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Enhanced Image Fusion Technique For Segmentation of Tumor Using Fuzzy C Means Cluster Segmentation

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Enhanced Image Fusion Technique For Segmentation of Tumor Using Fuzzy C Means Cluster Segmentation

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Abstract- This paper presents the MRI brain diagnosis support system for structure segmentation and its analysis using spatial fuzzy clustering algorithm. The method is proposed to segment normal tissues such as white Matter, Gray Matter, Cerebrospinal Fluid and abnormal tissue like tumor part from MR images automatically. These MR brain images are often corrupted with Intensity Inhomogeneity artifacts cause unwanted intensity variation due to non- uniformity in RF coils and noise due to thermal vibrations of electrons and ions and movement of objects during acquisition which may affect the performance of image processing techniques used for brain image analysis. Due to this type of artifacts and noises, sometimes one type of normal tissue in MRI may be misclassified as other type of normal tissue and it leads to error during diagnosis. The proposed method consists of pre processing using wrapping based curvelet transform to remove noise and modified spatial fuzzy C Means segments normal tissues by considering spatial information because neighbouring pixels are highly correlated and also construct initial membership matrix randomly. The system also uses to segment the tumor cells along with this morphological filtering will be used to remove background noises for smoothening of region. The project results will be presented as segmented tissues with parameter evaluation to show algorithm efficiency.

I. Introduction

MRI images showed the brain structures, tumor's size and location. From the MRI images the information such as tumors location provided radiologists, an easy way to diagnose the tumor and plan the surgical approach for its removal. MRI's use radiofrequency and magnetic field to result image's human body without ionised radiations. Imaging plays a central role in the diagnosis of brain tumors. On MRI, they appear either hypo (darker than brain tissue) or iso tense (same intensity as brain tissue) on T1-weighted scans, or hyper intense (brighter than brain tissue) on T2-weighted MRI. In medical, doctors don't have method that can be used for brain tumor detection standardization which leads to varying conclusions between one doctor to another . Edge-based method is by far the most common method of detecting boundaries, discontinuities in an image and segmentation.

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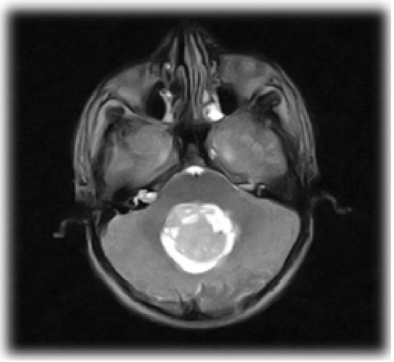


The parts on which immediate changes in grey tones occur in the images are called edges. Edge detection techniques transform images to edge images benefiting from the changes of grey tones in the images. As a result of this transformation, edge based brain segmentation image is obtained without encountering any changes in physical qualities of the main image. This image processing consist of image enhancement using histogram equalization, edge detection and segmentation process to take patterns of brain tumors, so the process of making computer aided diagnosis for brain tumor grading will be easier. With the advances in imaging technology, diagnostic imaging has become an indispensable tool in medicine today. X-ray angiography (XRA), magnetic resonance angiography (MRA), magnetic resonance imaging (MRI), computed tomography (CT), and other imaging modalities are heavily used in clinical practice. Such images provide complementary information about the patient. While increased size and volume in medical images required the automation of the diagnosis process, the latest advances in computer technology and reduced costs have made it possible to develop such systems.

II. Image Fusion

Multisensor Image fusion is the process of combining relevant information from two or more images into a single image. The resulting image will be more informative than any of the input images. Image fusion has become a common term used within medical diagnostics and treatment. The term is used when multiple images of a patient are registered and overlaid or merged to provide additional information. In radiology and radiation oncology, these images serve different purposes. For example, CT images are used more often to ascertain differences in tissue density while MRI images are typically used to diagnose brain tumors.

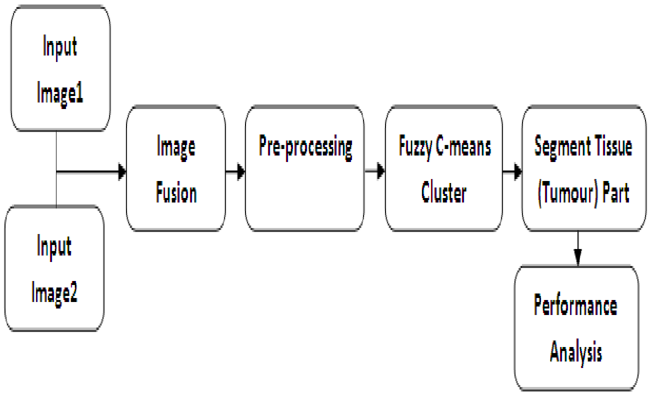
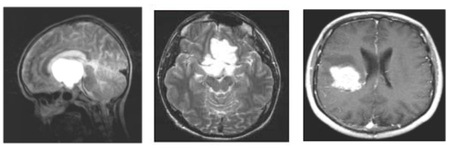


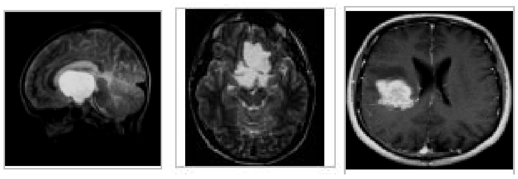
Figure : Block Diagram

a) *CT Scan Image*

Computed tomography (CT or CAT scan) is a noninvasive diagnostic imaging procedure that uses a combination of X-rays and computer technology to produce horizontal, or axial, images (often called slices) of the body. A CT scan shows detailed images of any part of the body, including the bones, muscles, fat, and organs. CT scans are more detailed than standard X-rays.

