



White Spot Syndrome Virus Detection in Shrimp Images using Image Segmentation Techniques

G. Nagalakshmi*, S. Jyothi

¹Ph.D. Scholar, Dept. Of Computer Science, SPMVV, Tirupati*Author for communication agnl.lakshmi@gmail.com²Professor of Computer Science, SPMVV, Tirupati

Abstract- One of the most serious problems confronted by the shrimp farming industry is the disease caused by white spot syndrome virus (WSSV). This paper describes the detection of white spot syndrome virus in shrimp (*Penaeid prawn*) by using K-Means clustering technique in image processing. There are so many methods for finding out wssv in aqua culture methods in that Highly sensitive capacitive biosensor is one, that uses wssv shrimp pond water and mixes glutathione-S-transferase tag for white spot binding protein (GST-WBP) was immobilized on a gold electrode through a self-assembled monolayer. Binding between WSSV and the immobilized GST-WBP was directly detected by a capacitance measurement. Under optimum conditions the capacitive bio sensor gives the detections in the shrimp species. This process is time consuming. By using image segmentation techniques we can get accurate results and its cost is also less and is very fast compared to other techniques. The proposed method consists of capturing image sensing technique followed by image acquisition, histogram and K-Means clustering methods.

KeyWords: white spot syndrome virus, Image Analysis Algorithm, Camera Calibrations, Segmentation, K-means clustering

I. Introduction

White spot syndrome virus (WSSV), the causative virus of the disease, is found in most shrimp farming areas of the world, where it causes large economic losses to the shrimp farming industry. The potentially fatal virus has been found to be a threat not only to all shrimp species, but also to other marine and freshwater crustaceans, such as crab and crayfish. To date, no effective prophylactic treatment measures are available for viral infections in shrimp and other crustaceans. Due to current aquaculture practices and the broad host range of WSSV, intervention strategies including vaccination against this virus would be pivotal to save and protect shrimp farming. Several achievements have been attained in the search of novel vaccines for WSSV. DNA vaccination, recombinant vaccines, oral vaccination techniques and gene therapy are some of the thrust areas of focus for scientists and researchers. This review article highlights the recent trends in the detection of WSSV in shrimp either as histogram method or K-means clustering strategies. Gross observations in shrimp can be easily made at the farm or pond side using little, if any, equipment. Although, in most cases, such observations are insufficient for prawns species detectors and coastal management. Accurate and detailed gross observations are need. For hatchery production of penaeid prawn seed a steady supply of spawners is essential for effectively planning of the operations, it can done by a machine vision system for monitoring prawns in aquaculture ponds, developed as a tool to study feed consumption and prawn size distributions. Cameras and lighting system operate in the near infrared to obtain controlled illumination even in the presence of sunlight. Image analysis algorithms for segmenting prawns are outlined by using refractive index boundaries in underwater imaging and their relevance for camera calibrations.

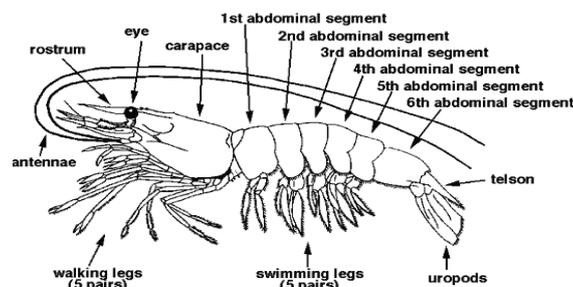


Fig1: Penaeid prawn showing all the parts of the body

Marine aquaculture has become one of the fastest growing industries worldwide, with annual growth rates of close to 15% for crustaceans during the 2000-2008 period [1]. Over the last decade, some areas of aquaculture, in particular salmon and tuna farming have benefited from the introduction of farm automation and monitoring equipment, including video-based sensors ranging from remote feeding and environmental monitoring systems. To date many of these advances for fish farming have not been implemented in prawn species detection aquaculture. Unlike fish, prawns

spend time on the bottom of ponds foraging and feeding. Husbandry techniques encourage algae blooms and other sources of turbidity in ponds. The resulting limited visibility combined with the bottom dwelling behavior present unique challenges, preventing the video techniques commonly used in fish farming from being successful for monitoring prawn feeding and sizes.

