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Optimized threshold based EM Fusion Technique for Shrimp White Spot Disease Detection

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ABSTRACT

Shrimp farming is the most profitable business of aquaculture farming. If a single shrimp gets affected by a disease, then the disease will spread within no time. Thus, shrimp diseases are considered as the primary cause of huge economic loss throughout the world. There is necessity of a new and efficient shrimp disease detection system. White spot syndrome virus is a special kind of pathogen which causes white spot disease in shrimps. This virus can affect both shrimp as well as other crustaceans. There is no proper treatment technique to cure different viral infections in shrimp and crustaceans. Most of the shrimp disease detection systems follow the basic concepts of image segmentation process and image fusion process. The process of image segmentation plays a vital role in shrimp disease detection like characteristic extraction, pattern detection and target recognition. In this paper, a novel threshold-based image blend method is projected to improve the white spot detection rate with high accuracy.

Key words: White spot disease, shrimp disease, image thresholding , image fusion.

1. INTRODUCTION

Pathogen like White spot syndrome virus is which usually affects most of the shrimp species all over the world. It is the prime reason behind huge economic losses of shrimp farming business. This virus is not only dangerous for shrimp species, but also dangerous for various kinds of marine and freshwater crustaceans just like crab and crayfish. There is no significant prophylactic treatment strategy developed in order to cure several viral infections in shrimp and certain kinds of crustaceans. Because of the present day aquaculture methodologies along with the vast host range of WSSV, there are several vaccinations against the particular virus. These strategies are beneficial in order to protect shrimp farming.

Some of the most popular vaccination strategies are:- gene therapy, DNA vaccination, recombinant vaccination,oral vaccination and recombinant vaccination. Among numbers of different strategies, there are two mostly used and popular strategies, those are:- histograms scheme and k-means clustering approach. Gross observations in shrimp can be evaluated at the farm or pond side with the help of small instruments. In most of the scenarios, these observations are not enough in order to detect prawn species and coastal management. An effective and efficient machine vision system is implemented in order to monitor shrimps in aquaculture ponds. The above mentioned system has the responsibility to analyse feed consumption and shrimp size distributions. Cameras in lightning systems are operated in the near infrared in order to get controlled illumination.

Image analysis techniques are implemented process of segmentation with the help of refractive index boundaries. Here we can mention one example; certain fields of aquaculture got the advantages from the implementation of farm automation and monitoring instruments. Shrimps mostly live inside water and they often touch each other. Hence, the chance of disease contamination is very high. If a single shrimp gets affected by a pathogen that causes disease, then the disease will spread very rapidly. Therefore, the disease will become the primary cause of huge economic loss throughout the world. So, there is necessity of an efficient and effective shrimp disease detection system.

1.1 Image Segmentation

The process of image segmentation can be defined as a process by which a single image is decomposed into several regions those have uniform and homogeneous attributes. The process of image segmentation is very vital in case of high level tasks just like feature extraction, pattern recognition and target identification. There are numbers of different schemes those support the process of image segmentation of textured natural images. Certain techniques completely depend upon the integration of a common image to enhance the quality of segmentation outcomes. Apart from this, we can achieve a proper compromise the complexity and efficiency. Almost all of the traditional techniques from a set of original and comparative segmentation maps completely depend upon the notion of median partition. The median partition technique has an objective to reduce the average of the distances isolating the solution from other segmentations. There have been carried out extensive amount of research works which depends upon the outcomes of the median partition issue.

1.2 Image Fusion

Almost all of the depict systems will restricted intensity of range. Emphasis is always given in a restricted space from the imaging plan. All the objects closer or farther become blurred or out of focus. Temporal sensor combination is identified as the major causes behind the blurring effect. Numbers of different images of a particular scenes can be captured through supplement to focus neighborhoods. But, these images are not applicable for perception. There are numbers of different computer vision applications for which these images are useless. Therefore, multi focus image fusion is considered as the most efficient solution [16]. The above-mentioned technique is responsible for automatic detection of focused regions in case of multi focus images. All of these images are combined in order to generate a composite image. Within a composite image, all of the objects are in focus. Since last two decades, there have been large numbers of multi focus image fusion approaches developed. According to the domain, methods are been classified into binary classes, transform domain as well as spatial domain methods. The working procedure of this transform based multi focus image fusion techniques can be divided into three phases.

