ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

# Probabilistic detection and temporal segmentation of cichlid fish tumour using watershed and modified threshold technique

**Stephen john T[1], Sivasundarapandian S[2], and Deborah paripuranam T[3].**

Sathyabama university [1,3],
Manonmaniam Sundaranar university[3]

**ABSTRACT**

One of the main causes for increasing mortality among ornamental fish (cichlid fish) is malignant tumour. Image segmentation is an important step for medical image processing which is a complex and challenging task especially in fish images. The accurate measurements in fish diagnosis are quite difficult because of diverse shapes, sizes and appearances of tumours. For detection of shape, size and boundary extraction we are using modified threshold and watershed algorithm. The main objective is to detect and segment the fresh water fish like cichlid fish (Etroplus maculatus) tumour using watershed and modified thresholding algorithm. An efficient algorithm proposed for tumour detection based on segmentation and morphological operators are applied to detect the tumour in the image. To improve the quality of image and limit the risk of distinct region fusion in the segmentation phase an enhancement process is applied. It will be simulated on MatLab software.Image segmentation helps in automated diagnosis of fish diseases and helps qualitative and quantitative analysis of images such as measuring accurate size and volume of detected portion. This technique is basically used to detect the differences in the tissues which have a far better technique as compared to computed tomography. So this makes this technique a very special one for the fish tumour detection and cancer using watershed and modified thresholding technique.If there is any disturbance in the water parameters leads to fish fungal and bacterial disease. The most common maladies seen in home aquaria are usually either parasitic or bacterial in origin. Fungal infections are also seen and occasionally physical ailments. Luckily, most fish ailments are easily diagnosed and can be treated with success.

**Keywords:** cichlid fish, Etroplus maculatus, fungal, bacterial, parasitic

***Corresponding author***

ISSN: 0975-8585

## INTRODUCTION

The major cause for the disease and increase in mortality rate of fish was the poor quality of water in which they are being reared. Fish are generally resistant to diseases when in good, clean, oxygenated and the temperature - regulated water. Man - made aquariums can mimic natural environmental conditions by using life - supporting parameters like filters, pumps, heaters, lights and chemicals[2].The maintenance of good water quality, since water dictates to a large degree, the survival of fish in tanks. The [1] aquarium management in which water chemistry was the most complicated task. The ratio between the compounds depends on temperature, pressure, salinity and the most important $p^H$. From the observations of [7], it can be concluded that a $p^H$ of 6.0 - 8.0, is safer since as $p^H$ increases, more unionized harmful ammonia will be produced [5].

James Diana 1989 studied on the effects of water exchange rate and density on yield of the walking catfish. Since growth and survival are often density dependent, improved water quality, checking was done periodically. Dissolved oxygen, ammonia concentration, fish number and fish biomass were measured regularly to quantify changes between and among tanks. Temperature may also have profound effects upon the interactions between feeding metabolism and growth in fish [3][4].The anchor worm (parasite) embedded its head with its cephalic horns to the skin cause damage to the epidermal cell and reach blood vessel to absorb blood [8]and cause severe haemorrhage, ulceration and fibrous nodule formation on the skin. The male worm die after mating and female worm burrow her flesh into the flesh of a fish and the portion hanging from body of fish visible to naked eye [9]. Treatment to this fish is careful manual removal without breaking and dipping of freshwater fish in salt water at 2.5 – 3% concentration for 5 – 10minutes and release immediately into the tank [10]. In[11]suggested that the difference in susceptibility of fish species to the parasite could be due to differences in ecological, behavioural and physiological and morphological variations. In [12]demonstrated the influence of climatic factors on parasite outbreaks. Stressed and poorly fed fishes are more susceptible to fungal infection [14]. Every fresh water fish is exposed to atleast one species of fungus during its lifetime [15]. Fungal diseases are the second most serious cause of losses in aquaculture [16]. Fungi are known to attack all the life stage of fish from egg to adult fish Bangyeckhun (2001). However it was[18] reported that penicillium species, Aspergillus species and Rhizopus species are normal microflora present in fish. According to [19]diversity of water molds depends upon the interaction of physiochemical factors.

