IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 9, September 2016

An Implementation of Tracking and Detecting Fish from Videos Using Adaptive Gaussian Mixture Model

Harmoninder Singh Brar[1], Er. Mandeep Kaur[2]

M.Tech Research Scholar, Guru Kashi University, Talwandi Sabo[1]

Assistant Professor, Guru Kashi University, Talwandi Sabo[2]

Abstract: Fish abundance estimation, which regularly necessitates the employment of bottom and middle water trawls, is critically needed for the commercially vital fish populations in earth science and fisheries science. In this paper, we present a multiple fish tracking system for low-contrast and low-frame-rate stereo videos with the use of a trawl-based underwater camera system. An automatic fish segmentation algorithm overcomes the low-contrast issues by adopting a histogram back projection approach on double local-threshold images to ensure an accurate segmentation on the fish shape boundaries. The Slowly moving objects detection are present in the scene such problems. A New algorithm for detection and tracking will be implemented in order to investigate improved efficiency. Furthermore, the algorithms developed to perform the video analysis, (such as pre-processing, detection, tracking and counting) could be integrated into a more generic architecture so that the best algorithm for each step will be selected. The quality of underwater image is poor due to the properties of water and its impurities. The properties of water cause attenuation of light travels through the water medium, resulting in low contrast, blur, inhomogeneous lighting, and color diminishing of the underwater images. This proposes a method of enhancing the quality of underwater image. Qualitative and quantitative analyses indicate that the proposed method outperforms other state-of-the-art methods in terms of contrast, details, and noise reduction. Ordinary histogram equalization uses the same transformation derived from the image histogram to transform all pixels. In this work Gaussian mixture model and filter is used to enhance the frames and detect the fish. In this work we are getting the 80% accuracy of the work.

Keywords: Fish, Frame, Cameras, Track, Detection, low-contrast, and low-frame-rate stereo videos etc.

I. INTRODUCTION

Fish wealth estimation, which regularly requires the utilization of base and mid water trawls, is basically required for the financially essential fish populaces in oceanography and fisheries science. In any case, fish caught by trawls regularly don't survive, and hence trawl overview techniques are improper in a few regions where fish stocks are seriously exhausted. To address these necessities, we built up the Cam-trawl to direct video-based studies. The nonattendance of the codend permits fish to pass unharmed to nature subsequent to being tested (caught by cameras).

The caught video information gives a significant part of the data that is commonly gathered from fish that are held by customary trawl strategies [1]. Video-based testing for fish wealth gauges produces unlimited measures of information, which introduce difficulties to information examinations. These difficulties can be decreased by utilizing video preparing procedures for computerized identification, division, following, length/size estimation and acknowledgment. A fruitful improvement of these calculations will enormously ease a standout amongst the most grave strides in video-based examining. In particular, object following gives a mean of dodging twofold including of individual fish that are caught in numerous casings, and takes into consideration more exact length estimation by averaging a few estimations of the same fish. Submerged video preparing for fish identification, following and numbering utilizing monocular or stereo cameras had been researched [2]. There are, be that as it may, a few difficulties for submerged picture/video investigations. In the first place, the quick lessening and non-consistency of LED brightening make numerous forefront objects had generally low diverge from the foundation, and fish with comparable extents from the cameras can had essentially diverse force on account of the distinctions in edge of frequency and additionally reflectivity of fish body among species.

These variables make division of fish troublesome. Second, the pervasive commotion is made by non-fish protests, for example, bubbles, natural flotsam and jetsam and spineless creatures, which can without much of a stretch be mixed up as genuine fish. Third, low casing rate (LFR) of catching results in poor movement congruity and continuous passageway/way out of the field of perspective for fish targets (see Fig. 1 (b)), and hence makes customary various target following calculations infeasible under such circumstances. Then again, programmed stereo coordinating (or correspondence) had been a standout

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 9, September 2016

amongst the most vigorously examined themes in PC vision [3]. All things considered, most best in class stereo coordinating methodologies experience the ill effects of their serious calculations, making them fairly infeasible for a continuous system. All these issues rouse us to fall back on a novel answer for submerged live fish length estimation and following for video-based fishery review frameworks. A different fish following calculation for trawl-based submerged camera frameworks is proposed to perform programmed fish size estimation and checking. We had beat the challenges forced by uncontrolled brightening and uproarious video catching, which are extremely normal in the submerged situations[4]. Moreover, stereo correspondence of articles is abused for not just being fused with element programming to build up a low-outline rate video target tracker additionally giving dependable length estimation in 3-D space. With the stereo vision accessible, we additionally proposed a quick and successful stereo coordinating methodology took after by a self-pay plan to finish the fish-pair coordinating and consequently takes into account length estimation of every fish target[5].