II. Camera Calibrations

Camera calibration is possibly one of the most classic and fundamental problem in computer vision which has been studied extensively for decades. It is fundamental because not only every newly produced camera must run calibration to correct its radial distortion and intrinsic parameters, but also it is the first step towards many important applications in vision, such as reconstructing 3D structures from multiple images (structure from motion, photometric stereo, structured lights etc). Camera self-calibration [8] avoids the use of known calibration pattern and aims at calibrating a camera by finding intrinsic parameters that are consistent with the geometry[12] of a given set of images. It is understood that sufficient point correspondences among three images are sufficient to recover both intrinsic and extrinsic parameters.

Algorithms for calibrating a pinhole camera can be primarily classified into two categories; those that require objects with known 3D geometry, and those that use self-calibration[4,8], including the use of planar calibration patterns. Both self-calibrations rely on point correspondences across images, it is important for these approaches to extract accurate feature point locations.

2.1 Camera Lens Calibration

The primarily goal of finding the quantities internal to the camera that affect the imaging process it includes

- Position of image center in the image it is typical not at (width/2, height/2) of the image
- Focal length
- Different scaling factors for row pixels and column pixels
- Skew factor
- Lens distortion(pin-cushion effect)

Scaling of rows and columns can be based on the camera pixels. These camera pixels are not necessarily square, and output of the camera may be analog (NTSC). The final image may be obtained by digitizing card i.e., in the form A/D converter samples NTSC Signal. Below fig shows the complete detail of converting the Captured image into the display form from into the monitor

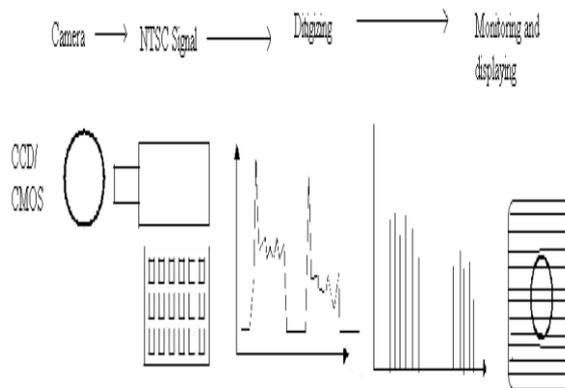


Fig2: A/D converter samples NTSC signal.

2.2 Hyper Spectral Imaging

Hyper spectral imaging is an emerging platform technology that integrates spatial information, as regular imaging systems, and spectral information for each pixel in the image. Compared to conventional RGB imaging, NIR spectroscopy and multispectral imaging, hyper spectral imaging has many advantages, like containing spatial, spectral and multi-constituent information and sensitivity to minor components[11]. The combined nature of imaging and spectroscopy in hyper spectral imaging enables this system to provide images in a three- dimensional (3D) form called “hypercube” which can be analyzed to ascertain minor and/or subtle physical and chemical characteristics of a sample as well as their spatial distributions.

2.3 Image sensing technique system

A laboratory visible and near infrared (VIS_NIR) hyper spectral imaging system was assembled to acquire hyper spectral images for prawns[7]. As Shown in fig1, the hyper spectral imaging system consists of a imaging spectrograph a high performance CCD camera an illumination unit containing two 150 W quartz tungsten halogen lamps, a table used for samples removing and a computer running the Spectral Cube data acquisition software which controls the motor speed, exposure time, binning mode, wavelength range and image acquisition. The camera spectral range was from 380nm to 1030nm divided in 512 bands. The camera has 672 X 512 (spatial X spectral) pixels with a spectral resolution of 2.8 nm.

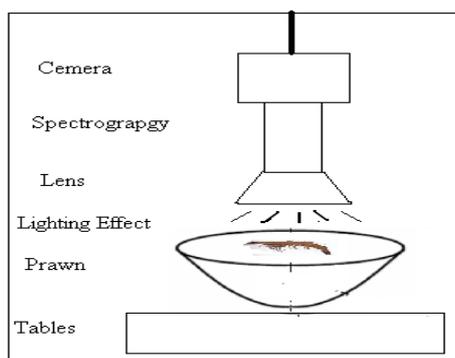


Fig3: Capturing Image sensing Technique by using Cameras

III. Prawn Image Segmentation

3.1 Image Acquisition

Glass dish is filled with prawns and was placed on the table in that the prawn is moving continuously and it be captured using 0.06 s exposure time to build a hyper spectral image with dimensions (x, y, λ) , where x and y are the spatial dimensions (number of rows and columns in pixels) and λ is the number of wavebands. Therefore, the images were acquired with 672 pixels in x -direction, n -pixels in y -direction (based on the length of the sample) and 512 wavelengths in λ -direction with 1.23nm between contiguous bands. 100X100 pixels were randomly selected from prawn image as a region of interest (ROI) and also treated as one sample. These samples were used to extract the spectral features and Structure features.

