International Journal of Emerging Technology and Computer Science
ISSN: 2455 9954

Survey on MRI Image Segmentation Techniques

Mrs. Shanthi K Guru, Mr.Vivek T Patil, Akanksha Bable, Manisha Bammani, Shreya Niphade, Mamta Bammani
Dept. of Computer Engineering
D. Y. Patil College of Engineering Akurdi

Abstract

In medical field Image segmentation plays a vital and difficult factor. In current time, medical image processing techniques and MRI images are heavily used for anatomical research and treatment planning. Specifically for the human brain, MRI (Magnetic Resonance Imaging) widely prefers and using for the imaging. However, medical pictures are naturally complex and noisy. This ends up in the need of processes that reduces significant problems in analysis and enhances quality of output. The identification and segmentation of brain tumors is one of the most difficult and time consuming tasks in the production of medical images.MRI is a medical technique, mainly used by the radiotherapist to visualize the internal structure of the human body without any surgery. MRI provides a lot of information on human brain tissue which helps in the detection of brain tumors. Precise segmentation of the MRI image is very essential for the detection of brain tumors by a computer-aided clinical tool. Once acceptable brain mister images are segmented, neoplasm is classified as malignant and benign, which could be a challenging task due to the quality and variety of the neoplasm tissue features such as its shape, size, light intensity and place.Taking the same difficulties into consideration, this research focuses on highlighting the methods of brain image segmentation of the MRI. This article, however, provides a thorough overview of techniques for brain tumor can be observed through segmentation of the MRI picture.

INTRODUCTION

Medical image segmentation is a vital phase in clinical diagnosis [5]. Data is transmitted via pictures. Image process may be a process wherever image input is processed to induce output as a picture as well. The main objective of all image processing methods is to allow visually easier recognition of the picture or object under consideration [2]. All the images used in the world of today are in the digital format. Medical images are images showing the distribution of physical attributes.Medical imaging modalities such as MRI, CT scans depend mainly on computer technology to produce or display digital images of the human body's internal organs that help physicians visualize the body's internal components. Image process is one of the most important accomplishments and commonly used engineering methods in all fields of science, as well as medical science that nowadays has significantly surpassed diagnosis and treatment of many illnesses Since magnetic resonance imaging compared to alterative diagnostic methods (radiography, CT scan, etc.) is safe and non-invasive and reflects on the other hand[1].

Segmentation techniques differ widely depending on the application, imaging modality, and optional factors. For instance, brain tissue segmentation has completely distinct demands from liver segmentation. General imaging objects such as noise, partial volume impacts, and movement can have essential impacts on segmentation algorithm efficiency. What's more, each imaging modality has to contend with its own

idiosyncrasies.what is more, every imaging modality has its own idiosyncrasies with that to contend. For the valuation and clinical research of extensive neurological pathology, full automatic brain tissue classification from magnetic resonance images (MRI) is of great significance. A key job is to properly segment MR images into completely distinct classifications of tissue, particularly gray matter (GM), white matter (WM) and cerebrospinal fluid (CSF).

LITREATURE REVIEW

Thresholding Methods

Thresholding techniques are often utilized for segmentation of pictures. These techniques are successful and basic for pictures with different intensity. This strategy is a pixel-based segmentation technique and it is based on the image histogram. One normal issue of thresholding techniques is defining threshold value, which can be found by means of various strategies. This procedure neglects to manage multi-channel pictures. This strategy gives up the spatial attributes due to noise sensitivity and inhomogeneity issue, which are normally found in MRIs. Both of these highlights (noise and inhomogeneity) make the possibility of abolishing the image histogramfor. To solve these difficulties, various variants of thresholding strategies have been presented like local thresholding. Localthresholding techniques have been utilized to MR Images by blend with different strategies, for example, morphological filtering. Issues and difficulties like a global thresholding strategy are envisioned. In this survey, thresholding strategies are likewise classified into bi-level thresholding and multi-thresholding. These methods have a typical issue, in that it disregards the spatial data, and consider just the histogram data. Numerous author proposed some thresholding strategies, which utilize spatial data. For example, Pal received the complexity estimation among regions homogeneity of regions by applying the intensity perception aspect of human, and then use those images for segmentation.Thresholding methods are straightforward and viable, however there are a few factors that can confuse the activity what's more, make issues for the procedures [2], for example, brightening or illumination associated and non- stationary noise, insufficient differentiate, and so on[1].