## SYSTEM ANALYSIS

The cichlid fish Etroplus maculatus was cultivated in four experimental tanks i.e C1,F1,F2,F3. Here the control and the commercial feed is given. And the three experimental tank contains 25% of fish meal in F1 and 50% and 50% of fish meal in F2 and 75% of fish meal in F3 tank. Here the water quality is maintained in the tank and the bacterial disease affect in C1 and F1 tank. So some fishes were lead to mortality. So the reason or the major cause for the mortality is studied in this paper. Bacterial diseases: bacterial diseases are usually characterized by red streaks or spots and/or swelling of the abdomen or eye. Poor quality water conditions can lead to fish gasping, not eating, and jumping out of the tank and more.

**Table 1: Water analysis in the four experimental tanks**

| Parameter | C1 | F1 | F2 | F3 |
|---|---|---|---|---|
| Temperature (˚C) | 30 | 30 | 30 | 30 |
| Salinity (%) | 0.30 | 0.20 | 0.35 | 0.30 |
| Hardness (ppm) | 57 | 51 | 53 | 54 |
| Alkalinity(ppm) | 300 | 350 | 300 | 200 |
| pH | 12 | 10 | 7.45 | 7.91 |
| Dissolved Oxygen(mg/l) | 2 | 2 | 4 | 3 |
| Ammonia (ppm) | 0.7 | 0.8 | 0.3 | 0.2 |
| Nitrates (mg/l) | 55 | 51 | 53 | 50 |
| Nitrites (mg/l) | 0.02 | 0.02 | 0.05 | 0.04 |

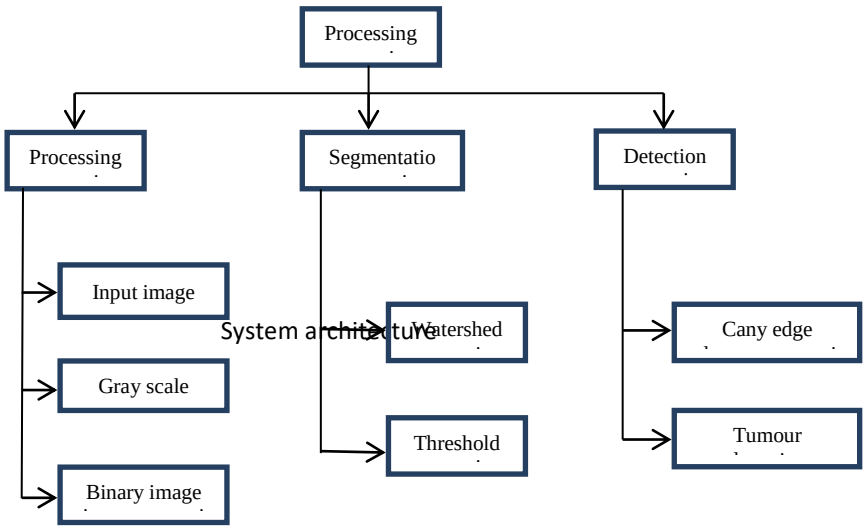
Where, C1- Control or commercial feed, F1- 25% of the fish meal, F2- 50% of the fish meal, F3- 75% of the fish meal.

ISSN: 0975-8585

Table 1 indicates the temperature, salinity, hardness, pH, alkalinity, dissolved oxygen, ammonia, Nitrates and Nitrites of water in the culturing tanks of fish. The temperature was maintained at 30˚C throughout the experimental period.Water quality determines not only how fish will grow in an aquaculture operation, but how well they will survive. Fish influence water quality through processes like nitrogen metabolism and respiration. Some water quality factors such as dissolved $O_2$, temperature and ammonia, pH, alkalinity, hardness and salinity might result in the loss of fish. The salinity ranges from 0.20 to 0.35% in the present study.Alkalinity is a measurement of carbonate and bicarbonate ions dissolved in water. Alkalinity can be increased by adding agricultural limestone to ponds or sodium bicarbonate to recirculating systems. Alkalinity ranged from 200 – 300ppm in fish rearing tanks and the hardness ranged from 50 to 60ppm.

