Middle-East Journal of Scientific Research 14 (5): 669-672, 2013
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2013.14.5.73122

A Cluster Based Segmentation of Magnetic Resonance Images for Brain Tumor Detection

R. Manikandan, G.S. Monolisa and K. Saranya

Information and Communication Technology SASTRA University, Thanjavur- 613 401, Tamilnadu, India

Abstract: Image Processing is one of the emergent research areas today. Medical image processing is the most challenging and highly wanted field in that. Brain tumor detection in Magnetic resonance imaging (MRI) has become an emergent area in the field of medical image processing. Segmentation of images is one of the most difficult tasks thus holds an important position in image processing which determines the quality of the final result. Image segmentation is the process of dividing an image into different homogeneous regions.MR Image segmentation is done through clustering. Clustering is a method of grouping a set of patterns into a number of clusters. The aim of this paper is to design an automated tool for brain tumor detection using MRI scanned image data sets. Detection and extraction of tumor from MRI scan images of the brain was done using MATLAB software.

Key words: Brain Tumor · Clustering · MRI · Segmentation

INTRODUCTION

A tumor is a throng of tissues that grows in an undisciplined manner that normalizes growth. Brain tumor is intrinsically serious and critical because of its persistent and infiltrative nature. The versatile brain tumors can be divided into two categories namely benign (non-cancerous) and malignant (cancerous) depending on the tumors beginning phase, their growth sample and melanoma. Benign brain tumors do not hold malevolent cells. Typically, benign tumors can be removed and and they hardly ever grow back. The margin or periphery of a benign brain tumor can be easily identified. These cells do not infect tissues around them or broaden to other parts of the body. But still, benign tumors can compress on responsive areas of the brain and cause severe health issues. Very rarely, a benign brain tumor may become malignant.

Malignant brain tumor contains cancerous cells. and They are likely to grow rapidly and crowd or invade the surrounding healthy brain tissue. Very rarely cancer cells may break away from a malignant brain tumor and spread to other parts of the brain, to the spinal cord, or even to other parts of the body. The spread of cancer is called metastasis. Sometimes, a malignant tumor does not extend into healthy tissue.

Imaging plays an essential task in the and and diagnosis and and of brain tumors. Recognizing a brain tumor generally involves a neurological assessment, brain scans and /or an analysis of the brain tissues. Doctors use the diagnostic information to categorize the tumor from the least insistent (benign) to the most insistent (malignant). Identifying the tumor type helps the doctors to verify the most suitable course of treatment. One of the most preferable types for diagnostic methods is MRI (Magnetic Resonance Imaging). MRI is a superior medical imaging technique used to generate high quality images of the human body with high spatial resolution and tremendous discrimination of soft tissues. MRI is often used when treating brain tumors, ankle and foot. From these high-resolution images, we can obtain elaborated anatomical information to observe human brain development and determine abnormalities.

In our paper the brain tumor is detected using image segmentation process. Defining in simple terms, Segmentation refers to the procedure of partitioning a digital image into various sectors. The purpose of segmentation is to shorten or modify the representation of an image into something that is more significant and easier to analyze. Image segmentation is typically used to locate objects and boundaries in images. Among the various general purpose segmentation methods,

Corresponding Author: R. Manikandan, Information and Communication Technology, SASTRAUniversity, Thanjavur-613401, Tamilnadu, India.

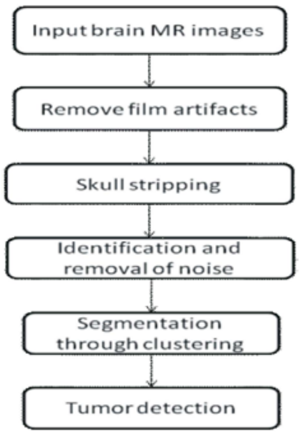

Fig 1: Flowchart of image pre-processing and segmentation

clustering has been chosen here. Clustering refers to the process of grouping pixels of an image such that pixels which are in the same group (cluster) are similar among them and are dissimilar to the pixels which belong to the other groups (clusters). Using the most popular and preferable K-Means clustering algorithm the tumor tissues are extracted from the brain [1-4].

Methodology: Thus the total process is as follows:

- Input a MRI brain slices.
- Remove the film artifacts.
- Skull stripping.
- Automatic identification of noise.
- Removal of noise using appropriate filter.
- Segmentation through K-Means clustering algorithm.
- Extraction of location of brain tumor tissues from MRI.