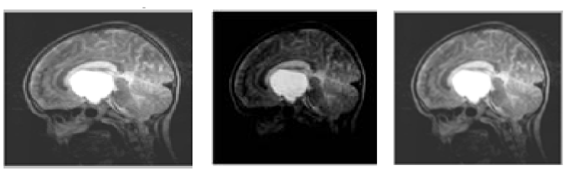


Magnetic resonance imaging (MRI) is a noninvasive medical test that helps physicians diagnose and treat medical conditions. MRI uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. The images can then be examined on a computer monitor, transmitted electronically, printed or copied to a CD. MRI does not use ionizing radiation (x-rays).



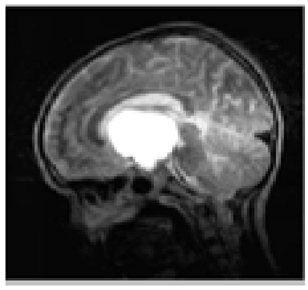
b) *Image fusion is carried out in four steps*

- Construct a pyramid transform for each source image.
- Compute match (M_{AB}) and saliency (S_A, S_B) measures for the source images at each pyramid sample position.
- Combine source pyramids to form a pyramid for the composite image.
- Recover the composite image through an inverse pyramid transform.



III. Preprocessing

Image restoration is the operation of taking a corrupted/noisy image and estimating the clean original image. Corruption may come in many forms such as motion blur, noise, and camera misfocus. Image restoration is different from image enhancement in that the latter is designed to emphasize features of the image that make the image more pleasing to the observer, but not necessarily to produce realistic data from a scientific point of view. Image enhancement techniques (like contrast stretching or de-blurring by a nearest neighbor procedure) provided by "Imaging packages" use no a priori model of the process that created the image. With image enhancement noise can be effectively be removed by sacrificing some resolution, but this is not acceptable in many applications. In a Fluorescence Microscope resolution in the z-direction is bad as it is. More advanced image processing techniques must be applied to recover the object. De-Convolution is an example of image restoration method. It is capable of: Increasing resolution, especially in the axial direction removing noise increasing contrast.

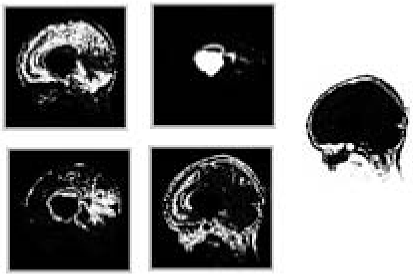


a) *Fuzzy Clustering in Medical Fusion Image:-*

In fuzzy clustering, every point has a degree of belonging to clusters, as in fuzzy logic, rather than belonging completely to just one cluster. Thus, points on the edge of a cluster, may be in the cluster to a lesser degree than points in the center of cluster. An overview and comparison of different fuzzy clustering algorithms is available. Any point x has a set of coefficients giving the degree of being in the kth cluster $w_k(x)$. With fuzzy c-means, the centroid of a cluster is the mean of all points, weighted by their degree of belonging to the cluster: The degree of belonging, $w_k(x)$, is related inversely to the distance from x to the cluster center as calculated on the previous pass. It also depends on a parameter m that controls how much weight is given to the closest center.

b) *The fuzzy c-means algorithm is very similar to the k-means algorithm:*

- Choose a number of clusters.
- Assign randomly to each point coefficients for being in the clusters.
- Repeat until the algorithm has converged (that is, the coefficients' change between two iterations is no more than ,the given sensitivity threshold)
- Compute the centroid for each cluster.
- For each point, compute its coefficients of being in the clusters.



The algorithm minimizes intra-cluster variance as well, but has the same problems as k-means; the minimum is a local minimum, and the results depend on the initial choice of weights. Using a mixture of Gaussians along with the expectation-maximization algorithm is a more statistically formalized method which includes some of these ideas: partial membership in classes.

c) Quantitative Result Of PSNR

Number of tumor cluster	Area in mm^2	MSE	Processing time for Cmeans	PSNR
2	14.0467	0.1589	7.1678	56.1190
4	19.5342	4.7302e-04	6.7529	81.3820
2	12.6224	0.0583	5.6700	60.4738

Z Noise (%)	Artifact (%)	Noisy Image	Denoised Image PSNR (dB)
1	20	28.6387	37.0348
1	20	28.3089	36.8780

IV. Result Analysis

To each cluster by means of a Membership Function, which represents the fuzzy behaviour of this algorithm. To do that, we simply have to build an appropriate matrix named U whose factors are numbers between 0 and 1, and represent the degree of membership between data and centers of clusters.

a) Conclusions and Future Work

In conclusion, image fusion techniques in terms of medical image modalities and organs of study have been discussed in this survey. The extensive developments in medical image fusion research summarized in this literature review indicate the importance of this research in improving the medical services such as diagnosis, monitoring and analysis. The FCM algorithm uses reciprocal distance to compute the fuzzy weights. When a feature vector is of equal distance from two cluster centers, it weights the same on the two clusters no matter what is the distribution of the clusters. It cannot differentiate the two clusters with different distributions of feature vectors. Therefore, the FCM algorithm is more suited to data that is more or less evenly distributed around the cluster centers. The FCM algorithm lumps the two clusters with natural shapes but close boundaries into a large cluster. For some difficult data such as WBCD data, it is hard to for the FCM to cluster the very closed classes together without the help of other mechanisms such as elimination of small clusters. The FCFM algorithm uses Gaussian weights, which are most representative and immune to outliers. Gaussian weights reflect the distribution of the feature vectors in the clusters. For a feature vector with equal distance from two prototypes, it weighs more on the widely distributed cluster than on the narrowly distributed cluster.

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