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A Review of Automated MRI Image Processing Techniques Employing Segmentation & Classification

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ABSTRACT

This paper is based on the survey of different techniques that can be used for detection of brain tumor by image processing of MRI Images. The MRI imaging technique is the best for detection brain tumors due to its high resolution and ability to show clear brain structures, tumor's size and location. From MRI Brain image, we get the useful information for the detection of tumor. We can get detailed anatomical information to check brain development and find abnormalities. In this new era of medical science there are different ways/methods are developed for classifying MR images, these are atlas methods, Fuzzy logic based methods, image variation segmentation and shape methods, neural networks, knowledge based techniques, region growing method, watershed segmentation methods and various other segmentation methods. The aim of pre-processing is an improvement of the image data that suppresses undesired distortions or enhances some image features relevant for further processing and analysis task.

Keywords :— Magnetic Resonance Imaging, Pre-processing, Segmentation, Tumor, Artificial Intelligence.

I. INTRODUCTION

Medical Image processing is the most challenging and innovative field specially MRI imaging modalities. This gives us good Quality images of the parts/organs of the human body. MRI technique is one of the available imaging modern techniques like CT-Scan, X-Ray and Mammography. It provides good quality visual details/ pictures about the anatomy and the brains overall structure. MRI is a 3-D non-invasive imaging modality, which is best suited for soft tissue abnormality detection. The MRI scanned image is taken for the entire process. The MRI scan is more comfortable than CT scan for diagnosis. It does not affect the human body because it doesn't use any radiation. It is painless. An MRI scan can be done for the head, chest, blood vessels, bones and joints, spine etc.

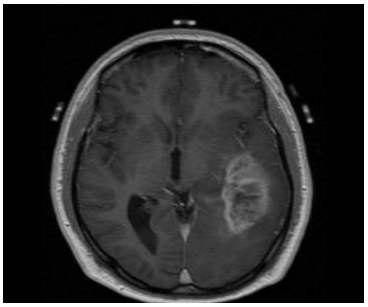

Fig.1 Scan MR Image of brain

Pre-processing of MRI images is the primary step in image analysis which is used for reducing image noise, highlighting edges, or displaying digital images. Many noise reduction techniques are used to enhance the image quality then some morphological operations are applied to detect the cancer cells in the image. KSL Filtering, Median Filter, High pass Filter, Adaptive Filter, Mean Filter etc. techniques are used in pre-processing to reduce noises and image enhancement. The enhancement stage includes resolution enhancement and contrast enhancement. These are used to suppress noise and imaging of spectral parameters. After this stage the medical image is converted into standard image without noise, film artifacts and labels.

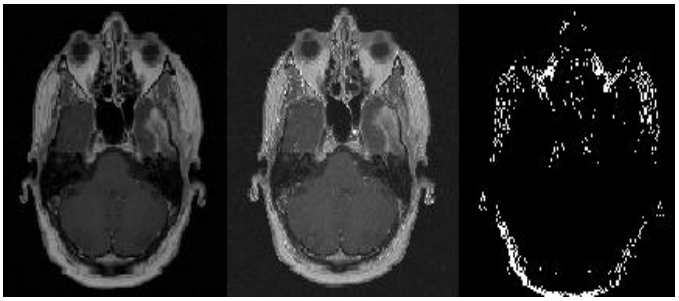

Fig.2 MR Image Processing

Tumor detection and segmentation techniques are performed to find the exact location, shape and size of tumor. The tumor can have different shape, size, location and intensities. The tumor not only changes the part of brain which tumor exist but also sometimes it influences shape and intensities of other structures of the brain. Brain tumor segmentation means segregating tumor from non-tumor tissues. There are various types of malignant tumors such as astrocytoma, meningioma, glioma, medulloblastoma and metastatic, which vary greatly in appearance — shape, size and location. Several automated segmentation techniques as region growing methods, thresholding, seed region growing, Neuro-Fuzzy logic, K-Means, KNN, fuzzy C-Means, watershed segmentation, edge based segmentation etc.

Fig. 3 MR Image Segmentation

Tumor classification is done on the basis of brain detection and segmentation result. There are various types of tumors such as benign, malignant, primary tumor, metastatic tumor etc. Benign tumors are least aggressive and originate from cells within or surrounding the brain, do not contain cancer cells, grow slowly, and typically have clear borders that do not spread into other tissue. It may grow in size but does not spread to the other parts of the body. Growth of tumor may cause some pain if it is processed against some vital organ or tissue.

