Detection of Liver Cancer using Image Processing Techniques

Atrayee Dutta and Aditya Dubey

***Abstract*—Image processing is a processing technique with the help of mathematical operations. It uses any of the form of signal processing. Here the input is an image or video and the output is also an image or a set of image. This technique is also used in medical applications for various detection and treatment. In this paper, it has been used to detect cancer cell of the liver. Here ostu's method is used for enhancing the MRI image and watershed method is used to segment the cancer cell from the image.**

***Index Terms*—Image Processing, Ostu's, Watershed method, MRI Image, Cancer cell.**

I. Introduction

CANCER is the abnormal growth of the tissue in an organ. Liver cancer is a type of cancer which affects the largest organ of the abdomen, liver. It is of two types namely Primary Liver Cancer and Secondary Liver Cancer. Primary Liver Cancer originates in the liver itself and is known as Hepatocellular Carcinoma (HCC) or Hepatoma. Secondary Liver Cancer is a type growth of cancer cell where the cancer cell originates from different organ and spread to liver. The first step is to find an image to do the further processing. MRI is a high quality imaging technique which produces the structure of human organ in more defined manner and useful for diagnosis of diseases and Biological Research [1-5]. The results of an MRI image are greatly enhanced by automotive and accurate classification of image [6-8]. The second step includes several enhancement technique to get best quality of the image by removing the unwanted noise from the image. The third stage segment or detect the cancer cell using segmentation. Block diagram of input image shown in Fig. 1.The rest of this paper Section II describes the Material and method. Proposed methodology in Section III. finally concludes the paper in Section IV.

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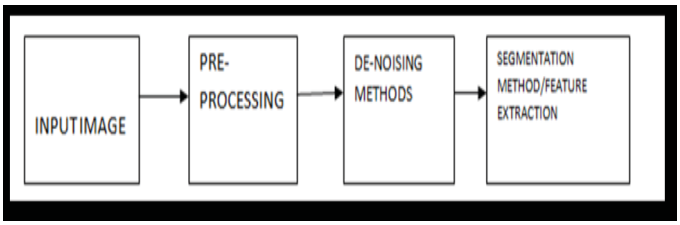

Fig. 1. Basic Block Diagram

II. Material And Method

In this research to detect cancer cell the work has been divided into three categories:

A. Image Enhancement Stage

This method enhance the image and remove unwanted noise from it. The ostu's method is used for this purpose.

B. Image Segmentation Stage

This method segment the cancer cell from the image. The watershed segmentation method is used for this purpose.

C. Feature Extraction Stage

This method enhance the segmented image.

III. Proposed Methodology and Analysis

A. Image Enhancement

Image enhancement is image pre-processing stage. The purpose of the process of image enhancement is to improve the image quality for the human eye. This process is also require to provide a better input image for further processing, so that the result of the image after processing all the stages contains less errors.

The image enhancement technique is divided into two parts which are spatial domain technique and frequency domain technique. In spatial domain technique the value of the pixel is changed with respect to the requirement whereas the frequency domain technique deals with the rate of change of pixels which are changing due to spatial domain. It cannot be determined that what type of technique is good for image enhancement. There are many techniques for image enhancement technique out of which we have use ostu's method.

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1) Ostu's method

This method uses clustering based technique shows in Fig. 2 in other words, it convert greyscale image into binary image. It assumes that the image contain two level of pixel which are foreground pixel and background pixel (bi-modal histogram). It calculate the optimum threshold by separating two classes. The result gives minimum combined-spread and maximum inter-class variance. The ostu's method Fig. 3 can roughly said to be one-dimensional method. The ostu's method search for the threshold which minimizes the inter-class variance.