Atlas-based Segmentation Methods

In order to constrain the classification, sure automatic approaches used a statistical chance atlas that originally registered to the processed image to estimate the desired parameters. The use of previous knowledge on the medical image analysis might greatly simplify this method. The previous information will be obtained by the reference or the atlas. One of the advantages of those digitized brain atlases is that they provide plenty of detail, and may simply be applied in computer-assisted analysis. it's necessary to say that employing an atlas is completely different from using a training dataset. associate atlas could be a demonstration of anatomical information, and it's freelance from the acquisition protocol, however the coaching dataset ought to have similar options to the pictures that square measure supposed to be divided [3]. In comparison of atlas-based segmentation ways with alternative segmentation ways, the opposite advantage is its ability to phase the image with no well-defined relation between regions and element intensities. The other facet of the brain deformation or registration methods consists of finding a metamorphosis that brings 2 MRIs into voxel-to-voxel correspondence so variation among population will be defined with fewer parameters. Additionally, brain pictures, which are derived from numerous subjects and modalities, can be placed among the atlas reference system to change the description and localization of the structures, enabling correlations between modalities and people. In medical image registration, transformation will be classified into rigid transformation and non-rigid

transformation. The rigid transformation will be defined by six parameters (three rotations and 3 translations) in 3D pictures. A slightly additional difficult transformation is affine transform, which might be defined by twelve parameters in 3D images. However, it's clear that physique will not change to associate affine or rigid transformation [4].

Neural Network Methods

These strategies are employed in the medical areas, including lesion detection, automatic diagnosing, imagereconstruction and additionally brain tissues segmentation. Results have shown an excellent development during thisclassification technique. As compared with theclassical statistical pattern recognition strategies, neuralnetworks are comparatively insensitive to the selection of thetraining datasets. These techniques work fine even inthe noisy pictures and they are ready to produce outputsin real time thanks to their data processing ability [16].The properties of the category edges, that are establishedby the neural network, allowable the advance ofa reconciling three-dimensional (3D) classificationmethod.This technique needs (region of interest) ROI detection on one slice image whereas allowing the calibrationof the neural network on every individual slice. One ofthe drawbacks of ANN strategies is that they're notable to overcome with the inter-slice intensity variationswhich are discovered in MRIs. Neural networks can also perform deterministic segmentation. Probabilistic neural networks (PNNs) include feed forward artificial neural networks (ANNs) and some of the finest math identification characteristics. PNN carries out probabilistic segmentation of MRIs, and Bayesian posterior opportunities also produce results. The precision of the PNN relies on the precision of the assessment of opportunity density operation produced by parametric, semi-parametric and non-parametric methods [5, 6].

Bayesian Classifier

Bayesian Classifier (BC) conducts smooth segmentation by allowing voxels to be allocated to quite one Gaussian. The BC implies that the voxels intensity distribution has a steady volume intensity distribution.A common assumption concerning the distributionin magnetic resonance imaging is that the intensity of a specific tissue is oftendistributed round the mean intensity of a particulartissue. Since a picture has totally different tissues, theintensity distribution of the whole image may bethought of as being a mix of Gaussian distributions.This idea was modified by Harmouche et al.[9], who ascertained that totally different regions of the brainhave different intensities, and these variations arealso necessary within the posterior fossa. Their techniquealso projected the modelling of every brain region bydifferent Gaussian distribution so as to boostsegmentation. The ensuing previous chancedepends on the region of the pixel/voxel and intensity.They additionally combined the MRF technique into theirmethod to require under consideration the benefits of nativespatial info.