1. In the initial stage, all of the source images are converted to transform domain.
2. Based on certain fusion rules, this transform positions are combined together in order to form composite coefficients.
3. Merged coefficients are again transformed to the spatial area in order to make fused image.

There are numbers of different transform image fusion techniques. Among those techniques, presently, spatial domain image fusion techniques have attracted many researchers. These techniques are capable enough to a different representation. All of these approaches implement a fusion rule on the source images in order to get completely focused image. All of these schemes can be classified into two categories, those are:-

1. Pixel level approaches and
2. Block or region label approaches.

In case of image fusion techniques, the pixels of source images can be averaged in order to generate the composite image. All of these approaches are quite simple and very fast. On the contrary, ghosting and blurring are certain serious problems. In case of region based multi focus image fusion techniques, the source images are decomposed in to numbers of different blocks or regions. Certain focus measurements just like variant, gradient are evaluated for every individual region. According to this measure, the focus measure is a binary map which is usually used to represent the blur and focus regions. In other words, it can be defined as a weight map having continuous values among 0 to 1. This range is used to represent both the blurred and focused regions. Examples of quality degradation are:- decrease in variance and vanish. It is quite challenging task to get satisfactory illustration performance in the above scenario.
Since years, there have been extensive amount of research works carried out in order to resolve the issues of hazing. Depending upon the numbers of input images, these approaches can also be categorized into two subcategories, those are:

1. Single image de-hazing and
2. Multi-scale fusion de-hazing approaches.

The first technique needs only a single input hazy image. On the contrary, the second one needs multiple numbers of input hazy images. The recovery scheme for the actual hazy image results lower algorithmic complexity. But the insufficient information may cause problem during the process of restoring observed hazy images. On the other hand, the multi scale fusion de-hazing approaches include different images at various kinds of weathers. The second approach always have vast amount of information, but this technique is more expensive and having high complexity.

2. RELATED WORKS

P. V. Rao introduced a new shrimp disease identification system by including the theories of back propagation neural networks [1]. Shrimp disease detection is considered as the most important and more popular field of research. By considering the low level of knowledge and poor reasonableness, an advanced shrimp disease recognition system is developed. This shrimp disease recognition system completely depends upon neural networks. This system includes the concepts of traditional shrimp disease detection system in order to form a network. This network has the responsibility to detect white spots syndrome disease that can be recognised through the trained neural network. This approach has the responsibility to detect each and every shrimp disease. Apart from this, it has significant importance in the modification process of shrimp disease analysis framework. This technique involves the traditional machine intelligence in the domain of aquaculture. In this piece of research work, a database of clinical sites are utilised during the process of feature extraction of white spot syndrome. The above-mentioned features are inserted in the neural network as an input. The presented approach is used just like a back propagation technique. By implementing this approach, overall accuracy of 88% can be achieved. The accuracy can be improved significantly.

A. Rocío Cabazos-Marína et.al, developed automatic focus and fusion image approach with the help of non-linear correlation [2]. They introduced an advanced autofocus and fusion technique in order to characteristics to improve the image along with reduced execution time. The above-mentioned autofocus approach has the responsibility to choose the best focused image in between stack of images gathered from various distances from the object. For every individual image in a particular stack, a vector is defined. The vector includes different elements selected through spiral scanning of the image. The spectrum for free individual vector is evaluated with the help of Fourier transform method. After that, nonlinear correlation must be implemented to the reference vector spectrum. For every individual image of stack, the relevant BFI is calculated. The complete process of fusion is performed along with a sub-group of images. It helps to evaluate the measure value close to the BFI ones. After that, the parabolic filter is implemented in order to detect the relevant elements of the images. These images play significant role during the fusion process. In the evaluation phase, a multi-image metric and a quality measure are used in order to represent the percentage enhancements of the fused image. We can mention here that, the above presented AFA algorithm enhances the image quality in reduced amount of time as compared to other classical approaches.