A low pH is acidic and a high pH is basic, Mortalities occur below 4.5 and above 10. Fish grow best in water with pH between 6 and 9. The pH was calculated and found to be between 7 - 8 in all the tanks except in tank C1 which is having 12 and in F1 tank having pH 10.When organic matters are discharged into the tank it is breakdown to carbon-di-oxide and water and it leads to the growth of bacteria and so 50% of the replacement of water is must in order to replace carbon-di-oxide with oxygen. The water purifier can be attached to the tank. In the present study the Biological oxygen demand is less and it lies within the range of 4mg/l. Many fish excrete ammonia as their main nitrogenous wastes. The proportion of TAN (Total Ammonia Nitrogen) existing in ionized and unionized form increases. Ammonia is removed by bacteria that initially convert it into nitrite and subsequently into nitrate. Detoxification of ammonia is facilitated by maintaining a suitable environment suitable for the growth of bacteria (pH between 7 and 9). The presence of ammonia ranged from 0.1 to 0.3ppm in the experimental tanks except in C1 and in F1 tank which has 0.7 and 0.8ppm.Bacterial oxidation and fixing of oxygen by plants produce nitrates and nitrites. Increase in Nitrogen leads to the carcinogenic effect and in the present study the level of Nitrates is 50 – 55mg/l and the nitrite was found to be 0.2 to 0.5mg/l.

Conversion of fish image into Gray scale image and Binary image




System architecture

**WATERSHED ALGORITHM**

Source: Read in the Colour0 Image and Convert it to Grayscale image

Step 1: Use the Gradient Magnitude as the Segmentation Function - The gradient is high at the borders of the objects and low (mostly) inside the objects.
Step 2: Mark the foreground objects
Step 3: computing the opening-by-reconstruction of the image
Step 4: Following the opening with a closing can remove the dark spots and stem marks.
Step 5: Calculate the regional maxima to obtain good foreground markers.
Step 6: Superimpose the foreground marker image on the original image, Notice that the foreground markers in some objects go right up to the objects' edge

ISSN: 0975-8585

Step 7: cleaning the edges of the marker blobs and then shrinking them a bit
Step 8: Compute Background Markers, Starting with thresholding operation
Step 9: Compute Background Markers, using the watershed transform of the distance transform and then looking for the watershed ridge lines of the result
a. Label each minimum with a distinct label. Initialize a set S with the labelled nodes.
b. Extract from S a node x of minimal altitude F, that is to say F(x) = min{F(y)|y ∈ S}. Attribute the label of x to each non-labelled node y adjacent to x, and insert yin S.
c. Repeat Step b until S is empty.
Step 10: Visualize the Result, one of the techniques is to superimpose the foreground markers, background markers, and segmented object boundaries.

Sobel operator is suitable for edge detection. In marker controlled watershed segmentation, sobel operator is used to distinct the edge of the object.

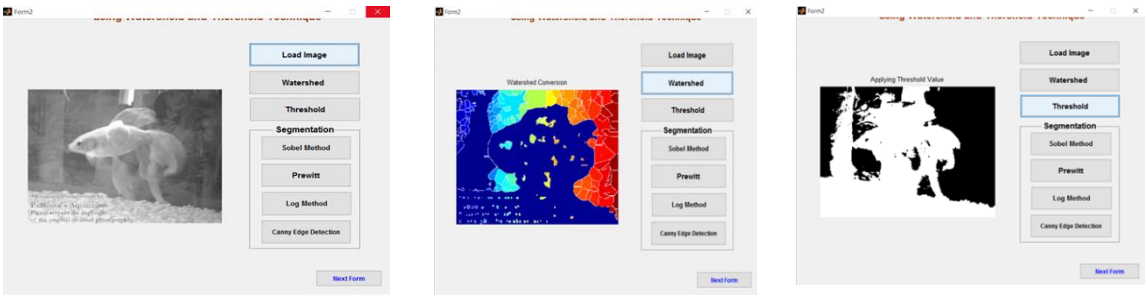
**THRESHOLD ALGORITHM**

The method is based on a threshold value which will convert grey scale image into a binary image format. This method is effective for images with different intensities. The image is partitioned directly into different regions based on the intensity values.

The basic global threshold, T, is calculated as follows:

1. Select an initial estimate for T (typically the average grey level in the image)
2. Segment the image using T to produce two groups of pixels: $G_1$ consisting of pixels with grey levels >T and $G_2$ consisting pixels with grey levels ≤ T
3. Compute the average grey levels of pixels in $G_1$ to give $\mu_1$ and $G_2$ to give $\mu_2$
4. Compute a new threshold value: Repeat steps 2 – 4 until the difference in T in successive iterations is less than a predefined limit $T_\infty$

This algorithm works very well for finding thresholds when the histogram is suitable.




Implementation of Watershed algorithm and Threshold algorithm

**4(a)Morphological operators**

After converting the image in the binary format, some morphological operations are applied on the converted binary image. The purpose of the morphological operators is to separate the tumour part of the image. Now the tumour portion of the image is visible, shown as white colour. This portion has the highest intensity than other regions of the image. Morphological operators are applied after the watershed segmentation.