Image Pre-Processing: MRI brain images cannot be inserted directly as the input for the proposed system. Image pre-processing is the technique of enhancing data images prior to computational processing. It can significantly increase the reliability, accuracy and interpretability of an optical inspection during image processing phase. The input image is subjected to a set of pre-processing steps so that the image gets transformed suitable for further processing.

Removal of Film Artifacts: The MRI brain image consists of film artifacts or labels on the MRI such as patient name, age and marks. In our paper these artifacts are removed using tracking algorithm. The intensity values of the pixels are analyzed from the first row and first column and

Fig. 2: MRI Brain with and without film artifacts

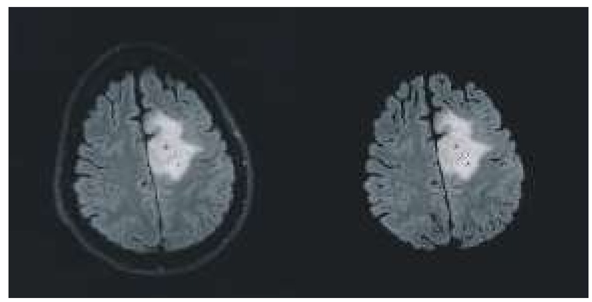

Fig. 3: MRI Brain before and after skull stripping

the threshold values of the film artifacts are found. Those pixels whose intensity values are greater than that of the threshold value are separated from the MRI brain image. In Figure 2, a MRI brain image with film artifacts is shown followed by Figure 3 with removal of film artifacts.

Skull Stripping: Skull stripping is an imperative pre-processing technique in MR image scrutiny. It is able to perceive the boundary separating brain and skull directly and thus evades the processing of background and skull areas. The main predicament in skull-stripping is the segmentation of the non-cerebral and the intracranial tissues due to their homogeneity intensities. In figure 3 the images of skull stripping is shown.

Automatic Identification and Removal of Noise: Noises are unwanted information in an image and can transpire during image capture, transmission etc. During noise removal the required information of that image should be preserved. To facilitate the removal of noise from the image, prior information about the temperament of noise must be known or else noise removal would cause image distortion. Recognizing the noise nature is an exigent problem. The noise identification and removal method anticipated here comprises of two phases, training phase and testing phase. Initially some delegate noise samples has been extracted from the given noisy image. Statistical features like kurtosis and skewness has been estimated from the samples. The noise can be classified by means of

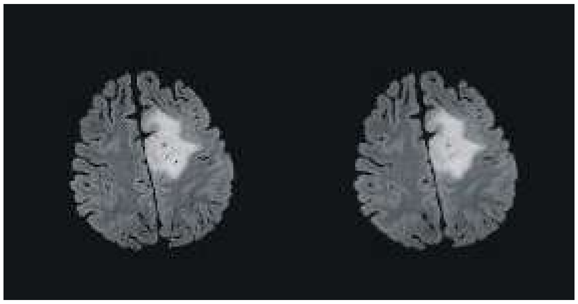

Fig. 4: Enhanced image after removal of noise

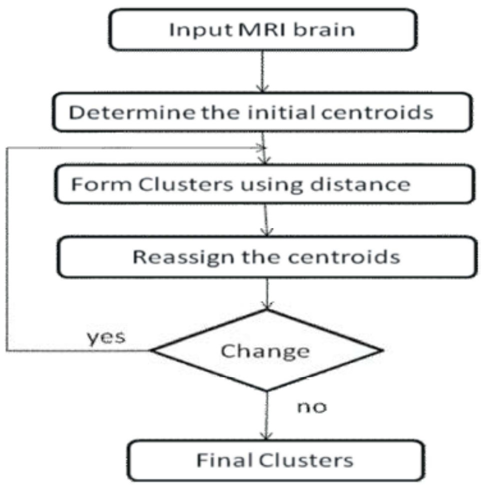

Fig. 5: Flowchart of K-Means Clustering Algorithm

statistical information and trained data[5,6]. In this paper the most commonly occurring noises like Gaussian, salt and and and pepper and speckle noises have been considered. The underlying algorithms include wiener filter for Gaussian noise, median filter for salt and pepper noise and Lee filter for speckle noise. Finally the noise type is identified and corresponding filter is applied and

Segmentation Through Clustering: One of the first steps in direction of understanding images is to segment them and find out different objects in them. Segmentation is to subdivide an image into its component regions or objects. It should stop when the objects of interest in an application have been isolated. In this paper the MRI images are segmented through cluster based methods. K-Means is a simplest unsupervised learning technique that solves the well known clustering problem. It is an algorithm to classify or to group your objects based on attributes/features into K number of group. K is positive integer number. The grouping is done by minimizing the sum of squares of distances between data and the corresponding cluster centroid.

