International Journal on Future Revolution in Computer Science & Communication Engineering
Volume: 4 Issue: 3
ISSN: 2454-4248
367 – 372

Enhancement Techniques and Methods for Brain MRI Imaging

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***Abstract*—** In this paper, it is planned to review and compare the different methods of enhancing a DICOM of brain MRIused in preprocessing and segmentation techniques. Image segmentation is the process of partitioning an image into multiple segments, so as to change the representation of an image into something that is more meaningful and easier to analyze. Several general-purpose algorithms and techniques have been developed for image segmentation. This paper describes the different segmentation techniques used in the field of ultrasound, MR image and SAR Image Processing. In preprocessing and enhancement stage is used to eliminate the noise and high frequency components from DICOM image. In this paper, various Preprocessing and Enhancement Technique, Segmentation Algorithm and their compared.

Keywords*—Enhancement, Pre-processing, Medical-Imaging, Image Segmentation, Center Weighted Median (CWM) Filter.*

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I. INTRODUCTION

The image processing techniques, image enhancement techniques and de- noising techniques are widely used in the field of medical imaging, especially Magnetic Resonance Imaging (MRI). The test that makes use of magnetic field and radio pulses to capture images of body especially that of the brain is called Magnetic Resonance Imaging. The MRI is superior to the X- ray and Computed Tomography or CT scan, as it can provide information of body tissues that cannot be provided by the others. Basically, the MRI technique of imaging is employed in medicinal backgrounds to generate high quality images of the human body parts. The MRI works on the principle of Nuclear Magnetic Resonance (NMR), which is a spectroscopic technique used by thescientists to acquire microscopic information about the molecules. The MRI is now advanced and uses the volume imaging technique and Magnetic Resonance Imaging is young and is growing in the field of science. The most suitable technique for the problemsof soft tissues differentiates MRI from other imaging variants in the medicinal field. An x- ray is ideal for hard tissue like bones while a MRI is ideal for soft tissue like human brain. The MRI is used for a number of purposes like diagnosing braintumors, multiple sclerosis, and spinal infections; to visualize torn ligaments, shoulder injuries, tumors in bones, herniated discs and strokes at initial stages. The MRI images clearly show the tissues that are damaged or diseased and these references. In order to view the MRI images clearly, sometimes a contrast material is also used and it helps to identify flow of blood, tumors and inflamed areas in the tissues. To give proper diagnosis and good results, doctors are provided with the different results of enhanced images. Enhancement is a fundamental task in digital image processing and analysis, aiming to improve the appearance of image in terms of human brightness perception. Contrast enhancement is among them and is often part of image processing systems in the pre-processing and/or post-processing stage.

II. IMAGE ACQUISITION

To access the real medical images for carrying our research is a very difficult because of privacy issues and heavy technical difficult. This idea is automatic brain tumor detection methods through MRI brain Images. A sample of 80 T1 weighted images is used for enhancement purpose.T1- weighted images visible water darker and the fat brighter. All MRI images were acquired on a 0.5T open prevent MRI system [2]. Most Medical Imaging Studies and detection are directed using MRI, Positron Emission Tomography (PET) and Computed tomography (CT) Scan.

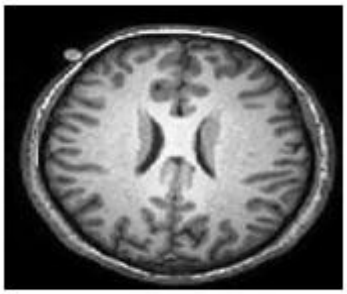

Figure 1: Sample of Brain MRI

III. PREPROCESSING TECHNIQUES

A. Removal of film artifacts

The MRI brain image consists of film artifacts or label on the MRI include patient name, age and marks. Modify

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trackingalgorithm used to eliminate film artifact. This algorithm analysis the brain tumor of image the first row and first column is started, the intensity value of the pixels are analyzed and found the threshold value of the film

B. Removal of Skull using Modified Tracking Algorithm

To eliminate unwanted portion of MRI by using modified Tracking Algorithm. The MRI brain image is left, right and top skull portions. To obtain finally eliminating the film artifacts and labels is taken. Brain imaging is started from first row, first column of left the given matrix and select the peak threshold value from matrix of left side and considers the 200 flag value.

C. Need for pre-processing

The pre-processing is required for MRI images as:

∑ Marks or labels present (Film artifacts) can prevent in the post-processing of these images.
∑ Images are to be made more suitable for advanced processing in CAD systems.
∑ Enhance the quality of image.
∑ Remove the noise of image.

