Comparative Study on Cancer Images using Watershed Transformation

M. Najela Fathin
Research Scholar, PG & Research Department of Computer Science, Sadakathullah Appa College, Rahmath Nagar, Tirunelveli, Tamil Nadu, India

Dr. S. Shajun Nisha
Head & Asst Prof, PG & Research Department of Computer Science, Sadakathullah Appa College, Rahmath Nagar, Tirunelveli, Tamil Nadu, India

Dr. M. Mohamed Sathik
Principal, Sadakathullah Appa College, Rahmath Nagar, Tirunelveli, Tamil Nadu, India

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 presurgical 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 for 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 the algorithm is to find the watershed lines in an image to separate the distinct regions. Thresholding technique is the vital part of image processing techniques.

1.1 RELATED WORK

Due to the advent of 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 care. 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. 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. Therefore, 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. 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. 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 unchecked 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.

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 have high sensitivity and low specificity. 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

![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 cancer becomes much easier with mammograms as compared to the ordinary X-Ray images. MRI images have 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.

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.

![Experimental Results Table]

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

\[
PSNR = 10 \log_{10} \left( \frac{L}{MSE} \right)
\]

**MSE-MEAN SQUARE ERROR:**
The MSE (mean square error) is defined as an average squared difference between a reference image and a distorted image. It is calculated by the formula given below

\[
MSE = \frac{1}{XY} \sum_{i=1}^{X} \sum_{j=1}^{Y} (c_{i,j} - e_{i,j})^2
\]

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

| WATERSHED TRANSFORMATION | MAMMOGRAM | MRI | CT |
|--------------------------|------------|-----|----|
| METRICS                  | IMG G1     | IMG 1 | IMG 2 | IMG 1 | IMG G 2 |
| PSNR                     | 12.20      | 14.3 | 13.0 | 10.0 | 8.9 |
| MSE                      | 62.52      | 47.69 | 47.4 | 57.0 | 75.7 | 72.91 |
| ELAPSED TIME             | 0.658      | 0.524 | 0.508 | 0.523 | 0.528 | 0.529 |

**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.

**REFERENCES**

1. Amruta B. Patil, J.A.shaikh “OTSU Thresholding Method for Flower Image Segmentation“ International Journal of Computational Engineering Research (IJCER), ISSN (e): 2250 – 3005 ,Volume, 06 Issue, 05, May – 2016

2. Ashutosh Kumar Dubey, Umesh Gupta, Sonal Jain” Analysis of k-means clustering approach on the breast cancer Wisconsin dataset“ Int J CARS,DOI 10.1007/s11548-016-1437-9, Received: 15 February 2016 / Accepted: 27 May 2016.

3. Ms. Bharti Chourasia, Dr Sanjeev Kumar Gupta, Anshuj Jain” Performance analysis of multi level threshold based OTSU method”, IJARIIE-ISSN(O)-2395-4396Vol-2 Issue-6 2016.

4. Dongju Liu, Jian Yu.” Otsu method and K-means”, 2009 Ninth International Conference on Hybrid Intelligent Systems DOI 10.1109/HIS.2009.

5. Miss Hetal J. Vala, Prof. Astha Baxi” A Review on Otsu Image Segmentation Algorithm”, International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 2, Issue 2, February 2013

6. M. Najela Fathin, Dr. S. Shajun Nisha,” Comparative Analysis between Otsu and Watershed for Mammogram Images”, Journal of Information and Language Engineering (Volume-1, Issue-1), DEC, 2017

7. M. Najela Fathin, Dr. S. Shajun Nisha,” Comparison Between Two Segmentation Techniques For Mammography”, Sadakath-A Research Bulletin Volume-1, Issue-1, Feb, 2017

8. Priya M.S, Dr. G.M. Kadhar Nawaz, “Multilevel Image Thresholding using OTSU’s Algorithm in Image Segmentation”, International Journal of Scientific & Engineering Research Volume 8, Issue 5, May-2017

9. Selin Uzelaltinbulat, Buse Ugur, Lung tumor segmentation algorithm, 9th International
Conference on Theory and Application of Soft Computing, Computing with Words and Perception, ICSCCW 2017, 22-23 August 2017

10. Shofwatul Uyun, Sri Hartati, Agus, Harjoko, Lina Choridah, “A Comparative Study of Thresholding Algorithms on Breast Area and Fibroglandular Tissue”, (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 6, No. 1, 2015.

11. Umit Ilhan, Ahmet Ilhan, Brain tumor segmentation based on a new threshold approach, 9th International Conference on Theory and Application of Soft Computing, Computing with Words and Perception, ICSCCW 2017, 22-23 August 2017