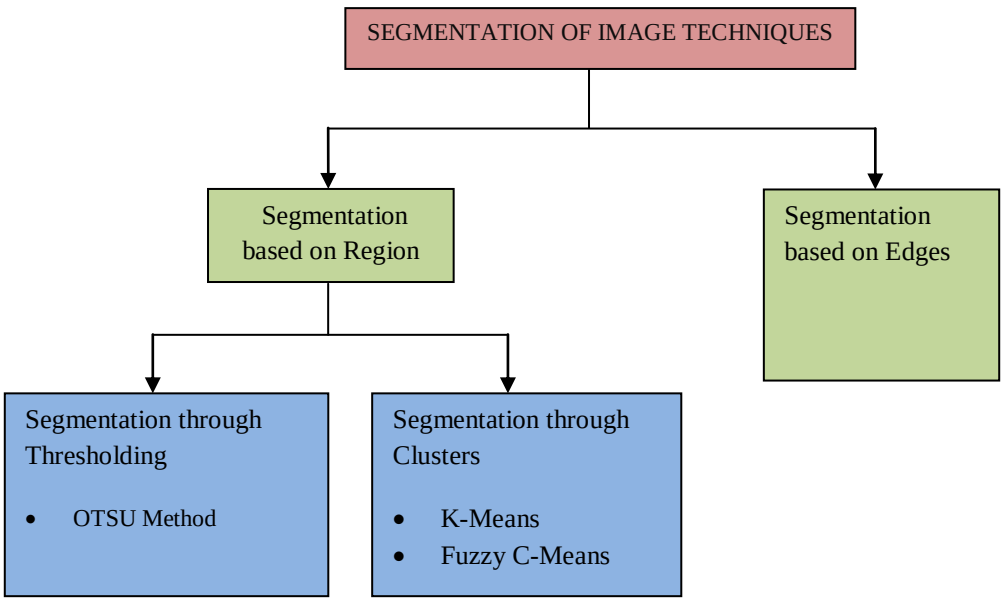


Fig 2. Image Segmentation Techniques

A. Segmentation Based On Region

Region-based methods had an assumption that the neighboring pixels within one region have similar value. Here it compare one pixel with its neighbors. If a similarity criterion is satisfied, the pixel can be set belong to the cluster as one or more of its neighbours [6].

a. Threshold Based Segmentation

This kind of segmentation of more significant for images having light objects on dark background. This technique is based on features of image. This operations convert a multilevel image into a binary image i.e., it choose a proper threshold T, to divide image pixels into several regions and separate objects from background [1].

This sort of segmentation of more critical for images having light objects on darkbackdrop. This method depends on features of an image. This operations change over a multilevel image into a binary image i.e., it pick an appropriate limit T, to divide image pixels into a few regions and separate objects from backdrop [1].

OTSU Method:

OTSU is a traditional method in image segmentation. It is a statistical method according to its probabilistic implementation [9].In this method, the pixels are separated into two classes C_0 and C_1 (background and object), using a threshold at level K. Later class means (μ_0, μ_1) and class variances (σ_0, σ_1) are calculated. Then a threshold K is searched, that maximizes one of the object functions (l, k, n) [4].

$$l = \frac{\sigma_B^2}{\sigma_W^2}; \qquad k = \frac{\sigma_T^2}{\sigma_W^2}; \qquad n = \frac{\sigma_B^2}{\sigma_T^2}$$

b. Clustering Based Segmentation

Clustering is an unsupervised learning how to distinguish a limited arrangement of clusters to order pixels. At the point when classes are known ahead of time then grouping can be utilized. Through closeness criteria every single comparable pixels are assembled together to shape clusters. In view of the standard of amplifying the intra class comparability and maximizing the inter class likeness the cluster groups can be shaped. There are diverse classifications of Clustering which are delegated k-means grouping, fuzzy grouping and so forth., [10]. By utilizing these Clustering techniques, this paper notice to distinguish the white-patches of an image.

K-MEANS Clustering Technique:

In arranges the objects into different clusters or groups. Every cluster information shares some regular quality. It is unsupervised learning that performs dividing the information set into k bunches [3]. This strategy that arranges the input information objects into different classes through their innate separation from each other. Here a vector space is shaped from the information elements and discovers natural groups in them.

Steps in K-Means Clustering Technique:

1 Calculate the distribution of the intensity values.
2 Initialize the centroids through k irregular intensities.
3 Repeat stages 4 and 5 until the names of the cluster don't change from this point forward
4 Cluster the image points based on the distance from centroids of their intensity values

$$c^{(i)} := \arg\min_j \left\| x^{(i)} - \mu_j \right\|^2$$

5 Calculate new centroid for each cluster

$$\mu_i := \frac{\sum_{i=1}^{m} 1\{c_{(i)} = j\} x^{(i)}}{\sum_{i=1}^{m} 1\{c_{(i)} = j\}}$$

FUZZY C-Means Clustering Technique:

Fuzzy c-mean clustering is a simple unsupervised learning method, which can be used for data grouping [2]. The FCM algorithm is very popular in fuzzy clustering technique.