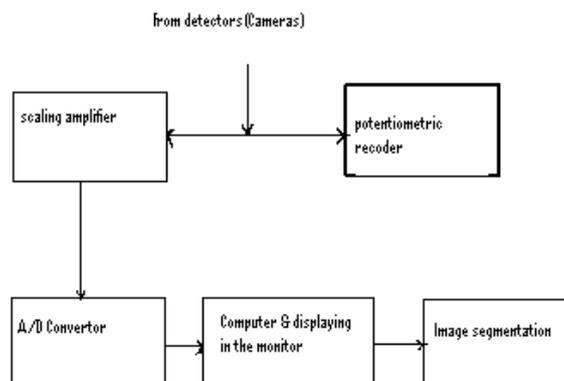


Fig 4: Image Acquisition System

The three categories of image-acquisition devices used in image segmentation are (I) Document Scanners (II) Charge-coupled device (CCD) cameras, and (III) Laser based detectors[14]. Document scanners as configured for densitometry are for measurements on images with one of the colored materials, CBB or silver. They operate in visible array CCD detectors used with the better densitometers can distinguish adjacent features that are separated by 50 μm or greater (spatial resolution), which is more than adequate for most image segmentation.

3.2 Edge Detection Technique

Edge detection is one of the most commonly used operations in image analysis, and there are probably more algorithms in the literature for enhancing and detecting edges than any other single subject. The reason for this is that edges form the outline of an object. An edge is the boundary between an object and the background, and indicates the boundary between overlapping objects. This means that if the edges in an image can be identified accurately, all of the objects can be located and basic properties such as area, perimeter, and shape can be measured. Since computer vision involves the identification and classification of objects in an image, edge detection is an essential tool. In this paper, we have compared several techniques for edge detection in image processing. We consider various well-known measuring metrics used in image processing applied to standard images in this comparison. Finally, an inverse transformation is applied to get the enhanced spatial domain image. Edges of this enhanced image can then be easily found with any spatial domain technique. Edge detection operators based on max and min operations are available in references [15,9]. In references [9] the entropy of a fuzzy set defined by an adaptive membership function, over a neighborhood of a pixel (x,y) is used as a measure of edginess at (x,y) . The use of an adaptive membership function makes the detection algorithm robust. The framework of the algorithm is quite general and works with any measure of ambiguity (fuzziness).

3.3 K-Means Clustering

Clustering can be considered the most important unsupervised learning problem; so, as every other problem of this kind, it deals with finding a structure in a collection of unlabeled data.

Clustering is defined as “the process of organizing objects into groups whose members are similar in some way”. A Cluster is therefore a collection of objects which are “similar” between them and are “dissimilar” to the objects belonging to other clusters.

The k-means algorithms are an iterative technique that is used to partition an image into k-cluster. In statistics and machine learning, k-means clustering is a method of cluster analysis which can to portions n observation into k cluster with the nearest mean[20-5]. The basic algorithms is given below

- Pick k cluster center's either randomly or based on some heuristic.
 - Assign each pixel in the image to the cluster that minimum the distance between the pixels cluster centre.
 - Re-compute the cluster centre's by averaging all of the pixels in the cluster.
- Repeat last two steps until convergences are attained. The most common algorithm uses an iterative refinement technique[6]; due to this ambiguity it is often called the k-means algorithms.

IV. Experimental Results

We taken input image as single prawn image which is captured by using camera and is shown in the fig3, then the captured image is used to specified the prawn species detectors. This process is also done by taken another two different types of prawns. The difference in the structure is identified and differentiated by using the following feature extractions.

4.1 Calibration from a Multiple Prawn image for lens distortion

The details of the lens distortion for the prawn image is displayed in MatLab by using orthogonal WDRC which is shown in the below figure. It can be used to identify the distortion of the original images by comparing with the other two different prawns. It can be done by using neighborhood technique in K-means clustering algorithm.



