Comparative Study on Cancer Images using Watershed Transformation

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ABSTRACT

Digital images are exceptionally huge in the medical image diagnosis frameworks. Image analysis and segmentation are very important tasks in the medical image processing particularly in the field of CAD systems. Visual inspection requires being clear in diagnosis process where the correct region which is affected, need to be separated. Medical imaging plays a very crucial role in all stages of the medical decision process. There are various medical imaging modalities in which mammography are used to detect breast cancer where as MRI for brain tumor and CT for lung cancer. The objective of this paper is to compare the cancer images with different modalities using watershed transformation using metrics.

Keywords: Mammogram images, CT images, MRI images

I. INTRODUCTION

Digital images are necessary in all modern medical image diagnosis systems. The detection of cancer and other distortions in the interior parts of the body can be detected to considerable extent and help radiologists in the diagnosis of disease. High quality medical images are very important for diagnosis purposes and health care .medical imaging actually includes different imaging modalities and process to obtain medical images or images of various parts of .human body for diagnostic and treatment purposes. Medical image processing and its analysis is used in several important applications such as early detection of breast cancer, lung cancer and brain cancer. Mammogram consists of mammographic images of used for the examination of breast cancer or similar disease. This is a kind of x-ray output where tissues are particularly highlighted. Detection and diagnosis of cancer becomes much easier with mammograms as compared to the ordinary x-ray images or some other types of imaging modalities. Mammogram is very much useful in detection or even in the early detection of cancer sometimes in the detection of small tumors which were not felt by persons earlier magnetic resonance imaging techniques are used for screening the breast and the brain .MRI's are examined in case of head injury if there is any internal injury to the brain . MRI becomes very useful in presurgicial planning to detect cancer. A CT scan reveals the anatomy of the lungs and surrounding tissues, in which it is use to diagnose and monitor tumor growth. Image analysis and segmentation are very important tasks in the medical image processing particularly in the field of CAD systems and other computer vision applications. This may involve identification of objects or regions, shapes, tissues with the help of certain features extracted from the images. The principal image of image segmentation is to get the region of interest extracted and detected. Biomedical image segmentation plays a vital role in all CAD based diagnosis systems. Watershed algorithm fro image segmentation is based on very popular

stimulation method. Watershed segmentation is the region based method under the classical technique of segmentation it is used for multi component images. The main aim of algorithm is to find the watershed lines in an image in order to separate the distinct regions. Thresholding technique is the vital part of image

1.1 RELATED WORK

Due to advent computer technology image processing techniques have been increasingly important in a wide variety of applications. Image segmentation is a classic subject in the field of image processing and also is a hotspot and focus of image processing techniques. Segmentation of the varied components among the particles is extremely vital to medical call. The complete objective of this segmentation is known as computer aided diagnosis which is used by doctors in evaluating medical images or in recognizing abnormalities in a medical image.[1]Image segmentation technique is used to separate the foreground from the background. Image segmentation is one of the hardest research problems in computer vision industry. Early detection and diagnosis of breast cancer using digital mammography and image processing can increase survival rate and medication can be given in proper time for complete recovery. Detecting breast cancer can be quite a challenging job. Specially, as cancer is not a single disease but is a collection of multiple diseases. Thus, every cancer is different from every other cancer that exist. Also, the same drug may have different reaction on similar type of cancer. Thus, cancer vary from person to person. Depending on only one technique or one algorithm to detect breast cancer may not provide us with the best possible result. As one cancer differ from another, similarly every breast appears differently from another. The mammography image can also be compromised if the patient has undergone some breast surgery[6]. Brain cancer is an abnormal cell population that occurs in the brain. Nowadays, medical imaging techniques play an important role in cancer diagnosis. Magnetic resonance imaging (MRI) is one of the most used techniques to identify and locate the tumor in the brain. Images obtained by medical imaging techniques may become a better quality image thru applying image processing techniques.[11] The lungs are the parts of our body that we use to breathe. They supply oxygen to the organs and tissues of the body. The lungs are divided into areas called lobes. The right lung has three lobes

and the left lung has two. Lung cancer is the type of cancer which unchecks the growth of unusual cells either in one or in both the lungs. These anomalous cells do not perform the functions of healthy human cells and do not mature into normal cells [9]Thresholding is an important technique in image segmentation applications. The basic idea of thresholding is to select an optimal gray-level threshold value for separating objects of interest in an image from the background based on their gray-level distribution[5].Image segmentation needs to segment the object from the background to read the image properly and identify the content of the image carefully, segmentation is necessary to interpretation of an image. For image segmentation Multilevel Thresholding method uses the Otsu's method to segment the image.[3]. Thresholding is an important technique for image segmentation.Otsu method is one of the most successful methods for image thresholding. The objective function of Otsu method is equivalent to that of Kmeans method in multilevel thresholding . They are both based on a same criterion that minimizes the within-class variance[4].The Otsu thresholding is a searching method of an optimal threshold value obtained by using discriminating criteria to maximize the distribution result of the two classes on the grayness level. This method was done to minimize the total weights of some variants in the class of the background and foreground pixels to obtain the optimal threshold[10]. The algorithm was used to evaluate the impact of clustering using centroid initialization, distance measures, and split methods. The experiments were performed using breast cancer dataset[2].