A. Galdrana introduced image dehazing with the help of artificial multiple-exposure image fusion [3]. Bad weather conditions can decrease the visibility of images collected outdoors. The visibility reduction means reducing the visual clarity. Image de-hazing approach can be defined as a specific kind of image processing approach that deals with the mitigation of the above mentioned effect. In this research paper, they have introduced an advanced image de-hazing approach which has the responsibility to eliminate the visual degradation because of haze. The above-mentioned approach discards the requirement of estimating depth along with expensive depth map refinement processes. In order to achieve the above objective, Images are combined to a haze-free outcome with the help of a multi-scale Laplacian blending approach. By analysing the outcomes of the above proposed approach, the fusion of artificially under-exposed images are capable enough to eliminate the effect of haze. All other traditional de-hazing approaches are incapable to generate better-quality outcomes.

Y Gao et.al, state the multifocus picture fusion approach [4]. The images and videos those are gathered at the time of bad weather generally have poor quality. Significant reduction of contrast value and faded color are major factors for the poor quality. All of the previously developed approaches are not efficient enough to resolve the issues of halo artifacts and brightness distortion. In this piece of research work, a multi-focus fusion approach for single fog image restoration is presented. Initially, they estimated the global atmospheric light only in the sky regions in order to decrease the interference from various regions. In the subsequent phase, they proposed fast local Laplacian filtering method along with adaptive boundary constraint. It has an objective to optimize the transmission process. Apart from this, it also decreases the halo artifacts significantly. At last, they have eliminated the haze and generated a visual recovery on natural effect with the help of a new multifocus image fusion approach. It can efficiently resolve the brightness distortion issues significantly. An advanced multifocus image fusion approach is presented in order to blend three numbers of de-hazing images gathered through various global atmospheric light and the transmissions. It enhances the influences of de-hazing image. This approach generates three numbers of images from an observed hazy image in order to resolve the hazy for the initial time. Additionally, this approach is efficient enough to generate image information in order to enhance the visual effects.

F. Garcia-Lamont, et.al, performed a thorough survey on color feature-based image segmentation approaches [5]. Image segmentation can be defined as a very important phase during the process of object recognition. Different kinds of approaches are presented since years for grayscale and color images. In the above presented research paper, they introduced a thorough survey on different kinds of color image segmentation approaches. They have included the basic concepts of different techniques The color spaces play vital role in all of the above mentioned approaches. Each and every color space is analysed in order to process colors. Apart from this, they have implemented the above proposed approach in certain important applications those include the basic concepts of image segmentation. At last, group of metrics are needed to compute the segmented images accurately.

S. Hosseinpour, et.al, analysed various applications of computer vision approaches for on-line monitoring of shrimp color modification at the time of drying [6]. The influences of drying temperature and drying medium velocity on color change kinetics of shrimp are analysed in this research paper. Drying experiments are performed on dryer with computer vision first-order and fractional conversion schemes are helpful in order to describe the color modifications of shrimps. The above-mentioned fractional schemes use experimental data. By analysing the outcomes, we can mention here that, the color parameters are affected via the studied parameters. If different color parameters increase at the time of drying, then the lightness of the samples reduces significantly. The color characteristic of the SSD based products are better as compared to the HAD processed samples. At last, dimensionless moisture content of shrimps at the time of drying is correlated to the color parameters. For the above mentioned correlation, quadratic regression scheme is applied. The moisture ratio is strongly correlated with the lightness modifications than that of redness and yellowness modifications. S. Hosseinpour, et.al, introduced an advanced image processing technique for in-line monitoring of visual texture at the time of drying [7]. The prime objective of this research work is to eliminate the unwanted influences of samples structural and positional modifications on the image texture features.