Fig4: Original image (Shrimp having white Spot Syndrome Virus)

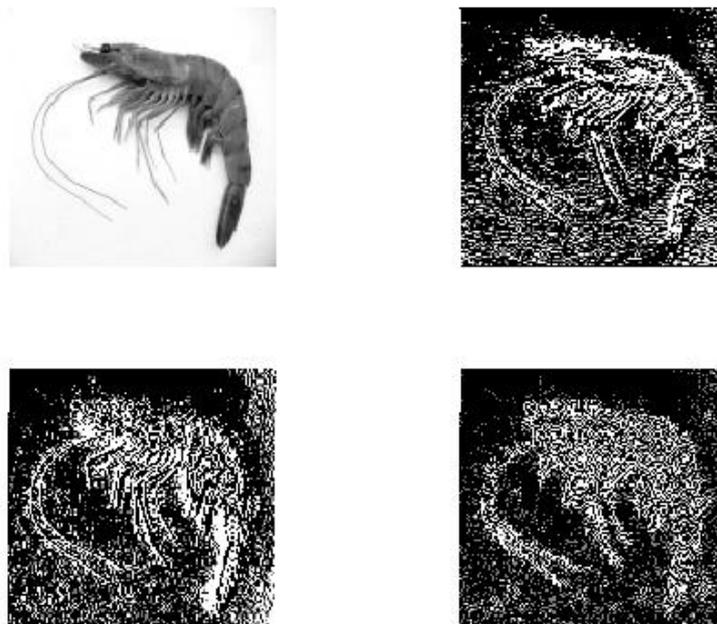


Fig5: Orthogonal WDRC

4.2 Calibration from a Multiple Prawn Image for noise distortion using wavelet:

The noise distortion of the prawn image is shown in the below figure. The threshold value between the original image and Histogram adjusted image is taken as 0.8

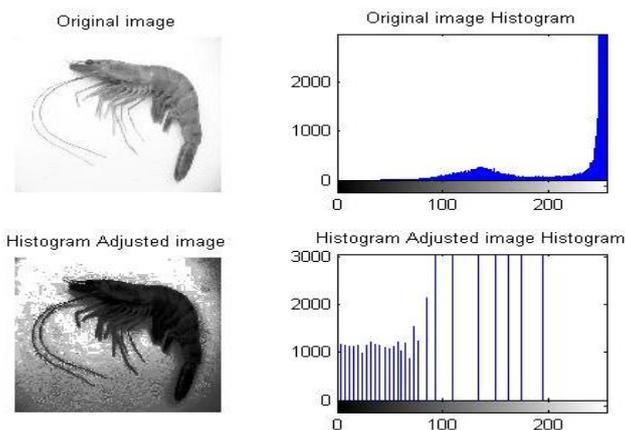
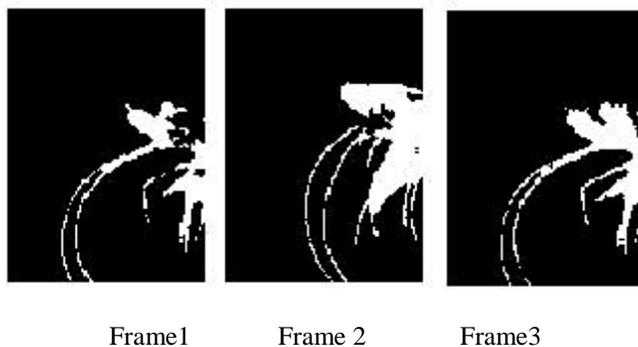


Fig6: Histogram details by using wavelet

4.3 Image segmentation by using edge detection to indentify the structure extraction:

The below figure gives the complete details of edge detection system which is implemented in MatLab. The given input Prawn image is compared with other two different Prawns is resulted as three frames i.e., frame1, frame2 and frame 3. Then by using edge detection algorithm implementing in Matlab we can find the nearest feature and structure based on the movements of prawn to identify whether it is stationary or not.



4.4 Image segmentation by using K- Means clustering to indentify the diseases distortions:



Fig7: Truly segmented image using K-Means

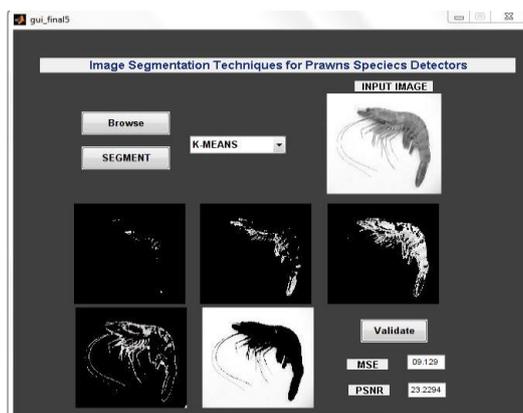


Fig8: K- Means clustering for detecting any diseases that occurred.