II. RECOGNIZING FISH FROM UNDERWATER ENVIRONMENT

Recognizing fish from underwater environment is challenging due to the difficult conditions: water blur, freely swimming fish, distance colour degradation, variable lighting and caustics. Previous algorithms in the literature were designed for dead fish, seen orthographically and using controlled lighting. Using features extracted from the underwater video stream that contains essentially 2D fish shapes moving freely in 3D, we developed an automatically generated hierarchical classification system with reject option[6]. Based on these developments, we have developed a fish recognition system capable of recognising more species with high accuracy than previously, and tested on a larger database than previously. The accuracy is based on the proportion of correct recognitions while robustness means recognizing fish in a complex environment (e.g. light distortion, fish occlusions and illumination transformations). To verify this claim, the project expects to recognize fish from different distances and angles from the camera, and to distinguish species from a large video set using the temporal information from tracked trajectories as well as using an individual's appearance similarity[7]. A reject option, which assesses the posterior probability of whether the classification result belonged to the predicted species, is also implemented and evaluated. To support this claim, an investigation into state-of-the-art fish recognition technologies is involved, which is evaluated by comparing accuracy and robustness with other models. Our procedure uses a combination of selected features such as the collective appearance, boundary geometry, specific shape geometry (e.g. fins, heads and tails), colour and texture distributions as well as features within a special species. The automatically generated hierarchical classification also provides a reject option to filter less confident decisions of known classes or to detect and remove fish from untrained classes. A multiple-frame voting method is applied to improve the accuracy of the classification result[8].

Figure 1: Fish detection result with bounding box on detected fish [4]

III. FISH RECOGNITION APPLICATIONS FOR DEAD FISH

The recognition applications for dead fish images, which are located in an expected observation area with fixed distance and pose and direction, are obtained by processing the still fish objects in a clean background. For example, [12] proposed a moment-invariant based method for fish species recognition. The method focuses on three species: common carp (Cyprinus carpio), St. Peter fish (Oreochromis sp.) and grey mullet (Mugil cephalus), all of which, in normal cases, live together. In the fish detection step, the fish images are grabbed through a transparent tunnel. The authors use background thresholds to determine fish, which extract background samples from first and last rows and columns. The experiment used the equipment shown in Figure 1.6.

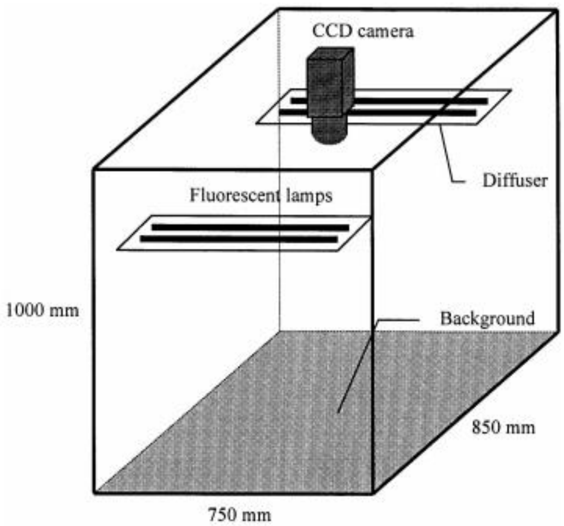

Figure 2: Equipment of fish image capture [9]

To avoid light distortion, they only use the green band of the image and calculate two boundaries' moment invariants. The prior probability distribution model of each species is considered and then a decision tree based on this information is built. As fish species always have an obvious bias distributions, which take top 80% quantities for top 20 species, prior information promises effective performance. In 124 sample images, a 4-fold cross validation method is used, and it achieves a recognition rate of 100%, 89% and 92%, respectively for the three species. In the result analysis, correlation coefficients show a high relative connection between these species that are 0.954, 0.986 and 0.986, respectively.

