Image Processing On Cardiac Images Using Maximum Entropy Algorithm

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*Abstract-***Now a day in so many areas digital image processing has been applied, specially for feature extraction to get patterns of studied images. Basically segmentation is used to retrieve the exact part of the interesting object from the respective images. There are several methods that intend to perform segmentation, but is difficult to find a method that can be easily adaptable for different type of images, which may be very complex or specific. So for this project aims to present adaptable segmentation method which is applied to different kind of images, which can be leads to provide better segmentation. The proposed method of this project is automatic multilevel thresholding in which technique of group histogram quantization analysis of histogram slope, percentage and calculation of maximum entropy to define the threshold. Basically this technique was applied to segment the cell core and potential rejection of tissues in cardiac images.**

Keywords – cardiac Images; segmentation; thresholding

I. INTRODUCTION

The biological vision system is one of the most important means of exploration of the world to the humans, performing complex tasks with great ease such as analysis, interpretation, and recognition and pattern classification. For this reason many studies attempt to produce artificial vision systems with the same efficiency of the biological system. This task is still highly complex, mainly to implement one of the most obvious problems, the quantification and qualification of information's represented in many different fields, such as intensity of gray level, edges, contours and texture. These attributes are naturally sought by the human visual system when the measured signal is an image . One possibility to represent an artificial vision system efficient is to use appropriate methods of segmentation, considered as a first step for analyzing an image, it allows to separate the objects in parts, according to some criterion of uniformity. For high quality segmentation systems, digital image processing is used in a primary stage of thresholding to separate the object of the rest of the image.

II. GRAY SCALE CONVERSION

Image processing operations work by manipulating the pixels of an input image, to result in an output image. Such operations may be of many types - two of which are point operations and region operations. Point operations are perhaps the simplest of image processing operations. A pixel value in the output image depends solely on its corresponding value in the input image. In other words, if the output value of the pixel at location (x, y) depends only on the value at the pixel location (x, y) in the input image, then this is a point operation. Point operations map each pixel in the input image to their corresponding pixel in the output image. In contrast, region operations use a group of pixels surrounding an input pixel to yield a single output pixel. Filters are examples of region operations. We perform simple implementations of four kinds of point operations on 8-bit grayscale images. An 8-bit grayscale image has pixels in the range 0 - 255, for both the input and output images.

Grayscale value = 0.33*(Value of blue channel) + 0.56*(Value of green channel) + 0.11*(Value of red channel).Therefore the program would involve cycling through each pixel of the 3-channel image, computing the grayscale equivalent of the pixel, and assigning it to the single channel of the pixel at the same position in the output image. This will generate the gray-scale equivalent of the image.

III. HISTOGRAM CALCULATION

An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in a digital image. It plots the number of pixels for each tonal value. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distribution at a glance.

The horizontal axis of the graph represents the tonal variations, while the vertical axis represents the number of pixels in that particular tone. The left side of the horizontal axis represents the black and dark areas, the middle represents medium grey and the right hand side represents light and pure white areas. The middle represents medium

grey and the right hand side represents light and pure white areas. The vertical axis represents the size of the area that is captured in each one of these zones. Thus, the histogram for a very dark image will have the majority of its data points on the left side and center of the graph.
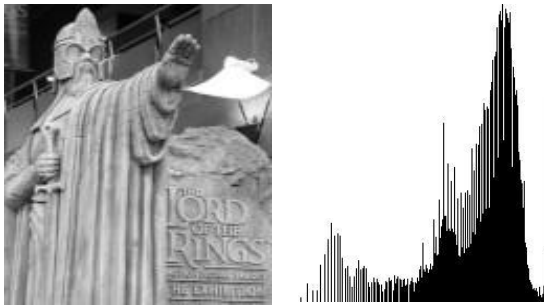
Input Image   Image Histogram
Fig.1 Image And Histogram

Conversely, the histogram for a very bright image with few dark areas and/or shadows will have most of its data points on the right side and center of the graph.