Fig9: Objects in cluster1, cluster2, cluster3

V. Discussion and Conclusions

The underwater photogrammetric models for extracting quantitative spatial information of underwater objects using CCD stereo images have been researched. The integration of multiple sensors for objects measurements will be conducted. Digital image classification and pattern recognition for specific objects, e.g., prawn species, will be carried out. In this paper, we are presenting only the detection of the prawn by comparing with another type of prawns by using image segmentation and clustering algorithms. The presented prototype image sensing system for prawn to addresses many of the challenges of operating underwater environment. The imaging sensing system is used to capture the prawn image in the water for our input. The resulted captured prawn image is used for detecting prawn species in the form of representing the structure of the prawns. We are presenting only identification of prawns by comparing with other prawns. The image segmentation methods for both features and structured are presented in the results. Our main contributions are the choosing of proper moments set which gives good feature and structure can be implemented by using k-means clustering algorithms. This concept is implemented in future for identifying the new prawns or detecting the wssv prawn species by using the svd and dwt techniques.

References

- [1] UN Food and Aquaculture Organization, "The state of world fisheries and aquaculture 2010," 2010.
- [2] INDUCED MATURATION OF PENAEID PRAWNS—A REVIEW, M.S. Muthu, a. Laxminarayana.182
- [3] CoNTE, F. S. 1978. Penaeid shrimp culture currentstatus and direction of research. In : Kauai, P. N.C. J.Sindermann. (Ed.) Drugs and Food from the sea-Myth or reality.
- [4] Boyle, Roger, Vaclav Hlavac, and Milan Sonka (1999) Image Processing, Analysis, and Machine Vision Second Edition. PWS Publishing
- [5] Bhagwati charanpatel, Dr. G.R.Sinha, an adaptive k-means clustering algorithms for breast image segmentation, international journal of computer applications(0975-8887), vol 10-n 4, nov-2010
- [6] P. V. G. D. Prasad Reddy, K. Srinivas Rao and S.Yarramalla, "Unsupervised Image Segmentation Method based on Finite Generalized Gaussian Distribution with EM and K-Means Algorithm," Proceedings of International Journal of Computer Science and Network Security, vol.7, no. 4, pp. 317- 321, April 2007.
- [7] W. Y. Ma and B. S. Manjunath, "Edge flow: a framework for boundary detection and image segmentation," Proceedings of IEEE Conference on Computer Vision and Pattern Recognition, pp. 744- 749, 1997.
- [8] S. J. Maybank and O. D. Faugeras. A theory of self-calibration of a moving camera. The International Journal of Computer Vision, 8(2):123–152, Aug. 1992.
- [9] y.h.Pao, Adaptive Pattern Recognition and Neural Networks. Addison-Wesely, New York (1989)
- [10] Norbert Rohrl, Jose Iglesias-Rozas and Galia Xuan, Xiao, Liao, Qingmin, "Statistical structure Weidl, "Computer Assisted Classification of Brain analysis in MRI brain tumor Segmentation Tumors", Springer Berlin Heidelberg, pp. 55-60, International conference on image and graphics, 2008. vol.22, pp 421-426, 2007.
- [11] Maxwell, T., 2005. Object-oriented classification: Classification of pan-sharpening quickbird imagery and a fuzzy approach to improving image segmentation efficiency. MScE Thesis, Department of Geodesy and Geomatics Engineering Technical Report No. 233 University of New Brunswick, Fredericton, Canada, pp. 157.
- [12] O. Faugeras and G. Toscani. The calibration problem for stereo. In CVPR, 1986.
- [13] F.D., K. Gonzales and N. Deatras. 1981. Survival, growth and production of Penaeus monodon Fab. At different stockingdens ities in the earthen ponds with flow through system and supplemental feeding. Fish. Res. J. Phils. 6:1-9.
- [14] R. Ramani, Dr. S. Suthanthirvantha, S.Valarmathy, A survey of current segmentation techniques for detection of Breast Cancer, Image segmentation, October 2012.
- [15] K. Pal and R.A. King, On edge detection of X-ray images using fuzzy set, IEEE Trans, pattern Analysis Mach. Intell. PAMI-5