Colour-based features Colour-based features describe the spatial (or temporal) intensity of the original image. [12] use RGB colour and shape features from 8-bit colour resolution images to deal with the shape-based retrieval problem. Their technique performs scale and rotation invariant retrieving of Cyprinus carpio, Oreochromis sp. and Mugil cephalus, by placing the fish on a conveyor belt. [12-13] investigate the effectiveness of features for the fish classification task. The colour features, i.e. YUV and HSI colour signatures of the dorsum and the ventral region of the fish, are included since they provide luminance and chrominance information in separate bands. Features are ranked and evaluated by their discrimination and uncorrelatedness in a Bayesian classifier, with six species of fish. Although the colour-based features are intuitive from observation, we note the divergence of the perception model in the underwater environment. [13] discusses how the water medium absorbs and scatters light when it propagates. Images recorded by the same equipment at two different scenes: water surface and c. 10m depth. The light model is changed in three aspects: diverse distortion of colours (image tends to be blue) as the water absorbs most red/yellow/orange energy at the depth of 10m; limited visibility distance due to attenuation of light by water or suspended solids; and low contrast of image and haziness. Even the colour distortion model itself changes at different depths because different wavelengths of light attenuate at different distance.


(a). (b).

Figure 1.8: Example of how light distorts from the surface to underwater environment [8].

These distortion factors remind us that the colour is diminished and needs to be restored/enhanced before feature extraction.

IV. PROBLEM FORMULATION

The nature of submerged picture is poor on account of the properties of water and its polluting influences. The properties of water cause lessening of daylight goes through the water medium, prompting low qualification, obscure, non uniform lighting, and shading diminishing of the submerged pictures. This proposes a method for upgrading the standard of submerged picture. The change of the shading component will expand the picture shading execution. Subjective and quantitative examinations demonstrate that the anticipated procedure beats diverse dynamic courses as far as refinement, points of interest, and clamor decrease. typical reference chart exertion utilizes a proportional change got from the picture visual chart to revamp all pixels. This functions admirably once the dispersion of picture component qualities is practically identical all through the picture. Be that as it may, once the picture contains locales that territory unit extensively lighter or darker than the majority of the picture, the refinement in those districts won't be adequately expanded. the matter of non-uniform brightening over the video outline by concentrating exclusively on the territory of each objective. The Slowly moving items recognition region unit blessing inside the scene such issues. Another Problems confronted are:

- Color differentiation of Image and recordings.
- Preservation of points of interest of an info Image and recordings.
- Artifacts
- Poor Quality of a picture and recordings

V. RESEARCH PLAN

This theory is to update the shading pictures. It is based upon GUI (graphical customer interface) in MATLAB. It is a push to further handle the essentials of MATLAB and acknowledge it as a fit application gadget. There are on a very basic level unmistakable records. Each of them includes m-report and figure record. The framework to enhance pictures will be realized using MATLAB. MATLAB is a mechanical assembly for numerical count and representation. The key data part is system. A photo in MATLAB is managed as a matrix. MATLAB had worked in maneuvering for systems and structure operations, rich outlines capacities and an intriguing programming tongue and headway environment. In video contrast upgrade and protest following after strides will be taken after:

Proposed Steps are given below:
Step 1: Read the color fish video.
Step 2: Apply the frame separation to separate the frames if we want to detect the individual frame.
Step 3: Apply the video reader to read the complete video.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 9, September 2016

Step 4: Apply the fish detection Gaussian model to detect the fish.
Step 5: track the total num of fish detected.
Step 6: Apply the camera selection if we want a real time camera object detection.

PARAMETERS USED:

- **PSNR** (Peak Signal-to-Noise Ratio): A high quality image has small value of Peak Signal to Noise Ratio (PSNR) or PSNR is defined as the ratio of signal power to noise power. It basically obtains the gray value difference between resulting image and original image.
PSNR is defined as follow:

$$PSNR=\left[10\log\frac{255^2}{MSE}\right].$$

- **MSE** (Mean Square Error): MSE is the sum over all squared value differences divided by image size and by three.

$$MSE=\frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j)-K(i,j)]^2$$

n=size(InputImage);
M=n(1);
N=n(2);
MSE = sum (sum ((InputImage-ReconstructedImage).^2))/(M*N);