Steps To Make A Histogram

STEP #1 - Count the data, in this case N=60.

STEP #2 - On the data in figure 6 above, looking only at Line A right now, find the largest value and call that X_L, and then find the smallest value, calling that X_S. On Line A, the largest value is "7" and the smallest is "- 2".

STEP #3 - Next, find the range of the data. R = X_L - X_S, or 7 -(-2), or R = 9.

STEP #4 – Determine the width of the class. The total data measurements equals 60 (N), the measurement unit is 1, and the range is 9 (R). There is a formula table listed below that will help you determine the number of classes to be used:

Number of Data (N)	Number of Classes (K)
Under 50	5 - 7
50 - 100	6 - 10
100 - 250	7 - 12
Over 250	10 - 20

Table 1 Histogram Classes

STEP #5 - The class interval (h), which is used as the horizontal graduation unit for the histogram, is determined by dividing the range (R) by the number of classes. For simplicity sake, since the range is 9, and from our table in figure 7, we can have 6 - 10 classes, we will choose 9 classes; thus 9 divided by 9 = 1.

IV. MAXIMUM ENTROPY

Having established the group with possible valley, the threshold identification can happen in two different ways, by seeking the lowest point or the calculation of maximum entropy.[1] The strategy at the lowest point compares analytically the gray levels values of the group to identify what has fewer occurrences. This is stored and identified as a threshold. The thresholding based on maximum entropy is achieved from probabilistic calculations. In this context we consider an image as a result of a random process, where the probability pi corresponds to the probability of a pixel of the image taking a value of intensity i (i = 1, .., n) [1], as shown below.

$$H = -\sum_{i=1}^{n} pi * \log p$$

$$pi = \frac{ni}{N}$$

where H is the entropy of the image, n is the total number of outputs, i.e., the number of gray levels of image; pi is the probability of gray level i to be found in the image; ni represents the number of pixels with intensity i and N is the total number of pixels in the image.The gray level of the group indicated with the highest entropy is identified as a threshold. Completed this phase, the process continues with the analysis of the other groups. To test the technique, we used myocardial images of biopsies from heart transplant. The choice of this type of image to processing is justified by the groups of existing objects, cell core, fibrous tissue, muscle and tissue rejection. 120 images were processed and the results were compared with those provided by the technique presented in [4].
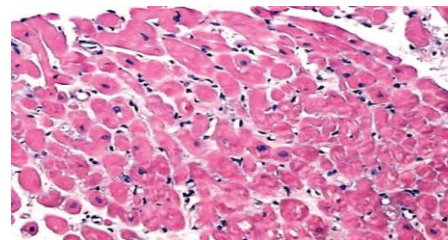
V. EXPERIMENT

Fig.2 Example of myocardial images obtained with biopsies of a transplanted heart patient.[1]

Fig.3. Result of image processing shown in Fig 2. showing the cell core ortissue rejection obtained with the maximum entropy.[1]
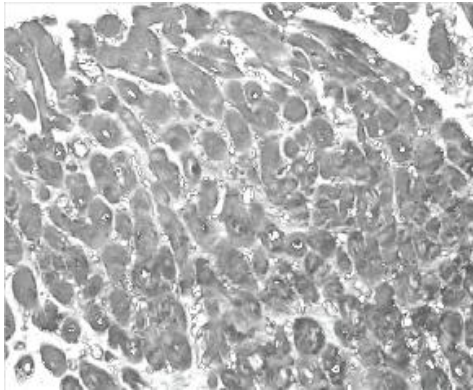

Fig4..Result of image processing shown in Fig 3, showing cardiac muscle.[1]

VI. CONCLUSIONS

Thus system is developed using thresholding on histogram generated from myocardial muscle images in an accurate & efficient way.This method is providing the best result as it clearly identify cell tissues and muscle in myocardial images. This versatility and quality of results make the developed technique is easily adaptable in real life.

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