An automated System for Brain Tumor Detection from MR Images

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Abstract and Objective

Radiologists carefully look into medical images, and diagnose a patient's disease by obtaining useful information and interpreting medical images with their experience, knowledge, and wisdom. Brain tumor identification is a crucial and complicated job for radiologist. Brain tumor identification form MR images consist of several stages. Segmentation is considered as an essential step in medical image analysis and classification. Manual brain MR images segmentation is a difficult task. Radiologist and other medical experts spend plenty of time for manually segmenting brain MR images and this is non-repeatable task. Therefore automatic segmentation of brain MR images is needed for accurately segmenting White Matter (WM), Gray Matter (GM) and Cerebrospinal Fluid (CSF) tissues of brain and performing this segmentation within short span of time. This is a very critical issue because wrong identification can lead to severe results. Major objectives of our system are following:

- Classify the brain MR image as normal or abnormal accurately.
- Perform segmentation within short span of time.
- Provide a system to radiologist a system which is self explanatory and easy to operate
- Enable the radiologist to accurately identify the region of tumor in MR image.

***Keywords**:*

Thresholding, MRI, Segmentation, Fuzzy partition

Methods

We have proposed a system capable to perform segmentation of brain MR images in an automatic/unsupervised way. Noise in MR image can appear at different stages. We use "Fast Discrete Curvelets Transform" via wrapping for noise removal from MR images. After noise removal from brain MR image we used a technique based upon fuzzy entropy that locates optimal and dynamic threshold according to the clusters find out by using Fuzzy C-Mean (FCM). It also gives an objective function that is used to find out adaptive, optimal and dynamic threshold which is used to segment the image. Region of the tumor is extracted from this segmenting image. After identification of tumor region, this system classifies weather this image belongs to normal and abnormal brain structure. For classification, we have extracted texture features and classify using Artificial Neural Network. We have achieved 96% accuracy.

Results

We performed our experiments by implementing this system using MATLAB environment. We applied our proposed technique on different T1 weighted, T2 weighted and Proton density MR images. We provide qualitative as well as quantitative measure for our experimental results. Signal to noise ratio, root mean square error and structural similarity index are measures which we used for quantifying the image quality after noise removal. This system can segment the WM, GM and cerebrospinal fluid tissues for different MR images accurately. Quality of the resultant experiments can be determined by directly visualizing the brain MR segmented images. This system accurately identify brain tumor region from MR images. This system shows efficient results for classifying brain images as normal and abnormal.

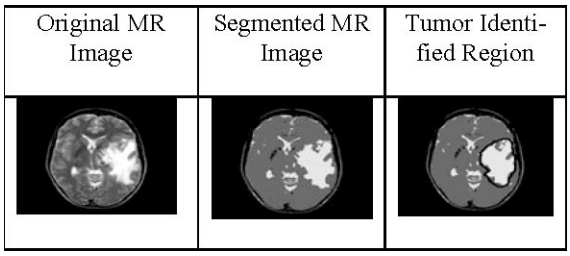

Figure 1-MR Transformation

Conclusion

This system is an automated system for brain tumor identification for radiologist. This is an easy to operate system for radiologist. Similarly it is noninvasive and inexpensive system for patients. This work is also the fundamental step for 3D visualization of brain. Future work of this research work is to measure the thickness of the brain tumor region

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