Although the BC methodology looks promising for mrisegmentation, there area unit some issues that delimit itsefficiency and additionally need resolution before creatingit associate applicable technique.For example, within the automatic methodology associate applicableinitialization for unvaried method is problematic. If thespatial correlation assumption is enclosed, an exactcomputation of the optimum segmentation at every stagebecomes unsubduable. The approximations also areinaccurate and computationally pricey the growing bias model may require an exponent conversion that distorts the intensity distribution and renders the Gaussian hypothesis for the clangourous allocation unnecessary. One bias field that impacts all tissue intensities could not be realistic, either [7]. Someresearchers projected totally different solutions to compensatethese issues so as to possess

additional acceptableresult. for instance, rather than one bias field thataffects all tissue categories, some constant quantity swish modelsare applied severally for every category of intensity.

Algebraic Methods

Algebraic techniques are used for image analysisoutside of the pattern recognition space. Theseapproaches manufacture a solution to address partialvolume result drawback for pictures, with clearly identifiedsignature vectors. Algebraic options representintrinsic attributions of a picture. Every image are oftenregarded as a matrix. Thus, totally different algebraic transformsor matrix decompositions are often applied foralgebraic feature extraction of pictures.The problem is that for pictures with complicated pathologicaltissues like brain MRI, algebraic techniques couldbecome unworkable. Thanks to operating with projections offeature vectors, the quantity of unrelated options,which requires it to be obtained to define Eigen-imagesfor each of the tissues, becomes huge. Kao et al. proposeda modified technique for the spatial property, butthe method works well for signature vectors, whichare multifariously orthogonal and not the case for pathologictissues [8].

Table 1 Survey Table for Other techniques

Approach	Description	Advantages	Disadvantages
Threshold Based Approach	Based on the separation of pixels in distinct groups, based on their gray level or intensity value called (threshold). Segmentation is accomplished by placing all pixels with an intensity higher than the limit to one class, and all other pixels to another class.	1. It operates well for objects and backgrounds that have a standard brightness of separate gray level values, respectively. 2. Simple but strong strategy to segmenting pictures with light items on a dark backdrop.	1. It doesn't operate well for various object pictures, each of which has a separate gray level significance. 2. Difficult to identify the right limit value. 3. Does not bring into consideration the spatial features of the picture. This makes it susceptible to noise and to the strength of homogeneity
Region Based Approach [11]	Based on the basis of homogeneity, images with comparable characteristics are grouped together to create a homogeneous region. Regional segmentation is further split into increasing regions, dividing regions, combining regions or combining them.	Work well when the homogeneity criteria for the region is simple to identify. They are also more resistant to noise than the edge detection strategy.	1. By essence, this strategy is linear and quite costly in computing time and memory. 2. There are opportunities for under-segmentation and over-segmentation of areas in the picture and the region may contain gaps.

Statistical Approach[10]	In this strategy, image texture is used to subdivide the picture into areas with distinct texture characteristics. Texture is described by a collection of statistically extracted features displayed as vectors in multidimensional space.	Statistical methods are particularly helpful for random patterns / textures as well as for complicated models.	The difficulty connected with this strategy is the correct choice of parameters that could otherwise contribute to overly fluid segmentation and the loss of significant structural information.
Atlas Guided Approach	This is the most potent strategy in the field of segmentation of medical imagery. In this technique, data on the anatomy, shape, size, and characteristics of the various organs, soft tissues, is compiled in the form of an atlas or a table (LUT). The atlas is used as a reference frame for the segmentation of fresh pictures. The Atlas-guided method is introduced in the picture spatial domain.	The strategy is very strong when a conventional atlas or model is accessible for medical image segmentation. It also conducts segmentation and classification in one go.	1. Approach faces constraints in the segmentation of complicated structures with varying form, size and characteristics.2. Expert knowledge is required in building the database.
Clustering Approach[11]	Cluster analysis or clustering is the given of a collection of statistics to subsets (called groups) so that measurements in the same cluster are comparable in some way. Commonly used clustering techniques are K-means, fuzzy Cmeans, etc.	Simple for classification and simple to implement.	1. How to calculate the amount of clusters is hard. 2. Features are often image-dependent and how to pick characteristics to produce a satisfying outcome, until it stays uncertain. 3. Does not use spatial data.