1.2 MOTIVATION AND JUSTIFICATION

Medical image processing is also one of the most emerging applications areas of digital image processing. In modern era, although medical facilities are of very high quality and modern hospitals are equipped with the latest technologies, but human visual perception and detection of abnormality often suffer with imprecision in the detection of cancer or other abnormality. This challenging task can be made easier and detection accuracy can be improved with the help of CAD systems, since a lot of digital image processing techniques makes the detection more efficient and accurate. Detection and diagnosis of cancer becomes much easier with mammograms as compared to the ordinary X-Ray images.MRI images has high sensitivity and low apecificity.MRI is found

more accurate than the other imaging for detecting brain tumors. CT scan is a kind of computed tomography techniques used to visualize throughout the body. CT scan helps to detect the lung cancer rather than other modalities.
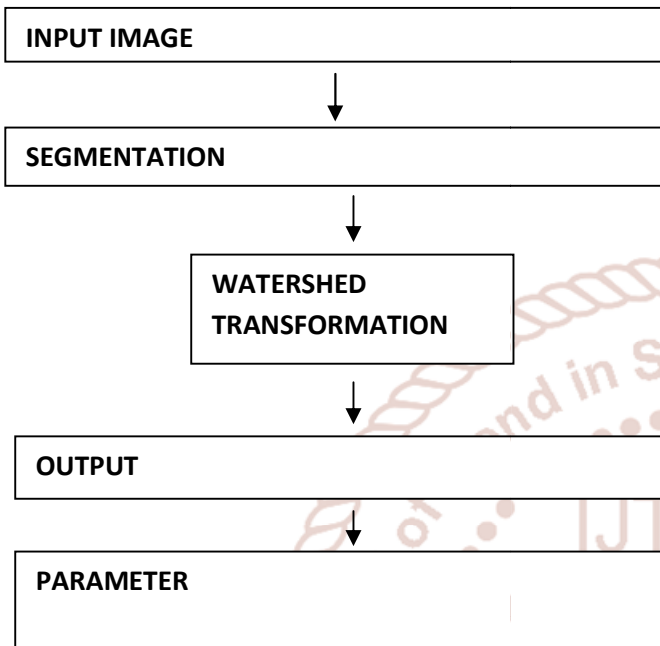
1.3 OUTLINE OF THE PAPER

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┌─────────────────────────────┐
│  INPUT IMAGE                │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│  SEGMENTATION               │
└─────────────────────────────┘
              │
              ▼
      ┌──────────────────┐
      │  WATERSHED       │
      │  TRANSFORMATION  │
      └──────────────────┘
              │
              ▼
┌─────────────────────────────┐
│  OUTPUT                     │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│  PARAMETER                  │
└─────────────────────────────┘
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Fig 1.1 Outline of the Paper

1.4 ORGANIZATION OF THE WORK:

The paper is planned as follows, Methodology which includes the Watershed transformation, presented in section II, Experimental results are shown in section III, Performance analysis is also discussed in section IV, Conclusion is presented in section V.

II.   METHODOLOGY

2.1 WATERSHED TRANSFORMATION:

Medical image processing is also one of the most emerging applications areas of digital image processing. In modern era, although medical facilities are of very high quality and modern hospitals are equipped with the latest technologies, but human visual perception and detection of abnormality often suffer with imprecision in the detection of cancer or other abnormality. This challenging task can be made easier and detection accuracy can be improved with the help of CAD systems, since a lot of digital image processing techniques makes the detection more efficient and accurate. Detection and diagnosis of

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Method:

(i)   Take input Images as Mammogram, MRI, CT
(ii)   Segment using Watershed Transformation
(iii)   Compare the segmented image
(iv)   The experimented results are evaluated using metrics

III.   EXPERIMENTAL RESULT

The table 3.1 shows the experimental results of the segmentation techniques. The original images are tabulated and the segmented results of watershed transformation, resultant images are been tabulated.

WATERSHED TRANSFORMATION			
IMAGES	SEGMENTED IMAGE		
	MAMMOGRAM	MRI	CT
IMAGE 1			
IMAGE 2			

Table 3.1 Experimental results

IV.   PERFORMANCE ANALYSIS

4.1 PERFORMANCE METRICS

PSNR-PEAK SIGNAL-TO-NOISE RATIO:

Peak Signal-to-Noise Ratio (PSNR) avoids this problem   by scaling the MSE according to the image range:

Where S is the maximum pixel value. PSNR is measured in decibels (dB). The PSNR measure is also not ideal, but is in common use. Its main failing is that the signal strength is estimated as , rather than the actual signal strength for the image. PSNR is a good measure for comparing restoration results for the same image, but between-image comparisons of PSNR are meaningless. One image with 20 dB PSNR may look much better than another image with 30 dB PSNR. The PSNR (peak signal to noise ratio) is used

to determine the degradation in the embedded image with respect to the host image. It is calculated by the formula as

$$PSNR = 10 \log 10 \ (L2 MSE)$$

MSE-MEAN SQUARE ERROR:

The MSE (mean square error)is defined as a average squared difference between a reference image and a distorted image.It is calculated by the formula given below

$$MSE = 1 XY X \Sigma i=1 X \Sigma j=1 (ci, -ei,)2$$

X and Y are height and width respectively of the image. The c (i, j) is the pixel value of the cover image and e (i, j) is the pixel value of the embed image.

TIME ACCURACY:

toc reads the elapsed time from the stopwatch timer started by the tic function. The function reads the internal time at the execution of the toc command, and displays the elapsed time since the most recent call to the tic function that had no output, in seconds

4.1 Parameter Evaluation

METRICS	WATERSHED TRANSFORMATION					
	MAMMOGRAM		MRI		CT	
	IMG1	IMG 2	IMG 1	IMG 2	IMG 1	IMG 2
PSNR	12.20	12.70	14.36	13.00	10.05	8.979
MSE	62.52	47.69	47.43	57.08	75.72	72.91
ELAPSED TIME	0.658	0.524	0.508	0.523	0.528	0.529

Fig 4.1 Parameter Evaluation

CONCLUSION

The Comparative analysis of three different cancer images has been carried out using the watershed transformation and the results has been analysed using the metrics.

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