FCM algorithm:

Initialize $V = \{v_1, ..., v_c\}$

Initialize convergence criteria

Initialize degree of fuzziness m>=1

Repeat

-$V^{previous} = V$

-Compute membership function using Eq.4

-Update cluster centers Eq.5

Until

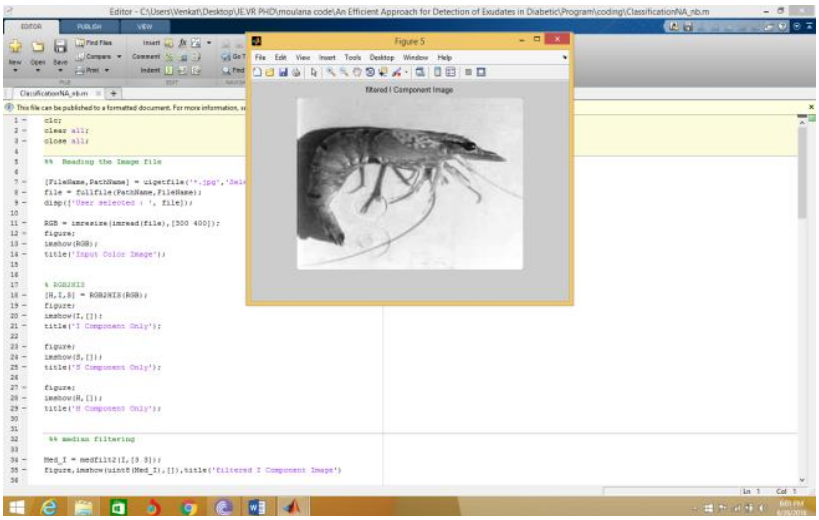
$$\sum_{i=1}^{c} \left\| V_i^{previous} - V_i \right\| \prec \varepsilon$$

B. Segmentation Based On Edge Detection

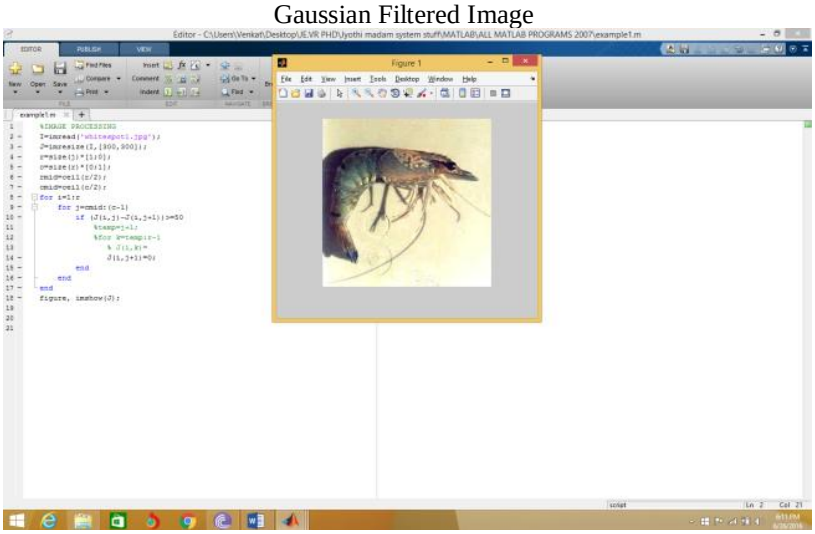
Edge detection is classifying and placing sharp discontinuities as a process of an image. The discontinuities are prompt changes in pixel fixation which recognize limits of articles in a scene.The output is a binary image. Many edge detection algorithms presented in [8]. Among all, some algorithms are also addressed the problem of identifying the white patches of the penaeus monodon image.

III. IMPELEMENATATION AND RESULTS

The proposed techniques of image processing was implemented in MATLAB 2013b and several images consisting of multiple objects were tested. The image of the Penaeus monodon is tested with various techniques as seen in the Fig. 3, 4, 5, 6, 7.