Deformable Models Approach[12]	Model-based method used to delineate boundary regions using closed gaussian curves or surfaces. Active contours and Active surfaces is included in this range.	Capable of generating closed curves or surfaces from pictures and robust to noise and spurious edges of the system	1. This strategy needs manual communication in order to set up an original model. 2. Choosing the appropriate parameter is hard.

CONCLUSION

Segmentation is a vital step earlier image analysis and computer vision and so is an ongoing research area though a dense literature is on the marketSeveral methods to segment MRI brain pictures have been created in recent centuries, but it stays a challenging job. A segmentation methodology could perform well for one MRI brain image however not for the other images of same sort.

REFEERENCE

1. A. Ehsani Rad, M. Rahim, M. Shafry, A. Rehman, A. Altameem, and T. Saba, “Evaluation of current dental radiographs segmentation approaches in computer-aided applications,” IETE Technical Review (Medknow Publications & Media Pvt. Ltd.),Vol. 30, no. 3, pp. 210_22, Sep. 2014.

2. A. Karimian, S. Yazdani, and M. Askari, “Reducing the absorbed dose in analogue radiography of infant chest images by improving the image quality, using image processing techniques,” Radiat. ProtDosim., Vol. 147, no. 1_2, pp. 176_9, Jul. 2011

3. Q. Zheng and Y. Fan, "Integrating semi-supervised label propagation and random forests for multi-atlas based hippocampus segmentation," IEEE-*2018 IEEE 15th International Symposium on Biomedical Imaging (ISBI 2018)*, Washington, DC, 2018, pp. 154-157.

4. B. Zhou and L. Chen, "Atlas-based semi-automatic kidney tumor detection and segmentation in CT images," IEEE- *2016 9th International Congress on Image and Signal Processing, BioMedical Engineering and Informatics (CISP-BMEI)*, Datong, 2016, pp. 1397-1401.

5. Y. Chang, B. Song, C. Jung and L. Huang, "Automatic Segmentation and Cardiopathy Classification in Cardiac Mri Images Based on Deep Neural Networks," *2018 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Calgary, AB, 2018, pp. 1020-1024.

6. W. El Hajj Chehade, R. A. Kader and A. El-Zaart, "Segmentation of MRI images for brain cancer detection," *2018 International Conference on Information and Communications Technology (ICOIACT)*, Yogyakarta, IEEE-2018, pp. 929-934.

7.A. Krishna, D. Edwin and S. Hariharan, "Classification of liver tumor using SFTA based Naïve Bayes classifier and support vector machine," *2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT)*, Kannur, 2017, pp. 1066-1070.

8. J. J. Corso, E. Sharon, S. Dube, S. El-Saden, U. Sinha, and A.Yuille, “Efficient multilevel brain tumor segmentation with integratedbayesian model classification,”Med. Imag., IEEE Trans.,Vol. 27, no. 5, pp. 629_40, May 2008

9. R. Harmouche, L. Collins, D. Arnold, S. Francis, and T. Arbel,“Bayesian MS lesion classification modeling regional and localspatial information,” in The 18th International Conference onPattern Recognition, ICPR 2006, Hong Kong, IEEE, 2006,pp. 984_7.

[10] D. D. Patil, and S. G. Deore, "Medical image segmentation: a review," *International Journal of Computer Scienceand Mobile Computing,*. vol. 2, no. 1, pp. 22 – 27, 2013.

[11]A. Funmilola, "Fuzzy k-c-means clustering algorithm for medical image segmentation," *Journal of InformationEngineering and Applications*, vol. 2, no. 6, pp. 21-32, 2012

[12]D. Jayadevappa, S. S. Kumar, and D. S. Murty, "Medical image segmentation algorithms using deformable models:a review," *Institution of Electronics and Telecommunication Engineers (IETE)*, vol. 28, no. 3, pp. 248-255, 2011