

Applying Image Processing to Analyze Liver Cancer

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Abstract

Image Processing is a technique in which the image is taken as an input and it is processed further to get the result which is also an image. We can also take multiple images as input and can get the output which may be a single image or set of images. The image processing technique uses certain types of algorithm to process the images. In the modern era image processing plays a vital role in almost every field that comes in our imagination. The usage of Image Processing can be classified based on the source of generation of the image.

The images that we use today are mainly generated from Electromagnetic Spectrum. Image processing is used in Medical Diagnostics, Astronomy, electronic circuit board to examine circuit boards for flaws in manufacturing, like missing components or broken traces, lithography, industrial inspection, lasers, microscopy, in automated visual inspection of manufactured goods, in fake currency detection, Pattern Recognition, MRI etc.

In this paper, this technique focuses on detection of Cancer cell of Liver. Here MRI is used to detect the cancer cell.

Index Terms: -Image Processing, Cancer Cell, MRI, Different Methods

I. INTRODUCTION

Cancer is also called malignancy.

It's the unwanted and abnormal growth of cells. Cancer can be of more than hundred types. Cancer in itself is a broad term. In Cancer our body starts behaving abnormally. The abnormal cells divide uncontrollably and destroy the body tissues. The most common type of Cancer includes Breast Cancer, Lung Cancer, Liver Cancer, etc. Cancer nearly affects every part of the body. Liver Cancer, also called Hepatic Cancer, is one such type of Cancer. Cancer begins in the cells of the liver.

Types of Liver Cancer: -

- I. PRIMARY LIVER CANCER
- II. SECONDARY LIVER CANCER

Primary liver cancer also called Hepatocellular Carcinoma (HCC) or Hepatoma occurs in the liver itself. In *Secondary liver cancer* the formation of the cancer cells takes place in different organs and it then spreads to the liver [7].

Here image processing technique plays a crucial role. Firstly, we look for an image and this image is further processed to move to the next step. Image is captured with the help of MRI. MRI (Magnetic Resonance Imaging) is used in medical science which is a medical imaging technique [9]. RI basically produces high quality detailed pictures of the internal body organs[13]. It combines the small sized

protons inside our body and captures their image. RI is a boon in the field of medical science, where the doctors can closely and accurately see the inside structure of the body non-invasively[20]. It captures the micro-to-micro pictures of the body organ. MRI uses a powerful magnetic field, radio waves and a computer to produce detailed pictures of the internal body structures. MRI doesn't use high -energy electromagnetic radiation like other imaging techniques[14]. It doesn't cause any pain to the body. The results of the MRI technique are further enhanced by accurately classifying the image.

In the next step Image Enhancement Techniques are used. Image Enhancement Technique processes an image so that the result is more suitable than the original image for a specific application. This technique uses certain mathematics and algorithms. The result of Image Processing Technique is another image which is better in some sense as compared to their appearance in the original image. The third step is to detect the cancer cell using segmentation.

Here's a block diagram of Image Processing Technique.

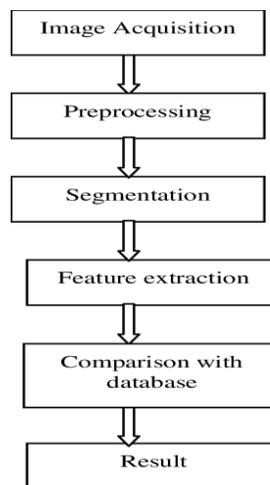


Fig 1. Block diagram of Image Processing Technique

II. METHODS

In this paper to detect the cancer cell the different methods are used and these methods are divided into three categories:

A. Image Acquisition

It takes the input image from the user that can be a single image or set of images.

B. Image Preprocessing

The image that is taken as an input from the user is preprocessed. It's one of the important steps in image processing. By selecting the best image processing technique, the quality of the image can be improved to the great extent[21]. There are a number of preprocessing operations: Contrast Enhancement, Brightness Enhancement, Sharpness Enhancement, Hue, Saturation, etc. can be changed as per requirement.

C. Image Enhancement

It can be categorized into two classes:

1. *Qualitative Enhancement*

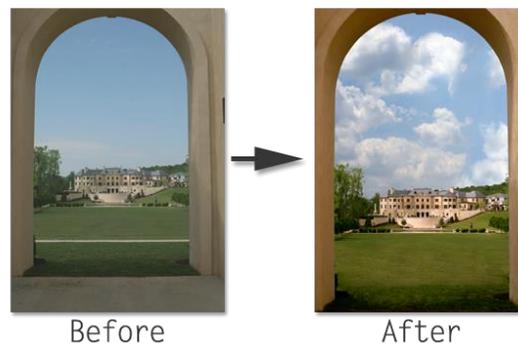
It refers to the modification of images to make it more appealing.