Fig. 2. Original image

Fig. 3. Ostu's Transformation

B. Image Segmentation

It is an important process for many task in image processing. Many of the important techniques like image description and image recognition are depend on the image segmentation. The process of segmentation divides an image into region or object. The image processing segments 2D image and it has numerous application in the field of medical. This may include visualization, estimation of volume of the interest object, detecting abnormalities like tumors, polyps etc. and tissue qualification and much more. The objective of the process of segmentation is to make the image more useful by changing the representation and simplifying the image due to which it will be easier to analyze the image. This process is use for detecting the boundaries and objects of an image. More precisely we could defined image segmentation as the process of assigning a name or label to the each pixel of that particular image which share certain visual characteristics. The result of a segmentation of an image is basically the entire image which will be formed by combining each segmented parts. The characteristics and the properties will also be same like contour, intensity or texture. However, the adjacent segments contains different characteristics. The segmentation process has two basic properties on intensity values namely discontinuity and similarity. The discontinuity property partitioned the image into different regions for example edges of an image. The similarity property partitioned the image into regions which has similar predefined criterion.The gradient magnitude shows in Fig. 4.

1) Marker-Controlled Watershed Segmentation Approach

Marker-Controlled Watershed Segmentation process enhance the region which indicate the presence of the required object. The location which are extracted by this process are then set to the minimum position within the same topological surface. The watershed algorithm is applied afterwards. Separating objects of an image is one of the difficult method which watershed segmentation makes it easier. Watershed Segmentation Approach is of two types: External associated with Background and Internal associated with the object of interest.The watershed transformation of the Gradient image shows in Fig. 5.

Image segmentation use watershed transform to locate the foreground and background object location. Opening and Closing Reconstruction results shows in Fig. 6 and Fig. 7. This locate the "catchment basins" and "watershed ringe line" of an image by treating its surface with light pixel classified as high and low pixel classified as low. The Fig. 8 and Fig. 9 shows the results of watershed segmentation results:

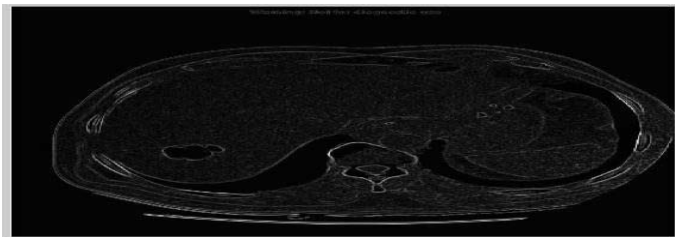

Fig. 4. Gradient magnitude

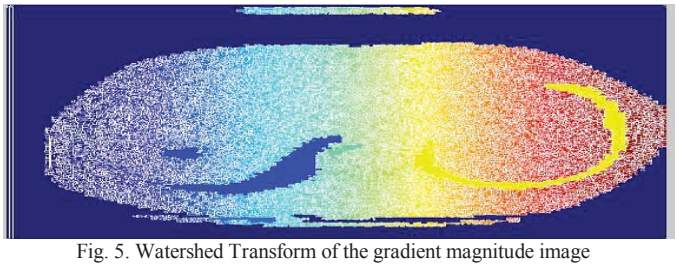

Fig. 5. Watershed Transform of the gradient magnitude image

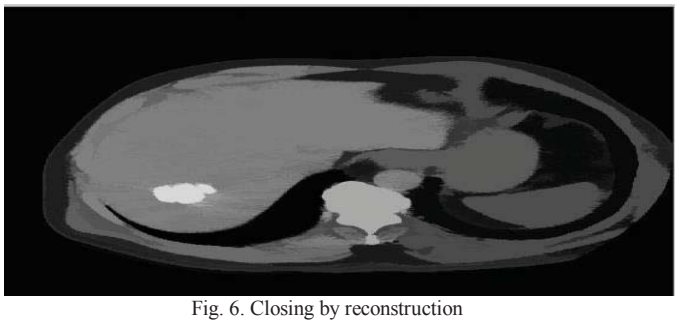

Fig. 6. Closing by reconstruction

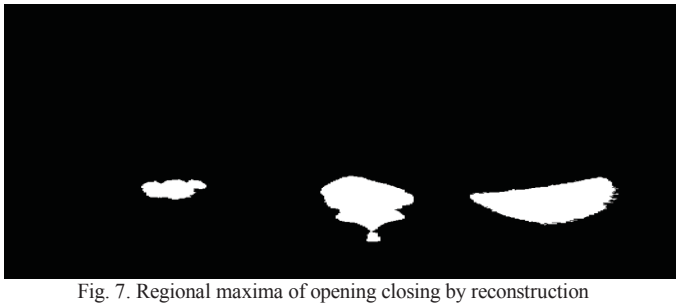

Fig. 7. Regional maxima of opening closing by reconstruction

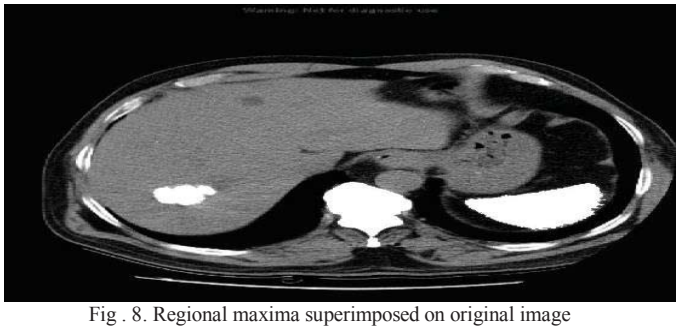

Fig . 8. Regional maxima superimposed on original image

Fig 9. Threshold opening-closing by reconstruction

Fig 10. Watershed ridge line

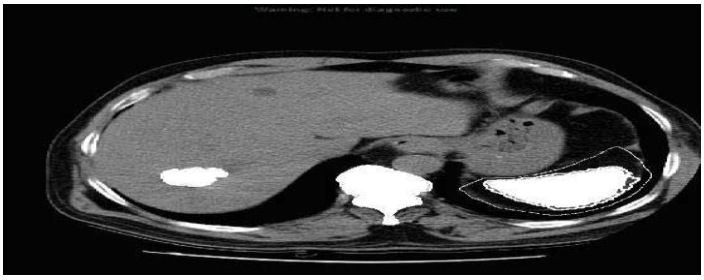

Fig. 11. Markers and object boundaries superimposed on original image

Fig. 12. Watershed label matrix

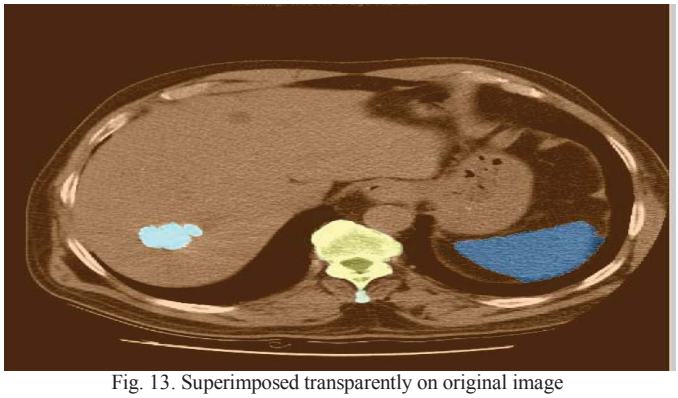

Fig. 13. Superimposed transparently on original image

C. *Feature extraction*

Image feature extraction is one of the most important technique of image processing Watershed ridge and boundaries images is shown in Fig. 10 and Fig. 11. It uses different techniques and algorithm to isolate and detect various shapes and portions of the image. The watershed label matrix and Superimposed image is shown in Fig. 12 and Fig. 13 There are numerous techniques to apply this to the image.Wavelet transform is one of the tool for feature extraction. The wavelet transform has a characteristic of analyzing the image with varying unit of resolution and has multi resolution analytic property [9]. The wavelet transform is better than Fourier transform and short time Fourier transform as it preserves both time and frequency as in Fourier transform it discard the time.

IV. CONCLUSION

Different MRI Images where acquired from the internet, basic Ostu preprocessing technique was used, for segmentation Marker-Controlled Watershed Segmentation was used and it was observed that for a few images' segmentation was done correctly, so our future works includes creating a GUI and enabling a single click feature extraction using wavelet transform, with the accuracy.

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