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A REVIEW- MRI SEGMENTATION TECHNIQUES

Mrs. Rashmi P. Belokar
Department of Electronics and Telecommunication, MMCOE, Karve Nagar, Pune
Mr. Pratul D.Belokar
Wipro Technologies, Pune
Ms. Priya S. Gadekar
Department of Electronics and Telecommunication, SSGMCE, Shegaon

Abstract: **In this paper author is trying to review, different methodologies available for MRI segmentation. Here various methodologies are discussed in great detail; moreover this paper will also try to give an elaborate scenario of all the methodologies presented in few popular researches. Few methods discussed here are diffusion weighted and diffusion tensor MRI to white matter diseases, atlas based segmentation, automatic segmentation methods, short axis cardiac images segmentation. Author is trying to discuss all different methodologies mention. The sole objective of this paper is to carry a systematic review of the available literature and to assess the various automatic segmentation techniques.**

Key words: Image processing, MRI Segmentation, Diffusion Tensor MRI, Automatic segmentation

I. Introduction:

In medical science one of the most widely used techniques is magnetic resonance imagining (MRI) [1]. This is due to non-enveloping, better spatial resolution and best performance amongst all methods available. In the last two decade, magnetic resonance imagining (MRI) has offered major help to medical practitioners in cardiac morphology, perfusion and different functions of human brain. However, even there are various methods are available in semi-automated and automated segmentation techniques are not widely practiced in medical science. MRI techniques generally used in characterizing and quantifying multiple sclerosis lesions in spinal cord and brain. In MRI technique conclusion is not adopted just from a few spins, but many spins are taken to capture total signal within voxel. Thus by measuring volume averaged propagation of diffusing molecules and calculating with the cellular structures present with the voxel.

II. Literature Review:

Mark A. Horsfield and Derek K. Jones:

This paper is trying to review all methods applications of diffusion weighted and diffusion tensor MRI to white matter disease. In this method of measurement signals are not just analyses from few spins but from many spins in image voxel. Volume average propagation are measured of the diffused molecules as they interact with cellular structures there in the voxel.

As compared to other methods available in market water diffusion of tissue has two main advantages, first is physical appearance properties are being measured. Second in this method T1 (Weighted), T2 weighted and diffused and magnetization transfer, it is not a property of MRI. These two advantages are very important and if we do MRI by this method the values obtained after MRI should be dependent on scanner. It simply means that magnetic field strength, magnetic field gradient pulses and imperfections in RF pulses have relatively less importance. Magnetic field gradients are normally quite accurately measure up to accuracy of 99% on all three different axes. It helps in correctly sizing the images for better resolution and clarity.

In some of the MRI parameters, e.g. nuclear relaxation time may have the correlation with direction static polarizing field with respect to the tissue alignment [2]. But if we use solenoid type of magnet, the direction doesn't matter. However, in many times diffusion encoding magnetic field gradient can be useful in any random direction. In case of white matter, where bundles of axons give healthy tissue and a ordered structure with an different direction configuration. If the axons are

degenerated due to some diseases that can be filled by more amorphous cells may give a definable signature on diffusion type of MRI.

The new era of technology is already began which called as, "axonal fiber tracking from DTI" data [3] [4], will change our understanding of the clinical manifestations of degenerative and inflammatory diseases process. By using this method we can also primary site of axonal injury, it might be valerian degeneration [5]. Even sometimes axonal pathways underpinning cortical modeling can be seen.

Mariano Cabezas, Arnau Oliver, Xavier Lladó, Jordi Freixenet, Meritxell Bach Cuadra:

The authors have written this paper to help researchers, for enhancement of their knowledge on the existing techniques that are available for MRI segmentation using atlas. This method is quite useful to find normal and abnormal brains by recording master image using atlas. In this paper atlas is a combination of intensity image and segmented image. The first step towards the MRI is register an atlas image template and master image and then atlas image labels are propagated and compared with master image. This paper is also written, in aiming to find advantages and disadvantages of atlas based methods and list some ideas for upcoming research. Application of image processing has been widely reviewed in the literature [6-10]. The different studies carried out in literature gives as detail explanation of can be used for atlas unseen MRI scan. Atlas process is integration of information of three different parameters label propagation, probabilistic atlas – based segmentation and multi alias propagation. The advantages and disadvantages are explained in the following table.

Method of atlas propagation	Description	Advantages	Points to remember	Application
Label propagation	Atlas lables are put on directly image space	Single registration	Atlas & registration dependent	Mainly used for contour initialization.
Multi atlas propagation	Image space is combined with multiple labels.	Anatomical unpredictability	Proper selection of atlas and combination	It defines shape very neatly
Probabilistic atlas based propagation	Probabilistic framework is used in this method	Simple registration gives multiple input features	Estimating this type of model is quite complex.	High anatomical unpredictability

In short many techniques will come every day in the field of atlas based segmentation for MRI of brain. Here a try was given to summarize all the different techniques available for atlas based MRI segmentation.

Daniel García-Lorenzo, Simon Francis, Sridar Narayanan, Douglas L. Arnold, D. Louis Collins:

This is an survey paper talks about automatic segmentation methods of multiple sclerosis & white matter lesions by using an conventional resonance imaging.

The spatial pattern of WM focal lesions on MRI and the presence of WM lesions are major factors of latest diagnostic criteria. Many times in clinical trials, the treatment greatly depends on accrual of WM lesions plays an vital role in measure of efficacy. More specialized techniques such as magnetization transfer imaging, magnetic resonance spectroscopy and diffusion tensor imaging helps to diffuse MS pathology outside of concentrated WM lesions. Above mentioned techniques are little complicated to implement and interpret, moreover this methods are not used clinically. Much more advancement is needed in this area, researchers have big scope to do work and explore these two methods.

In this paper many methods are proposed and classified, while working on each method instead of working on individually methods very lengthy. Author has tried to find similarities between various methods. In this paper author had even not compare and numerical results, reason for this is every paper used different statistics. If we talk about description

of the segmentation, there are two different process finding a lesion and segmentation of lesion border. Once identification of lesion is done then the next step is definining its boundaries and this process must be carried out any condition e.g. even if boundaries are not clear. Segmentation is little complicated for historologically lesions don't have clear borders.

III. Conclusion:

Fully automated, accurate and robust lesion segmentation method will be very useful for clinical area is still not available. Although to get this done multimodal information is necessary. It's compulsory that we must get all lesions in one sequence, but lesion should be confined to other sequences as well. Next important point if we want better MRI, we must have a spatial information, little information is not sufficient for good MRI especially brain MRI.
In case of atlas based segmentation much more attention is needed for MRI of Brain. Most prominent two methods are combination segmentation and registration segmentation, and doing summation of regional and temporal information in main atlas.

The more good quality of MRI scanners with higher magnetic field intensity and strength are capable of performing echo-planar delusion weighted sequence. This type of method will get maximum attention by the researchers.

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