P. V. Rao et.al, performed a survey on advances in machine learning methods for a pelagic shrimp disease detection [8]. Shrimps are usually affected with different kinds of diseases. We can mention here that, white spot disease of the shrimp is considered as the most dangerous disease which is responsible for huge economic loss. It can affect different species of shrimps such as:- Penaeus Monodon and Penaeus Vennammei. There exist large numbers of computer vision approaches which can detect white spot disease in case of shrimp. This approach is very much helpful in order to get perfect solution with the help of different image processing approaches and neural network approaches. The main intension of this method is to find out the white spot disease and assist the aqua farmers to take required and appropriate decisions. Early and proper diagnosis of disease is very much important. White spot syndrome disease can be defined as a specific disease which is mostly found in shrimp species. A proper survey is performed which has the objective to identify various kinds of diseases. Different diseases in case of all domains are detected through the implementation of efficient machine learning approaches. It can achieve better recognition accuracy and speed. In future, this research work can be modified and extended in order to automatically detect the severity of the disease. Apart from this, this approach can be enhanced to form various efficient hybrid approaches. Again, the overall recognition rate can also be enhanced significantly.

L. Khelifi and M. Mignotte developed an advanced multi-criteria framework for the fusion of color image segmentation [9]. With the rapid advancement of technology, numbers of practical applications of image processing techniques are increasing rapidly. It is very much essential to propose an advanced and efficient image processing algorithms in order to resolve the issue of image segmentation. Since last decade, numbers of research methodologies are proposed in the field of fusion based segmentation. The above mentioned fusion based approaches use consensus clustering method. The major issue of all of these approaches is to choose the best fusion criterion that will help to achieve best performance in case of an image segmentation model. In this piece of research work, they introduced an advanced image segmentation model. This technique includes the basic concepts of multi objective optimisation process. The prime objective of this work is to resolve all the issues produced by the single criterion. Apart from this, it has the responsibility to generate enhanced segmentation.

The above-mentioned fusion model integrates two different conflicting as well as complimentary criterion to carry out fusion segmentation. These criterion are known as region based variation of information criterion and contour based F-major criterion. The entropy based confidence weighting factor has significant role during the integration of the above two criteria. In order to optimise the energy based model, they have developed a modified and extended version of regional optimisation procedure. The mentioned optimisation procedure completely depends upon super pixels. These super pixels are generated from the iterative conditional mode scheme the above proposed multi-objective median partition based technique completely depends upon the fusion of an accurate, fast and spatial clustering outcomes. They have considered Berkeley database for the experiment and by analysing the outcomes of this technique, we can mention that, this approach is very much feasible and efficient as compared to other traditional approaches.

Z. Liu, F. Cheng and W. Zhang presented a new recognition –based image segmentation approach of touching pairs of cooked shrimp (Penaeus Orientalis) with the help of enhanced pruning method for quality measurement [10]. Shrimp that touch each other can be very conflicting during the process of assessing shrimp quality with the help of a machine vision system. In order to resolve this issue, recognition based segmentation approach which is also known as improved pruning approach based on watershed scheme is introduced in this research paper. Total 352 individual shrimp are included in order to form the classification model during the training phase by implementing the above proposed technique, 96.39% average hit ratio and 0.0265 average standard deviation can be achieved with three numbers of iterations. In the testing phase, total 247 touching shrimp are considered along with 6 touching scenarios. By analysing the outcomes of the above proposed technique, we can say that, this technique is capable enough to separate the touching shrimp along with average height ratio of 90.94% and average standard deviation of 0.065. This approach is robust in order to isolate most of the touching scenarios along with small number of exceptions (overlapping of shrimps or presence of rough boundaries).

