

# Chapter 55

## Brain Tumor Segmentation and Classification Using Intelligent Hybrid Morphology and Diffusion

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### **ABSTRACT**

*Noise present in the images degrades the image quality as well as the performance of tumor detection from images. The main objective of this research work is to improve the image quality and develop an accurate and effective automated computer-aided diagnosis system for tumor detection from brain MR images. Contourlet transform is used for image enhancement. Thresholding and morphological operators are used for detecting tumor segment. After segmentation, features extraction and classification has been performed by using Support Vector Machine and Neural Networks. The proposed method is tested on various brain MR images and this system generates good and accurate results.*

### **1. INTRODUCTION**

Brain tumor, which is one of the most common brain diseases, has hit and perished many lives. According to a survey of National Cancer Institute (NCI) United States, estimated new brain cancer cases expected to be reported in 2014 stood at 23,380 for both men and women,. Out of these, 14,320 patients died and remaining were diagnosed to be in treatment (Do, M. N., & M. Vetterli 2005) Brain Cancer Statistics (2005). Another survey of International Agency for Research on Cancer estimated that more than 126,000 people were being diagnosed with brain tumor annually around the world with more than 97,000 mortalities (Ge, F., S. Wang, T. Liu 2006). Data show low survival of cancer patients in the case of brain tumor Magnetic Resonance Imaging (2014). A very large community of researchers from all over the world is actively engaged in finding ways and means for early diagnosis of brain cancer for many years now (Kapur, Tina., W. Eric L. Grimson, William M. Wells III and Ron Kikinis 1996). In recent

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times, researchers of very high caliber throughout the world from assorted affiliations are trying to get a better understanding of the disease and effective treatments in a combined effort of the disciplines of medical sciences and mathematical and computer sciences both [6,7,8]. The manual segmentation by experts is time consuming and non-repeatable task. Wrong diagnosis can lead to a severe problem. The computer-aided diagnosis (CAD) system provides the help to radiologists and experts to take the opinion to diagnose the tumor and other such diseases. In the past decade, several CAD systems have been developed by many researchers by using the different segmentation techniques which provides the accuracy of detection of abnormalities at different levels. Automatic segmentation of brain MR images is very difficult and challenging task.

The main objective of this study is to develop an accurate, effective and efficient automated computer-aided diagnosis system for the detection of tumor which could provide the opinion to the experts for the diagnosis purpose.

Major Contributions:

- Enhancement has been performed to improve the quality of images as well as to remove noise from images by using contourlet transform
- Fuzzy entropy based thresholding has been performed to segment the brain part
- Texture features has been extracted and classified using SVM and ANN
- Extensive experimentation has been performed to test the validity of proposed method

The rest of the paper is managed as follows: First, Section 2 comprises a survey on related research that is most closely related to the present work and find out problems. Section 3 outlines the detailed methodologies. Section 4 comprises results and discussions. Finally, conclusion is given in the Section 5.

## **2. RELATED WORK**

Mustaqeem, Anam., Ali Javed, Tehseen Fatima (2012) proposed method to detect the tumor from brain mr images. In this method many different filters used to enhance the image and for segmentation purpose thresholding, watershed and morphological operators techniques were used. This method extracts tumor portion from image and generates some better results but some noise still exists in the resulting image. (Kapur, Tina., W. Eric L. Grimson, William M. Wells III and Ron Kikinis 1996) proposed the method for the segmentation of brain MR images. The global thresholding and morphological operators methods had been used for the segmentation. This method does not generate the good results as some non-brain parts exists in the final segmented image. They proposed a method for the segmentation of brain MR images. In this method Expectation Maximization (EM), morphological and spatial information techniques were used for segmentation. This method showed good results but this method takes large time to perform the segmentation of an image. (Mikheev, Artem., Gregory Nevsky, Siddharth Govindan, Robert Grossman and Henry Rusinek 2008) proposed a method for the segmentation of brain MR images by using bridge burner algorithm, thresholding and morphological operators. This method showed good results but this method is very complex. Pauline John (John, 2012) used the discrete wavelet transformation (DWT) and texture based feature for classifying the MRI brain tumor. (Haralick, R. M., Shanmugam, K. and Dinstein, I. H 1973) proposed a feature extraction mechanism which is used for many classification problems. (Nixon, Mark S., & Alberto S. Aguado 2008) used feature selection methodology effectively

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