Gaussian Filtered Image



Median Filtered Image

Fig 3. Image Pre-Processing Techniques

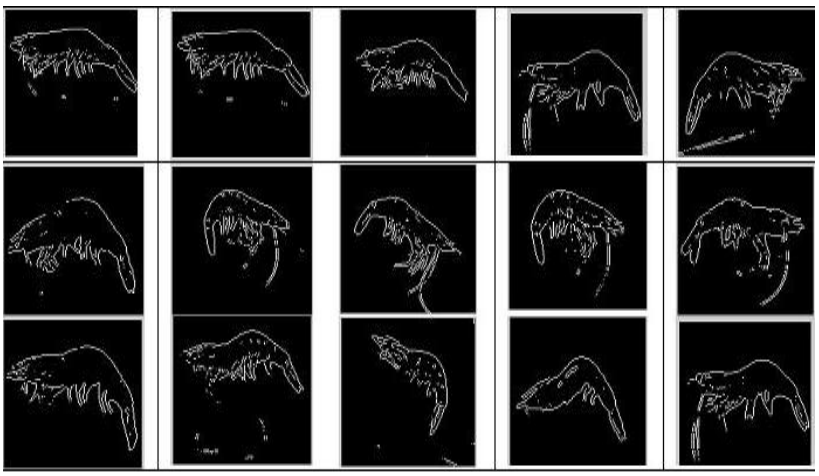


Fig 4. Edge Detection based Segmentation

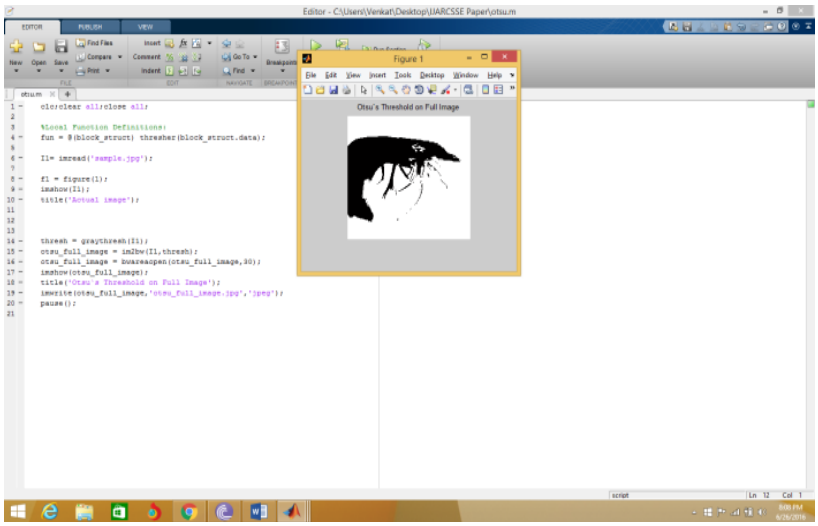


Fig 5. Otsu Method Segmentation

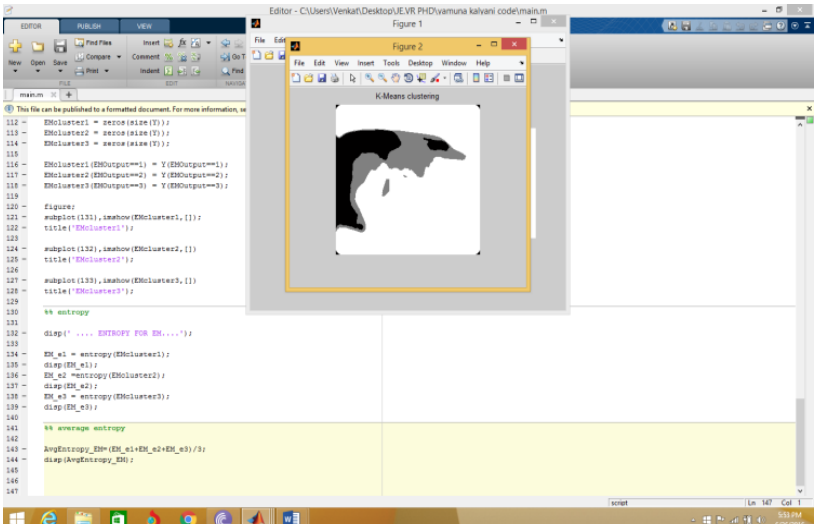


Fig 6. K-Means Clustering Segmentation

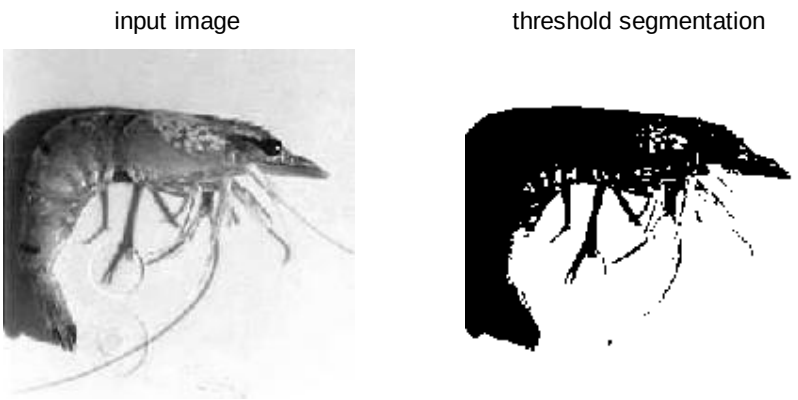


Fig7. Fuzzy C-Means Clustering Segmentation

IV. DISCUSSION

Among all various image processing techniques, the results shows that K-Means Clustering techniques is more efficient and suitable technique to identify the white patches syndrome of the penaeus monodon of an image comparatively with other techniques. This study will be helpful for further investigation on white patches syndrome of the penaeus monodon.

V. CONCLUSION

Various techniques in image processing is proposed to identify the white patches in penaeus monodon image in this paper. The implementation results show satisfactory results on various image processing techniques. This implies that K-Means clustering image segmentation technique is suitable process in identifying the disease of the penaeus monodon. This study is required to be continued for future investigation in various skin diseases to be identified forshrimps.

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