M. Mohebbi, et.al, developed a new computer vision system in order to estimate the moisture content in case of dehydrated shrimp [11]. This research paper includes a new approach that completely depends upon computer vision systems which has the responsibility to estimate shrimp dehydration level. The dehydration labels can be evaluated through the analysis of color at the time of drying process. The most common color space which is used in food industry is L*a*b. RGB digital images are converted to L*a*b units in two different phases. All the experimental data those are gathered from images captured at various drying temperature and certain time intervals. Complete randomised block design method is used during the collection of these experimental data. Multiple linear regression and artificial neural networks can be implemented in order to correlate the color features to the moisture content of dried shrimp. There is no significant and statistical difference in between these two approaches. Both approaches are capable enough to predict the shrimp dehydration along with very high correlation. The automated vision based systems are better as compared to other traditional subjective approaches.

D. C. T. Nguyen, et.al, proposed a superpixel and multi-atlas based fusion entropic scheme in order to segment X-ray images [12]. X-ray image segmentation process is considered as the most popular process. It is very much important during the three-dimensional bone reconstruction process. On the other hand, the process of segmentation is challenging when considering human structures of the lower limbs. In this piece of research work, they have introduced a new multitask fusion framework for the process of automatic segmentation. In above proposed technique, a training dataset of co-registered x-ray images of bone regions are used to estimate a group of super pixels. These super pixels have the responsibility to consider nonlinear and local variability of bone region present inside a training data set. Apart from this, it has significant role during the simplification process of the super pixel map pruning process. Again, a propagation phase is also included in this technique which completely depends upon the entropy theory for refining the final segmentation map. The researchers have performed the process of cross validation by considering 31 manually segmented graphic image dataset for every individual bone structure.

This technique can achieve better performance than that of probabilistic patch-based label fusion models and traditional patch-based majority voting fusion method. The classification accuracy can be achieved through implementation of the above proposed method.

T. H. Noble, et.al, emphasized on PCR testing of single tissue samples in misleading data on gill associated virus infection loads in shrimp [13]. In case of shrimp aquaculture, the presence and load of pathogens is very crucial for the process of disease management. Any infection which is caused by pathogens is not distributed homogeneously throughout all the tissues. The identification strategy is different for different types of tissues. Apart from this, the infection severity and nature of the tissue play vital role during the disease management process. This approach includes the basic concepts of reverse transcriptase real time quantitative PCR in order to evaluate the sensitivity and variability. In future, additional research works are needed to be carried out in order to modify and enhance proposed technique. The accuracy and performance of the above presented technique can be improved significantly.

N. Paramanandham and K. Rajendiran developed multi-focus image fusion approach with the help of self – resemblance measure [14]. The process of image fusion can be defined as a process in which different source images are integrated together in order to give rise a single image. The resulted image can provide necessary and important information. The redundancy can also be decreased significantly. In this research paper, the authors have included the basic concepts of pixel correlation characteristic in order to develop a fusion rule that depends upon self-resemblance measure. A new and effective image fusion scheme is introduced in order to combine multifocus images with the help of self-resemblance measure, consistency verification and Multiple Objective Particle Swarm Optimisation. According to the above mentioned fusion rule, all of the source images are combined together. Several quantitative metrics just like root mean square error, peak signal to noise ratio, correlation, standard deviation, mutual information and petrovic metric have also significant role in the development of the framework. This technique is compared with other traditional approaches in terms of visual effect and objective evaluation criteria.

J. Tian, G. Liu and J. Liu introduced an advanced multi-focus image fusion approach which is based on edges and focused region extraction [15]. The goal of the multifocus image fusion is to combine different partially focused images in order to form a sharper image. The detection procedure of focused region is very crucial and vital. In this research paper, the presented image fusion approach depends upon two different kinds of edges and focused region extraction. The first kind of edge is also known as salient focus edges. The above mentioned focused edges can only be found inside the focus regions. These regions can be identified with the help of high pass filter images and a threshold approach. This technique can be implemented in order to distinguish focused regions source images according to the quad tree structure. Another kind of edge is known as canny edge which can be utilised to refine the boundaries of every individual focused region. At last, the extracted focus regions are integrated in order to form a clear image. From numbers of different advantages of this approach, the most important advantage is:- the resulted images can eliminate distortion artefacts. Again, it can also preserve the sharpness of the focused objects.