- Precision (TP/TP+TN)
- Recall (TN/TN+TP)
- F-measure (%)
- Sensitivity
- Specificity
- BER (%)
- F-measure of sens/spec (%)
- Geometric Accuracy
- pFMeasure (%)

VI. RESULT& DISCUSSION

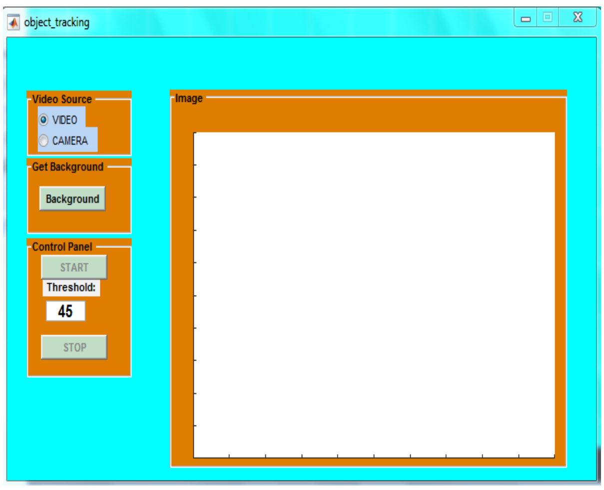

Figure 1: GUI for tracking the fishes

The figure 1. is the browsing the input video for the processing and the figure 2: is the GUI window that is used to track the fishes with the input video. There are different buttons that are used to perform different operations