**4(b) Canny Edge Detector**

The Edge detector finds edges of objects in images. For sobel, prewitt and Roberts algorithms, the object finds edges in an input image by approximating the gradient magnitude of the image. The gradient is

ISSN: 0975-8585

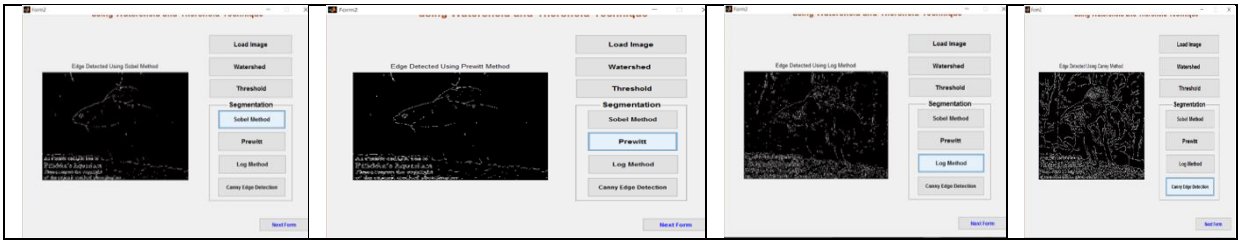
obtained as a result of convolving the image with the sobel, Prewitt or Roberts kernel. For canny algorithm, the object finds edges by looking for the local maxima of the gradient of the input image. It calculates the gradient using the derivative of a Gaussian filter. This algorithm is more robust to noise and more likely to detect true week edges.

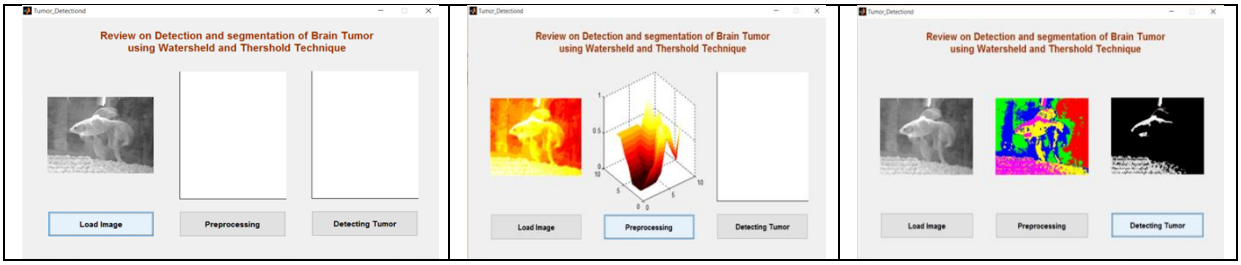
**4(c)Detection of Fish Tumour**

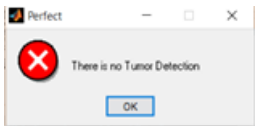
After applying watershed and thresholding segmentation we get a high intensity portion from whole image and this portion is called tumour. This portion contains only high intense pixels and its showing with totally white portion. We are taking Gray scale image then sharpening and enhancing the image for removing noise from the image. Finally applying the threshold segmentation and Watershed segmentation for tumour detection from whole image and we get tumour detected image.

**4(d) Boundary extraction of fish tumour**

Boundry extraction off fish tumour is the third part of our research Edge based segmentation is the most common method based on detection of edges i.e boundaries which separate distinct regions, various edge detection operators are used which are prewitt edge detection, canny edge detection operator. part finding only boundary of tumour, which we are getting form thresholding segmentation.




**RESULTS AND DISCUSSION**

Initially we notice a gray or whitish growth in and on the skin and / or fins. Untreated fungus resembles a cottony growth. Eventually, as fungus continues to eat away at the fish's body, the fish will die.
Symptoms:

A white cottony appearance can be seen near the head or near the fin of the body. It causes itching and it swims along the sides of the tank and scratches its body.

Treatment

Many bacterial infections are misdiagnosed as fungal, so common medications include both a fungicide and antibiotics. Tetra Fungus Guard contains malachite green and formalin. Treated one tablet per 10 gallons once every 4 days until symptoms are gone. In order to remove activated carbon and conduct partial water changes in between treatments.