3. PROPOSED APPROACH

There are several methods for computing the texture features. The most commonly used methods for describing the texture are spectral, structural and statistical methods. The spectral method uses the images in the frequency domain to extract the texture feature. So, this method requires Fourier transform of the actual image to acquire frequency domain representation of an image. The periodicity and directionality of the texture are revealed by the two dimensional power spectrum of an image. Therefore the iterative thresholding approaches perform well with the texture having the strong periodicity. The performance of these approaches degrades as the periodicity of the texture weakens. Structural methods perform well with deterministic patterns. In general, most of the textures may not be stick on to that geometry but they exhibit uncertain random behavior.

In this paper are proposed to provide two algorithms, since there is no general solution to the problem of image segmentation in submarine image processing. Existing techniques must often be combined with domain knowledge to solve the segmentation problem for a specific application effectively. The proposed threshold method in the first algorithm is used to find the regions of the shrimp by using inter and intra variances. The second algorithm combines segmented images with a single picture called image fusion, which preserves the important characteristics of the images from the individual segmented images. This technique uses an image to identify the possible objects in it. However, some of the edges of the target cannot be retained. The second algorithm uses the maximization of expectations to improve the detection of shrimp in order to remove noise.

3.1 Pre-processing

Pre-processing of shrimp white spot is the principal step in forecast of disease, to decrease the noise and to optimize the image characteristics. An adaptive median filter is used to improve the image feature as well as remove the poison noise from the image. In the median filter, a window pass along the image and the calculated median value of the window pixels becomes the output [17]. It preserves the limits and minimizes the noise in the image. Every pixel is replaced with the median value of the neighborhood of the input images as shown in Figure 1.

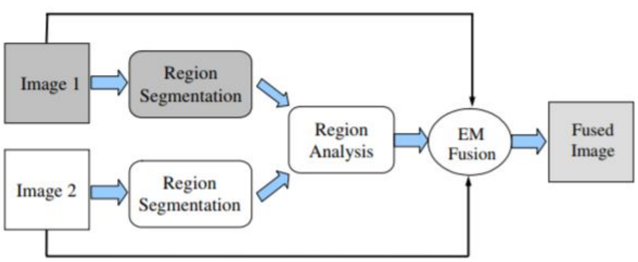

Figure 1: Architecture of the Enhanced Segmented Method

3.2 Maximized Probabilistic and Gaussian Thresholding Approach

The iterative method uses the exhaustive search based on the classes' background and foreground. Each frame in the training data is processed using threshold algorithm to filter the noise in the edges.

Step 1: Divide the shrimp image into two classes Cls_1 and Cls_2 with foreground level fl and background level bl with the region mean value μ_1 and μ_2 such that

$$\mu_1 = \sum_{i=1}^{n} X_{cls_1} / N$$

$$\mu_2 = \sum_{i=1}^{n} X_{cls_2} / N$$

$$Th = \frac{(\mu_1 + \mu_2)}{2}$$

Step 2: Determine the foreground level lower threshold using C-V model.

The variance of foreground level $fl = \{0,1,2...Th\}$ is

$$M_1(x,y) = (Th.\nabla(G_{min}(x,y)) + |\sigma_X(I - \mu_1)|)$$

$$M_2(x,y) = (Th.\nabla(G_{max}(x,y)) + |\sigma_X(I - \mu_2)|)$$

$$G_{min}(x,y) = min\{\frac{e^{-\sqrt{x^2+y^2}/2.\sigma_X^2}}{\sigma_X\sqrt{2.\pi}}, \frac{e^{-\sqrt{x^2+y^2}/2.\sigma_y^2}}{\sigma_y\sqrt{2.\pi}}\}$$

$$G_{max}(x,y) = max\{\frac{e^{-\sqrt{x^2+y^2}/2.\sigma_X^2}}{\sigma_X\sqrt{2.\pi}}, \frac{e^{-\sqrt{x^2+y^2}/2.\sigma_y^2}}{\sigma_y\sqrt{2.\pi}}\}$$

Let shrimp image be represented as I(x,y) with grey levels 0,1… ρ-1. The graph of the key image I is presented as $F=\{f_0,f_1.....f\rho-1\}$, where $f_0,f_1.....f\rho-1$ represents the frequency of each grey scale level in the key picture I.