figure 2. input color video frame

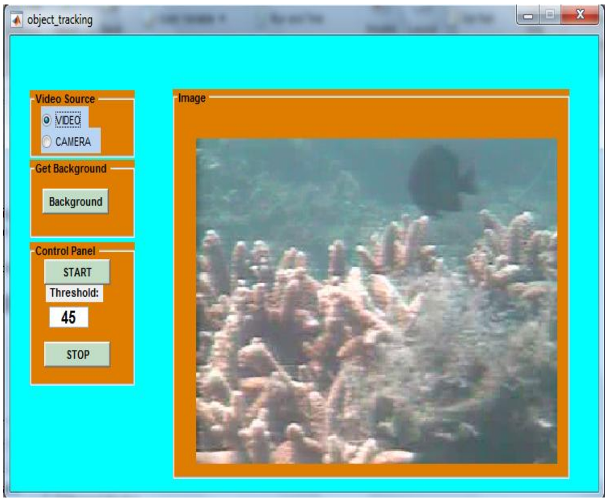

Figure 3: Fish input video

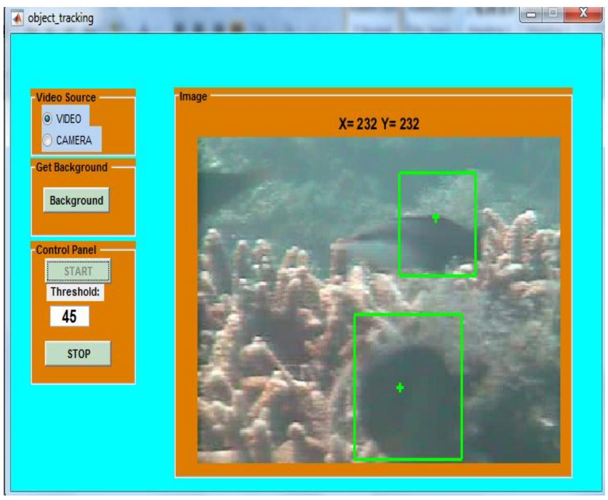

Figure 4: Detected fish from video

DOI 10.17148/IJARCCE.2016.5950

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 9, September 2016

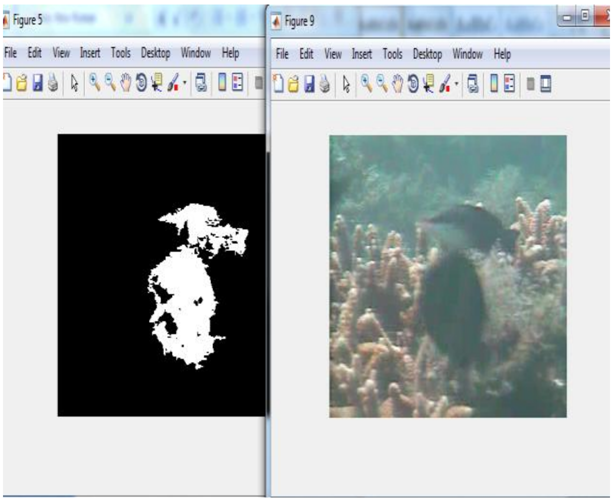

Figure 5. Original image and fish detected

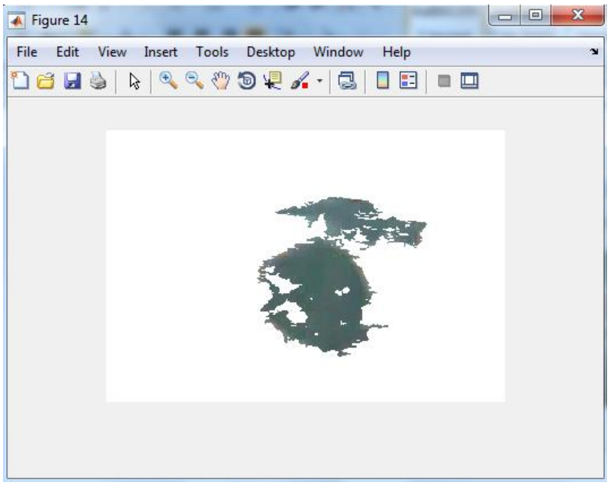

Figure 6. Fisk Marking of frame

Frame Name	Precis - ion	F measu -re (%)	Geometric Accuracy	PSNR
70.png	0.21018	34.73552	0.18851	1.14931
110.png	0.29994	46.14649	0.11650	1.59027
150.png	0.55779	71.61311	0.19766	3.62112
155.png	0.27136	42.68764	0.11064	1.41388
158.png	0.25820	41.04269	0.12787	1.35035

VII. CONCLUSION

A novel multiple fish tracking system is proposed for low-contrast and low-frame-rate underwater stereo cameras. Double local thresholding is developed to overcome the challenges posed by unstable illumination and ubiquitous noise in underwater imaging. Using histogram back projection, we successfully generate a reliable fish segmentation in shape boundary under very low contrast. For low-frame-rate tracking, exploiting various appearance features, the cost function for feature-based object matching acts as an effective metric to find the temporal relationship of targets in the noisy underwater environment. Multiple-target Viterbi data association exploits multiple video frames from the past and takes advantage of dynamic programming to overcome the difficulties of abrupt target motion and frequent entrance/exit due to the low frame rate. a machine vision system that automatically determines and annotates characteristics of underwater video images. The main goal of our system is to extract and detect the multiple fishes. In this work we are using the Gaussian mixture model to detect and extract the fishes. In this work morphological operators are used to enhance and mark the extracted fishes with the help of mask. Unlike other existing fish image processing methods which are mostly conducted in a lab, our approach provides a reliable method where analysis are carried out on data captured in their natural habitat where conditions may vary drastically which inevitable introduced uncontrollable interferences, e.g. murky water, algae on camera lens, moving plants and unknown objects, low contrast, low frame rates, etc. in this work we are getting the maximum accuracy of the work.

VIII. FUTURE WORK

Further development for fish classification and occlusion handling is in progress. Fish classification for the EcoGrid videos is a very challenging task due to the low quality images and varying scenarios that need to be taken into account. New algorithms for detection and tracking will be implemented in order to investigate improved efficiency.

Furthermore, the algorithms developed to perform the video analysis, (such as pre-processing, detection, tracking and counting) could be integrated into a more generic architecture so that the best algorithm for each step will be selected. The performance level for the algorithms will be determined by a measure such as processing time or certain user provided requirements. Thus a combination of optimal algorithms to perform the video analysis could be utilized.

REFERENCES

[1]. A. Azim and O. Aycard, "Different individual by walking taking after using Viterbi data alliance," Proc. of Intelligent Vehicles Symp. (IV), 2010 IEEE, pp.706-711, Jun. 2010.

[2]. B. P. Klimley and S. T. Cocoa, "Stereophotography for the field researcher: estimation of lengths and three-dimensional positions of free-swimming sharks," Marine Biology, Vol. 74, No. 2, pp. 175-185, 1983.

[3]. B. L. Zitnick and T. Kanade, "An accommodating figuring for stereo organizing and obstruction disclosure," Pattern Analysis and Machine Intelligence, IEEE Trans. on, Vol. 22, No. 7, pp. 675–684, Jul. 2000.