Precautions:

1. We should always buy only good-quality, compatible fish.
2. Quarantine new fish before adding them to the aquarium. (A hospital tank can be used for this).
3. Avoid stressing the fish with rough handling, sudden changes in conditions.
4. We should not over feed the fish.
5. Remove sick fish to a hospital tank for treatment.

## CONCLUSION

These are just a few of the most common fungal and parasitic infections that can infect fish. After reviewing the list of infections, it is very clear that most infections are caused by a few similar situations and that following a few basic precautions can prevent most of these infections. There is unusual increase in the level of pH and the ammonia level in the C1 and in the F1 tank which leads to the fungal and parasitic infection and it can be prevented by maintaining the tank condition and also by taking precautions. Good practice of adding1tbs.aquarium salt per gallon will help prevent clamped fins.

## REFERENCES


[1] Beleau, M.B.Evaluating water problems. Vet. Clin. North Am. Small Anim. Pract 18 1988, 293 - 304.

[2] Gregory.A, Lewbart.. Clinical Nutrition of Ornamental fish. Avian and Exotic pet medicine 1998;7(3) (July) 154 - 158.

[3] Jobling, M.. Fish Bioenergetics. Chapman and Hall 1994, London

[4] Jobling, M. Temperature and growth. Modulation of growth rate via temperature change. In Global warming. Implications for freshwater and marine fish (eds) , 1997, C.M. Wood and D.G. Mc Donald 225 - 253. Cambridge Univ. press, Cambridge.

[5] Noga, E.J. Fish Disease : Diagnosis and Treatment St. Louis , M.O. Mosby Yeast Book. 1996

[6] NRC (National Research Council). Nutrient requirements of fish. National academyPress, Washington D.C 1993, USA. 114pp

[7] Pannevis, M.C; Earle, K.E.,. Maintenance energy requirement of five popular species of Ornamental fish. J. Nutr 1994; 124: 2616S - 2618S.

[8] Ahmed, M.S.. Histological studies of the skin, affected by Lernea cyprinacea infection in a freshwater fish, Cirrhinus mrigala. Pakistan Journal of Fisheries 2000; 1(2): 59-64.

[9] Murphy, K.M and G.A. Lewbart,. Aquarium Fish Dermatologic Diseases. Seminars in Avian and Exotic pet medicine 1995; 4(4): 220-233.

[10] Schaperclans, W. Fish Diseases, Vol. 1, 5th ed. Oxonian Press Pvt. Ltd., New Delhi 1991

[11] Barson M., Mulonga A. and Nhiwatiwa T.,. Investigation of a parasitic outbreak of Lernaea cyprinacea Linnaeus (Crustacea: Copepoda) in fish from Zimbabwe. Afri. J. Zoo 2008b; 43, 175–183.

[12] Kupferberg S.J., Catenazzi A., Lunde K., Lind A.J. and Palen W.J., Parasitic copepod (Lernaea cyprinacea) outbreaks in foothill yellow-legged frogs (Rana boylii) linked to unusually warm summers and amphibian malformations in Northern California. Copeia, 2009; 529–537.

[13] Idris H.B. and Amba M.A.,. A Note on Lernaea cyprinacea parasitizing the cultured marble goby Oxyeleotris marmorata and their control with salinity modification. Adv. Environ. Bio., 2011; 5, 817–820.

[14] Siddique, M. M. R., Basher, M.A., M.A. Hussain and A.S.M. Kibria. Fungal Disease of Freshwater Fishes in Natore District of Bangladesh. J. Bangla. Agri. Uni., 2009; **7**(1), 157-162.

[15] Neish, G.A. Observations on Saprolegniasis of adult sockeye salmon, Oncorhynchus nerka (Walbaum). J. Fish. Biol. 1997;**10,** 513-522

[16] Meyer, F. P. Aquaculture Diseases and Health management. Anim. Sci.1991 69:4201-4208.

[17] Bangyeekhun E and M. A. Sylvie. Characterization of Saprolegnia sp. isolates from channel catfish. Dis. Aquat. Organ 2001; **45**: 53-59

[18] Refai, M., K. Laila., A. Mohamed., M. Kenawy and El. SMS. Shimaa. The assessment of Mycotic settlement of freshwater fishes in Egypt. J. Amer. Sci 2010; **6**(11), 595- 602.

[19] Pailwal, P, S.C. Sati. Distribution of Aquatic fungi in relation to physiochemical factors of Kosi River in Kumaun Himalaya. Nat. Sci., 2009; 7(3), 70- 74.