Let $N = \sum_{i=1}^{\rho} f_i$ be union the entire picture element in the shrimp image. The probability of the i[th] grey stage is calculated as $Prob_i = \frac{f_i}{N}; Prob_i > 0, \sum Prob_i = 1$

The Proposed technique is detachment the shrimp image into T+1 parts as $S_k = \{S_o, S_1 .... S_k\}$. Here T is to choose from the set of thresholds T={t[r],t[r+1],…..t[r+1]-1}; Every part of neighbourhood is the set of grey level from T.

To every segment S to calculate the weighted probability and mean weighted grey levels η as Weighted mean grey scale intensity μ_{WI} and mean inter-class variance σ_{VS}^2 between the parts of whole image is given by

$$ws_k = \sum_{i \in s_k} Prob_i$$

$$\eta = \sum_{i \in s_k} \frac{Prob_i . max\{i, g*log(i)\}}{ws_k}; g \in GC$$

$$\mu_{WI} = \sum_{i=0}^{\rho} i * Prob_i$$

$$\sigma_{VS}^2 = \sum_{i=0}^{\rho} ws_k . \eta^2 - \mu^2{}_{WI}$$

$$(\sigma_{VS}^2)^* = \sum max\{\sigma_{VS}^2(S_i), \sigma_{VS}^2(S_j)\}$$

In the proposed design, optimal thresholds are strong-minded to every grey scale stage of the every part of region by maximising the inter-class variance as

$$\{t^*[1], t^*[2]...t^*[n]\} = argmax\{\sigma_{VS}^{2\,*}(t[1], t[2]....t[T])\}$$

3.3 Image Fusion using EM segmentation algorithm

Probability maximization algorithm follows an iterative three step procedure:
Step 1: E-step: In this stage, model based parameters, and proposed model compute the probability of every data point as a group. Let θ be the form parameter to be predictable using the posterior probability calculation. $\Pr ob(\theta/c)$ Is the probability of the incidence of the characteristic in the known disorder classes.

In the enhanced maximization stage, the parameters of the expected step are optimized using the following equation.

$$\Pr ob(\hat{\theta}/c)=\frac{\max\{\sigma_k(A_i,T),\sigma_k(A_i,F)\}\sum_{i=1}^{N}\Pr ob(D_{i,m}=c/D_i)}{|N|.\Pr ob(\hat{\theta}/c_k)}--(1)$$

Step 2: bring up to date the model parameters using the group assignments in the initial stage. Combination the disorder case in point using the naive parameter opinion calculation in proposed EM model as

$$\Pr ob(c/D_i,\hat{\theta})=\frac{\Pr ob(D_i/c,\hat{\theta}).\Pr ob(c/\hat{\theta})}{\Pr ob(D_i/\hat{\theta})}--(2)$$

Find the features using EM clusters as S_{IF}.
For each feature set $S_{IF}[i]$
Do

$$\eta_1=\sum_{i=1}^{|S_r|}S_r[i].Sim(S_r(x,y),S_{IF}(x,y))$$

$$\eta_2=\sum_{i=1}^{|S_{IF}|}S_{IF}[i].Sim(S_r(x,y),S_{IF}(x,y))$$

$$MI=MutualInformation(S_r(x,y)$$

$$Sim(S_r(x,y),S_{IF}(x,y)=Max\{MI,Correlation(S_r(x,y),S_{IF}(x,y))\}$$

$$\text{Similar Cluster measure}=\frac{2.Max\{\eta_1,\eta_2\}}{(\eta_1+\eta_2)}$$

Step 3: Iterate the process until all the parameters are updated or convergence or iterations completed.