[4]. Costa, A. Loy, S. Cataudella, M. Scardi, "Evacuating fish size using twofold submerged cameras," Aquacultural Engineering, Vol. 35, No. 3, pp. 218-227, Jun. 2006.

[5]. C. Kim and J.- N. Hwang, "Video object extraction for thing arranged applications," The Journal of VLSI Signal Processing, vol. 29, no. 1–2, pp. 7–21, Aug.–Sep. 2001.

[6]. C. G. Hankin and G. H. Reeves, "Surveying hard and fast fish riches and total domain range in little streams in light of visual estimation procedures," Can. J. Fish. Aquat. Sci., NRC Research Press, vol. 45, no. 5, pp. 834-844, 1988.

[7]. D. Walther, D.R. Edgington and C. Koch, "Area and taking after of things in submerged video," in Proc. of Computer Vision and Pattern Recognition, IEEE Int. Conf. on (CVPR '04), Jun. 2004.

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 9, September 2016

[8]. D. Scharstein and R. Szeliski, "A Taxonomy and Evaluation of Dense Two-Frame Stereo Correspondence Algorithms," Computer Vision, Int. Journal of, Vol. 47, No. 1, p.7–42, Apr. 2002.
[9]. Chandra and K. Kanagalakshmi, "Clatter Suppression Scheme using Median Filter as a piece of Gray and Binary Images." Int. J. PC Applications 26, 2011.
[10]. E. Harvey, M. Cappo, M. Shortis, S. Robson, J. Buchanan and P. Speare, "The precision and exactness of submerged estimations of length and most great body significance of southern bluefin fish (Thunnus maccoyii) with a stereo–video camera system," Fisheries Research, Vol. 63, No. 3, pp. 315–326, Apr. 2003.
[11]. J. D. Charitable, C.- C. J. Kuo, "Effective stereo organizing with upgraded diagram and surface models and obstacle dealing with," Journal of Visual Communication and Image Representation, Vol. 21, No. 5–6, pp. 404–415, Jul. –Aug. 2010.
[12]. J. Matai, R. Kastner "Automated Techniques for Detection and Recognition of Fishes using Computer Vision Algorithms" Southwest Fisheries Science Center, NMFS, NOAA jmatai@es.ucsd.edu.
[13]. J. A. Lines, R. D. Tillett, L. G. Ross, D. Chan, S. Hockaday, N. J. B. McFarlane, "A customized picture based system for surveying the mass of free-swimming fish," Computers and Electronics in Agriculture, Vol. 31, No. 2, pp. 151–168, 2001.
[14]. K. Williams, R. Towler and C. Wilson, "Cam-trawl: a mix trawl and stereo-camera system," Sea Technol., vol. 51, no. 12, Dec. 2010.
[15]. M. S. Srividya, Shobha G. "A Survey on: Underwater Video Processing for Detecting and Tracking Moving Objects" International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-4, Issue-1, March 2014.
[16]. Mustafa Man, Fakhrul Adli Mohd Zaki "FishDTecTools: Fish Detection Solution Using Neural Network Approach" Journal of Communication and Computer 8 (2011)
[17]. M. J. Swain and D. H. Ballard, "Shading indexing," Int. Journal of Computer Vision, vol. 7, no. 1, pp. 11-32, 1991.
[18]. M.- C. Chuang, J.- N. Hwang, K. Williams and R. Towler, "Modified fish division through twofold close-by thresholding for trawl-based submerged camera structures," Proc. of Image Processing, IEEE Int. Conf. on (ICIP '11), pp.3145- 3148, Sep. 2011.
[19]. M.- C. Chuang, J.- N. Hwang, K. Williams and R. Towler, "Different Fish Tracking through Viterbi Data Association for Low-Frame-Rate Underwater Camera Systems," Proc. of Circuits and Systems, IEEE Int. Symp. on (ISCAS '13), May 2013.
[20]. Meng-Che Chuang, Jenq-Neng Hwang, Kresimir Williams, Richard Towler "Taking after Live Fish from Low-Contrast and Low-Frame-Rate Stereo Videos" IEEE Trans. on Circuits and Systems for Video Technology, vol. 25, no. 1, pp.167-179, Jan. 2015