Preprocessing is used to displaying the digital images orhighlighting edges of image. The Preprocessing Techniquesinclude the Content Based model, Fiber tracking Method, Wavelets& Wavelet Packets, and Fourier transformtechnique.

TABLE I : AN OVERVIEW OF PREPROCESSING TECHNIQUES

METHODS	**REMARKS**
Neural Networks, Genetic Programming[62]	Data is large volume the processed successfully.
Head Model, Finite DifferenceTime-DomaiN (FDTD)[59]	It is used to analyze the more type of tissue.
PCA (Principal Component Analysis)[60]	To reduce the artifacts present in the PET data set.
Pixel Histograms,Morphological Process[63]	It removes the noise and it can improve the integrity performance.
Fiber tracking Method, Runge-Kutta method[61]	The satisfied of MR-DT1 datasets.
Geometric prior, Bimodal[58]	It is use to image of registered.
Boundary Model ,Nonlinear matching scheme[64]	It represents the idealized MR intensity profile accurately.

IV. ENHANCEMENT

Image enhancement techniques used to develop the visual appearance of images from Magnetic Resonance Image (MRI) and the enhancing brain volumes were aligned linear and this image is contrast. The enhancement operate are eliminate of film artifacts and labels, filtering of images. There are more number of enhancement techniques such as Median filter, Gabor Filter, Gaussian Filter, low pass filter and Prewitt edge-finding filter.

V. SEGMENTATION

Segmentation is the process of partitioning a digital image into segments i.e. into small number of pixels to simplify therepresentation of the image. There are several segmentation methods. Thresholding technique in which input gray scale image is converted into binary image based on some threshold value. Thersholding is of two types a) Global b) Local In watershed transformations pixels of an image are grouped on the basis of their intensities. Morphological operations are non-linear operations which are related to the shape and morphology of features in animage. K- means clustering is an algorithm which is used togroup pixels based on attributes into k number of groupswhere k is a positive integer. Fuzzy c-means is a several authors suggested various algorithms for segmentation wayof processing the data by giving the partial membership value to each pixel in the image. Genetic algorithm is basedon heuristic method. It works in five stages i.e.

1. Initialization of population
2. Evaluation of fitness function
3. Selection
4. Crossover
5. Mutation and termination.

Inneutrosophic theory, every event has not only a certaindegree of the truth, as well as a falsity degree and an indeterminacy degree that must be considered autonomouslyfrom one another. Region growing technique is pixel basedimage segmentation. In normal region growing method,only the intensity constrain is taken into account. Here, firsta threshold value is set and a seed point is found out. Theneighboring pixels, whose intensity difference between theseed point and corresponding neighbor pixel is below theparticular threshold value, are grown to the region. [38, 39]

A. Literature Survey

G. Evelin et al, 2013; presented threshold based imagesegmentation. The outcome shows the proper detection ofregion of interest.

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Jin Liu et al, 2014; presented a review paper on differentsegmentation methods. The results of this paper show the comparison of different segmentation techniques.

Nikhil R. Pal et al, 1993; presented image segmentationchallenging problems that has received an enormous amount of attention by many researchers. Authorspresented various techniques used in medical imagesegmentation and analysis. The segmentation problem canbe categorized as supervised and unsupervised problem. For appropriate analysis, different image models have beenproposed for taking care of spatial intrinsic characteristics.

Yongyue Zhang et al, 2001; proposed a popularstochastic model provides the better framework for manycomplex problems in image segmentation is MarkovRandom Field (MRF) model [4]. MRF model and itsvariants have been successfully used for brain MR imagesegmentation.

S. Ruan et al. proposed a fuzzy Markova method for brain tissue segmentation from magnetic resonance images that calculates fuzzy membership in each pixel to indicate the partial volume degree, which is statistically modeled.