The initial partitions are chosen by getting the values of the pixels. Every pixel in the input image is compared against the initial partitions using the Euclidian Distance and the nearest partition is chosen and recorded. Then, the mean of all pixels within a given partition is determined. and This mean is then used as the new value for the given partition. Once the new partition values have been determined, algorithm returns to assign each pixel to the nearest partition. The algorithm continues until pixels are no longer changing which partition they are associated with or until none of the partition values changes by more than a set small amount.

The K-Means algorithm will do the three steps below until convergence

Iterate until stable (= no object move group):

- Determine the centroid coordinate
- Determine the distance of each object to the centroids
- Group the object based on minimum distance (find the closest centroid)

The execution time of k-means is very less when compared to other algorithms. It provides robust and straight results. Thus the physician has the accurate and effective use of the cluster image obtained from the

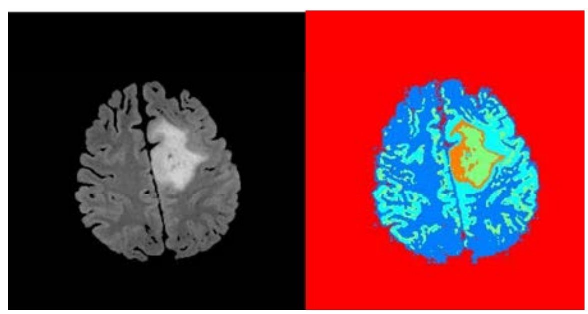

Fig. 6: Clustered Image

Fig. 7: GUI model of system detecting Brain Tumor location

unsupervised computing of medical image. They cluster the MRI image into various segmentations and the tumor content of the image can be easily segmented by the proposed algorithm[7]. The flowchart of k-means algorithm is shown in figure 5.

CONCLUSIONS AND FUTURE ENHANCEMENT

The performance of the MRI scanned image is studied in terms of detected tumor pixels. This project inherits several methods in medical image processing and gives more information about brain tumor detection and segmentation. The target area is segmented and the evaluation of this tool is positive and helps the doctors in diagnosis, treatment plan making and state of the tumor monitoring. In our project medical image analysis includes the image to be segmented in terms of a few parameters and into smaller sizes or regions to address the different aspects of analyzing images into anatomically and pathologically meaningful regions. Classifying regions using their multi parameter values makes the study of the regions of physiological and pathological interest easier and more definable for future enhancement.

In future, the system could be improved by adapting more segmentation algorithms to suit the different medical image segmentations. The time for analysis could be made lesser and execution of the process can be made much easier and user friendly. The execution time and accuracy level can be analyzed with other clustering algorithms for effective measures. Further, the work in three dimensional domains can also be enhanced with its necessary algorithms.

REFERENCES

1. Beham, M.P. and A.B. Gurulakshmi, 2012. "Morphological Image Processing Approach on The Detection of Tumor and Cancer Cells", IEEE Conference on Devices,Circuits and Systems (ICDCS).
2. Gonzalez and Woods, 2008. "Digital Image processing" 3rd Edition, Prentice Hall.
3. Rapine, N.H. and R. Bhavani, 2012. "Automatic MR Brain Tumor Detection Using Posibilistic C-Means and K-Means with Color Segmentation", International Journal of Computer Application (0975-8887), 56: 2.
4. Roy, S. and S.K. Bandyopadhyay, 2012. "Detection and Quantification of Brain Tumor from MRI of Brain and its Symmetric Analysis", International Journal of Information and Communication Technology Research, ISSN: 2223-4985, 2(6): 477-483.
5. Viji, K.S.A. and J. Jayakumari, 2012. "Performance Evaluation of Standard Image Segmantation of MRI Brain Tumor Images", European Journal of Scientific Research, ISSN: 1450-216X, 79(2): 166-179.
6. Ganesh, J.S., Dr. V.S. Rao and Dr. K. Srinivas, 2012. "Enhanced Noise Type Recognition Using Statistical Measures", IOSR Journal of Computer Engineering (IOSRJCE), ISSN: 2278-0661, 2(1): 19-23.
7. George, E.B. and M. Karnan, 2012. "MRI Brain Image Enhancement Using Filtering Techniques", International Journal of Computer Science and Engineering Technology (IJCSET), ISSN: 2229-3345, 3(9): 339-403.