Malignant brain tumors contain cancer cells and often do not have clear borders. The cancerous cells are carried by blood or lymph to the other parts of the body where they spread secondary cancers. They are considered to be life threatening because they grow rapidly and invade surrounding brain tissues.

II. LITERATURE REVIEW

This section, presents review of the selected literature in image segmentation techniques and their usage.

IJESIT Sept 2012 'N.Gopinath' paper titled "Extraction of Cancer Cells from MRI Prostate Image Using MATLAB" proposed methods for Pre-processing of Noisy input image using High pass and Median Filtering and Segmentation by Threshold Segmentation, Watershed Segmentation and Morphological operations on given MRI Prostate Image. The extracted cancer cell regions from the given image are highlighted in the final output of the MRI Prostate image.

IEEE Conference on Pan American Health Care Exchanges, pp:1-1, 2014 'V. Zeljkovic, C.Druzgalski, Y.Zhang, Z.Zhu, Z.Xu, D.Zhang and P.Mayorga' paper titled "Automatic Brain Tumor Detection and Segmentation in MR Images" have developed a computer aided method for automated brain tumor detection in MRI images. This method allows for the segmentation of tumor tissue with an accuracy and reproducibility comparable to manual segmentation. The results show 93.33% accuracy in abnormal images and full accuracy in healthy brain MR images. This method for tumor detection in MR images also provides information about its exact position and documents its shape. Therefore, this assistive method enhances diagnostic efficiency and reduces the possibility of a human error and misdiagnosis.

IJRET March 2014 'Swe Zin Oo, Aung Soe Khaing' paper titled "Brain Tumor Detection and Segmentation using Watershed Segmentation and Morphological Operation" proposed a way by which the tumor region is extracted from the single MRI brain slice. The tumor region is detected using morphological operation. The volume of the tumor is calculated to get the exact result of the tumor region.

IJCS 2009 'Shi. Z, He.L, Suzuki T.N.K, and H. Itoh' paper titled "Survey on Neural Networks used for Medical Image Processing" employed neural networks for medical image processing, including the key features of medical image preprocessing, segmentation, and object detection and recognition. The study employed Hopfield and feed-forward neural networks. The feed-forward and Hopfield neural networks are simple to use and easy to implement. The added advantage of Hopfield neural networks is that it does not require pre-experimental knowledge. The time required to resolve image processing predicament is substantially reduced by using trained neural network.

IJETAE April 2012 'Dibyendu Goshal, Pinaki Pratim Acharjya' paper titled "MRI Image Segmentation Using Watershed Transform" proposed a robust approach for 3D medical image segmentation with human brain images by using marker-based watershed segmentation. This approach can reduce user interaction and speeds up the entire segmentation process.

SARC-IRF International Conference May 2015 'SONU SUHAG, L. M. SAINI' paper titled "Automatic Detection of Brain Tumor by Image Processing in MATLAB" proposed an algorithm in MATLAB GUI developed for the detection of brain tumor from MRI brain scanned images based on various operation like pre-processing, Fuzzy C- means segmentation, and feature extraction and by using SVM classifier in MATLAB GUI.

III. AUTHOR'S REVIEW

We have reviewed above papers and concluded that MRI is a promising technology for further research & indispensible to medical fraternity. Software(s) are designed to dramatically reduce the time required for MRI examinations of the brain. Automated system would facilitate use of time -critical treatments in individual cases by diagnosis the disease in minimum time. Despite the work of various authors there are shortcomings in technology. Software(s) are not relevant to medical terminologies. There is no fully integrated system for detection of tumors and classify them by their symptoms. The author proposes the development of system which identifies tumor's effect according to its location and size. Detection and segmentation of tumor and classification of an effected brain area and its automated management, prognosis and symptoms can be done. We can do integration of an automatic tumor staging technique for staging and grading of tumor and its management. Detection and classification of malignant or non-malignant tumor based on artificial intelligence classifier can be done.

IV. CONCLUSIONS

This paper includes the description of various technique of image processing which are used to detect the brain tumor and to find the exact location, shape and size. The techniques are promising enough for detection and segmentation. This technology enables early detection of tumor, low manpower, better result etc. An automated system can speed up the treatment process without using manual force. It may render significant reduction in mortality rate.

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