TABLE II: A BRIEF SURVEY OF SEGEMENTATION METHODS

Year of Publication	Author Name	Method Used	Remarks
2009	H.B et al	LindeBuzo-Gray algorithm method[40]	Linde Buzo-Gray algorithm (LBG) used for segmentation of MRI images.
2010	A. Gregory et al	Attenuation- Correction Method[37]	AC entirely on the MRI data obtained and used for neurologic performed with the MR-PET human brain scanner prototype.
2010	T.Logeswari et al	Unsupervised MR image Segmentation method[46]	Fuzzy C-mean clustering algorithm for Segmentation is presented.
2010	T.Logeswari et al	Hierarchical-Self Organizing-Map (HSOM)[38]	To achieve lowest value of weight vector, a highest value of tumor pixels, computation speed. It's used to classify the brain tumor of MRI image.
2011	Matthias et al	Atlas registration and pattern recognition[41]	To PET attenuation correction (AC), used two algorithms for whole-body MRI-based AC (MRAC) based on atlas registration and pattern recognition (AT&PR)
2011	Yu Zhang et al	Alzheimer's-disease (AD) and front temporal Dementia (FTD)[42]	To assess brain gray (GM) and white matter (WM) abnormalities jointly between the disease to elucidate differences in abnormal MRI image.
2012	Yannick et al	Ultra short-Echo- Time/ Dixon MRI sequence[44]	To separate cortical bone and air, the Dixon technique for soft and adipose tissues are used.
2012	Matthew et al	Momestic pig method[41]	To develop and validate MRI methods for estimating brain volume of image.
2013	Andres et al	SOM-FCM-Based Method and 3D Statistical.[24]	It using 3D statistical features extracted from the brain tumor image are proposed effective and efficient of segment of image
2013	Francisco et al	Gaussian Mixture Model[45]	It used to efficiently pixels of image as belonging to either the low-intensity or high-intensity background of image.

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Zhang et al. proposed Hidden Markov Random Field (HMRF) model to achieve brain MR image segmentation in unsupervised framework [6]. The segmentation obtained choice of initial model parameters. As Expectation-Maximization algorithm yield solutions at the cost of high computational burden, in order to overcome this **Marroquin et al.** have proposed a new class of probabilistic model, called
Hidden Markov Measure Field model that solved the complex segmentation problem by minimization of differentiable energy function.

Wellsetal et al. proposed an adaptive brain MR image segmentation scheme in EM framework [19,20].They have also taken spatial intensity in-homogeneity into account and Have estimated the bias field. Recently Hung et al. proposed an automatic segmentation method based on a decision tree to different classes the brain tissues in magnetic resonance (MR) images.

Martin et al. Described away to segment the medical images using an appropriately defined fuzzy clustering based on a fuzzy relation. The considered relation is defined in terms of Euclidian distance.

Panas et al. proposed the Adaptive Fuzzy Clustering/Segmentation (AFCS).In AFCS, then on-stationary nature of the taken the image in account using modifying the prototype vectors as function of sample location in the image. A multimodal is utilized for varies of estimating the spatially prototype vectors for different window sizes. The results provide segmentation having lower entropy. Mohamed et al. described the application of fuzzy settheory in medical imaging
Guanetal et al. have proposed an automatic hotspot detection and segmentation of whole body PET images usingthreshold and the Hidden Markov Model(HMM) .They compare the fixed PET pixel data threshold and the fixedstandard up take values(SUV) threshold for segmenting hotspots.

Nanda et al. proposed a Tabu search based unsupervisedscheme using HMRF-EM framework which could segmentthe images properly taking arbitrary initial parameter.To obtain cluster is proposed of fully automatic technique.A modified fuzzy c-means classification algorithm is by to provide a fuzzy partition. The method is inspired byMarkov random field (MRF) and to be less sensitive to noise found as it filters the image while **clusterin Karnan et al.** presented a new method called Fuzzy Membership C-Means (FMCM) for segmentation ofMagnetic Resonance Images (MRI). This work develops the construct the initial membership matrix to clusters into improve the strength of the clusters [20].

VI. CENTER WEIGHTED MEDIAN FILTER

Median filter is used to eliminate the noise and high frequency components from MRI image. and reduce' salt and pepper' noise and without disturbing the edges. A median is calculated by all pixel values sorted by their size, then selecting the new value as median value for the pixel. The amount of 3*3 window pixels should be used to calculate the median. A weighted median filter used for removing noise from MRI brain images with contrast. It has a great potential for being used in rank order filtering and image processing. The Center Weighted Median (CWM) filter, is a weighted median filter .it uses to weight of value of each window. This filter can preserve image details while suppressing additive white and/or impulsive-type noise. The statistical properties of the CWM filter are analyzed.

VII. CONCLUSIONS

In this review paper, various method of Image Segmentation through MRI are studied and compared for preprocessing and segmentation techniques. It is used to give large information about DICOM image segmentation and detection and milestones for analyze from different MRI medical image processing. In this paper, various steps in Preprocessing and Enhancement Technique, Segmentation Algorithm and their performance have been studied and compared.

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