4. EXPERIMENTAL RESULTS

Experimental results are performed on different shrimp image datasets. In this experiment the effectiveness of our representation, noisy white spot images of the shrimp are used with dissimilar variations. The average values of structural similarity index, correlated calculate and mean squared fault for the projected model with the customary models are performed on the datasets. Further, correspondence coefficient is used as presentation metric to give the comparison between the segmented regions.
SSIM: Structural similarity index is used to calculate the image deformation stage between the blare image and the filtered image. Experimental results are compared with existing methods [9][11] with the proposed are given in Table1 and the Figure 2 and Figure 3.

$$SSIM_{FImg}^{A,B}=\frac{1}{N}\sum_{i=1}^{N}[\varphi(i).sim(NI_i,FI_i)+(1-\varphi(i).sim(N_i,FI_i)]$$

Where 'sim' is the resemblance index between two images and $\varphi(i)$ is the covariance between the two images.

Table 1: Comparison of proposed model to existing algorithms on shrimp images.

Algorithms	Runtime(ms)	PSNR	SSIM
Niblack's	4335	46	0.64
Sauvola's	3855	53	0.68
Bernsen's	3755	48	0.71
OTSU	3646	51	0.73
Proposed	3014	59	0.86

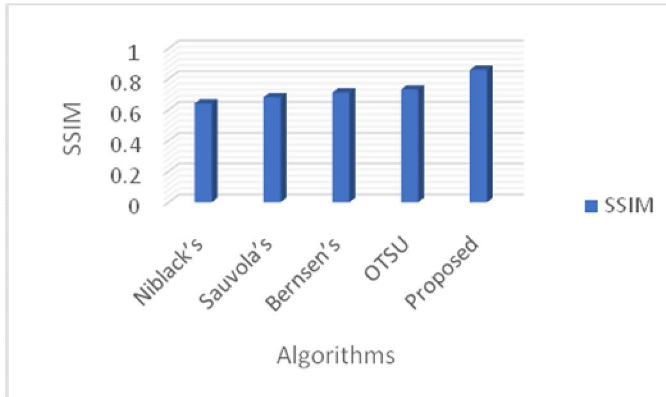

Figure 2: Comparison of EM fusion model to existing algorithms on shrimp images w.r.to SSIM.

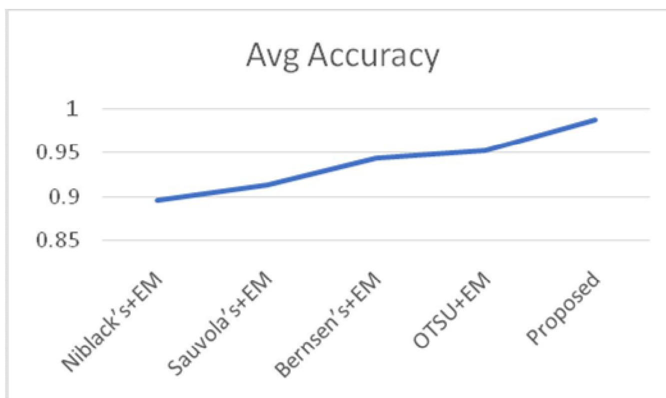

Figure 3: Comparison of proposed model to existing algorithms on shrimp images wrt accuracy.

5. CONCLUSION

Now-a-days, the image fusion algorithms are used in more applications to unite multi-focus image data into a single composite image. Most of the shrimp disease detection systems follow the basic concepts of image segmentation process and image fusion process. The process of image segmentation plays a vital role in shrimp disease detection like characteristic extraction, pattern detection and target classification. In this paper, a novel threshold-based image fusion technique is proposed to improve the white spot detection rate with high accuracy.

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