2. *Quantitative Enhancement*

It refers to the modification of information that an image carry. The look of the image is not concerned.

Image enhancement enhances the image by removing unwanted noise from it. In this paper Otsu's method is used for this purpose. Below is a picture of Enhance image vs Original Image.

Fig 2. Original image vs enhanced image



D. *Image Segmentation*

This method subdivides an image into its constituent region or object. We use a set of rules to analyze the content of an image. We use segmentation, when we want the computers to make the decisions. It's not required in case images have to be shown to human beings. Examples of Image Segmentation include Automated Blood Cell Counting, Fingerprint matching in forensic. This method segments the cell which is affected by cancer from the image. In this paper watershed segmentation method is used[17-18].

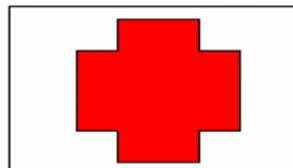


Fig 3. Original image

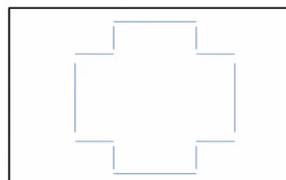


Fig 4. Segmented image

E. Feature extraction

It's a projection of higher dimensional feature space to a lower dimensional feature space[19]. Whatever be the image that was segmented it makes them more appealing.

F. Comparison with the Database

Using different photo matching algorithms, the output of the segmented images is compared with the original images that are stored in the database.

III. ANALYSIS USING PROPOSED METHODOLOGY

Otsu's method

This is one of the thresholding methods. In this method by detecting the threshold we can detect the image.

Thresholding is basically classifying the pixel values in an image.

It actually performs clustering based on image thresholding. It converts grayscale images into binary images[11]. Assuming that image contains two classes of pixels- foreground pixels and background pixels, it separates the two classes and then calculates the optimum threshold. It combines the optimum threshold separating the two classes so that their combined spread is minimal, or equivalent, so that their inter class variance is maximal.



Fig 5. Original Image



Fig 6. Otsu's Transformation

Watershed Segmentation Method

Morphological watersheds provide an integral approach to the segmentations of objects [10][12][15]. It is especially useful for segmenting objects that are touching one another [16]. To segment the touching things in an image is one of the most tedious tasks in image processing. The Watershed Segmentation Method is used most commonly to tackle this problem. To understand the watershed transformation - we view a grayscale image as a topological surface. Here a surface is viewed in two ways: one surface is that where light pixels are high and another where dark pixels are low. “Catchment basins” and “watershed ridge lines” are found in an image. Below image shows these two terms.

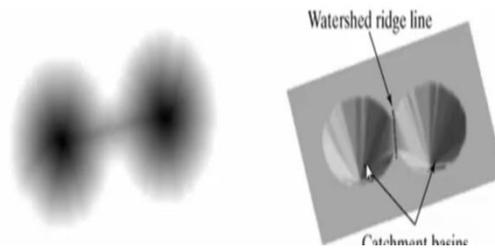


Fig 7. Watershed ridgeline and catchment basins

Results of watershed segmentation method is below:



Fig 8. Original Image [1]

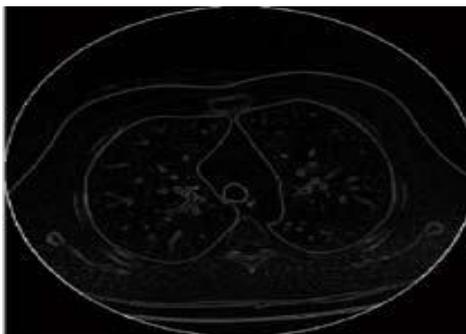


Fig 9. Using gradient magnitude as the segmentation functions [2]

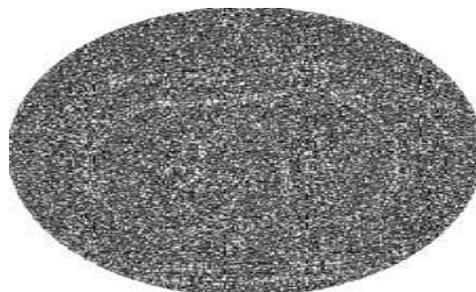


Fig 10. After applying watershed method [3]



Fig 11. After using Marker [4]



Fig 12. Watershed method

successfully applied [5]

Conclusion

This section concludes the review of this survey paper. In this paper different steps of image processing have been covered along with cancer and its types. Image acquisition, preprocessing, segmentation, feature extraction all these terms have been covered. This paper also focuses on thresholding method Otsu's Method which can detect the image by the help of thresholding. It also focuses on a segmentation method called the Watershed method. Also, the result of the Watershed method has been displayed in a series of pictures which gives a deep understanding of segmentation.

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