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Assessment on Brain Tumor Detection using Rough Set Theory

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Abstract: Computer aided diagnosis systems for detecting Brain tumour for medical purpose have been investigated using many techniques. In this paper our concern is to presents an approach which will be useful for enhanced detection of brain tumour using Post -processing and Pre-processing steps of Digital image processing. The emergence of tumour is basically because of mass or cluster formation that will aid to classify the type of cancer with the processing method on MRI images for cancer detection. Taking the six variant ways of processing an image is applied on to our MRI images. The result is observed on various types of MRI images with different types of cancer regions.

Keywords: Brain cancer, Ontology, RST, MRI.

I. INTRODUCTION

Brain cancer is one of the most life-threatening and intractable ailment. Tumors may be embedded in regions of the brain that are critical to provide the body's vital functions, while they shed cells to invade other parts of the brain, forming more tumours that are too small to detect with the help of the normal imaging techniques. Brain cancer's location is sometime tedious to identify and that makes it difficult to some people who has to fight with their life.

In Recent years we have seen that the rise in cancer patient have outnumbered than the normal. The tumor in the early stage is certainly hard to identify but once it gets identified the treatment can be done and is curable with techniques like chemotherapy. But certainly late detection of tumour is deadly.But the cancer is kind of disease in which symptoms are identified late. The use of computer aided technology have taken a wide step in detection of tumour these days like used in Neuro surgery [1].The availability of 3-D images with the relationships of their important structures (e.g., functionally significant cortical areas, vascular structures) and disease [2] .

A brain tumor can be termed as a disease in which cells grow rapidly in the brain. Brain tumor is basically of two types:

1) Benign tumors

2) Malignant tumors

Benign tumors do not have the ability to spread beyond the brain itself. Benign tumors in the brain have limited self-growth and it do not to be treated. But they can create problem due to their location and has to be treated as early as possible.

Malignant tumor is the real brain cancer. These tumours can even spread outside of the brain rapidly. Malignant tumors are left almost untreated most of the time as the growth is so fast that it gets too late for the surgeon to control or operate it. Brain malignancies again of two types:

i) Primary brain cancer originated in the brain.

ii) Secondary or metastatic brain cancer spread to the brain from another site in the body.

In general the cell grows in particular speed and in a proper manner but when the rapid growth of cell (here brain cell) is observed, and it keeps on dividing uncontrollably, when the new cells are not required, a mass of tissue forms which seems like a cluster, this is called as tumor.

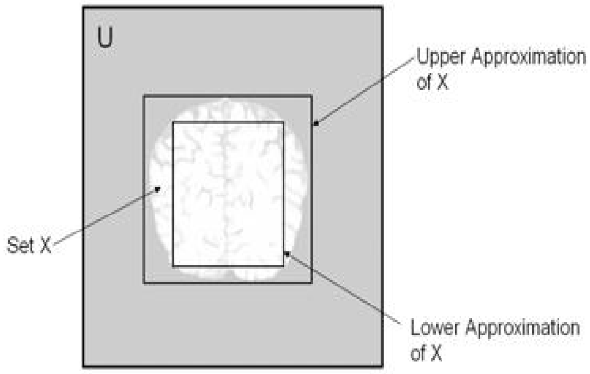

Fig. 1. An Example brain image of representing a rough set

II. LITERATURE REVIEW AND RELATED WORK

Atiq Islam, Syed M. S. Reza, and Khan M. Iftekharuddin, *Senior Member, IEEE* [1] they present the segmentation concept in Biomedical Engineering implication. Varying intensity of tumors in brain magnetic resonance Images (MRIs) makes the automatic segmentation of such tumors enormously challenging. Brain tumor segmentation using MRI has been an intense research area. Both feature based and atlas-based techniques as well as their combinations have been proposed for brain tumor segmentation.

T.Rajesh and R. Suja Mani Malar [2] presenting the Rough Set Theory based Brain Tumor Detection in MRI images. The developments in the application of information technology have completely changed the world. The obvious reason for the introduction of computer systems is: reliability, accuracy, simplicity and ease of use. Besides, the customization and optimization features of a computer system stand among the major driving forces in adopting and subsequently strengthening the computer aided systems. In medical imaging, an image is captured, digitized and processed for doing segmentation and for mining important information. Manual segmentation is an alternate method for segmenting an image. This method is not only tiresome and time consuming, but also produces inaccurate results.

Segmentation by experts is variable. Therefore, there is a strong need to have some efficient computer based system that accurately defines the boundaries of brain tissues along with minimizing the chances of user interaction with the system. Additionally, manual segmentation process requires at least three hours to complete. According to the traditional methods for measuring tumor volumes are not reliable and are error sensitive.

Paul and Bandyopadhyay may 2012 [3] they present an automated two-step segmentation procedure which will stripped the skull by generating a skull mask and then after that by using an advanced K-means algorithm to provide two- level granularity for assessing the length and breadth of brain tumor. In a specified algorithm, MRI image is read and image is enhanced using a 3 by 3 unsharpened filters. A clearer picture can be obtained by removing all the blurred area of the prior image. The two- dimensional array can be using to hold the output and values are rounded off in case if they are in the form of fraction. Mask can be generated for skull stripping and using a method automatically a histogram shape based image threshold is performed.

Corso et al. [4] state that bottom up affinity-based segmentation and top down generative model techniques were not enough to get good results, and propose a novel methodology of automatic segmentation of heterogeneous images. Main difference in this paper is the use of Bayesian formulation to make complex calculations on soft models. It uses multichannel MR volumes to detect and segment brain tumor. Calculation in this model is more efficient than the conventional presented models and results are presenting improved output in the form of quantitative analysis. A 2D portion of MR image can be used to detect multiform brain tumor and an outline can be drawn to label the edema or active part of tumor.

T. Paul et al.June 2012 [5] state that brain segmentation is automated using Dual Localization method. In the first step of their process scull mask is generated for the MRI images. White matter and tumor region is used to improvise K- means algorithm. In the last step of their method, they assessed the breath and length.

Meenakshi and Anandhakumar sept. 2012 [6] emphasize that MRI are useful for analyzing brain images because of its high accuracy rate. The proposed technique combines the clustering and classification algorithm to minimize the error rate. Segmentation task is performed using orthonormal operators and classification using BPN. Images having the tumor are processed using K-means clustering and significant accuracy rate of 75% is obtained.

Kumar and Mehta Aug 2011 [7] highlight that segmentation results will not be accurate if the tumour edges are not sharp, and this case arises during the initial stage of tumour. Texture-based method is proposed in this paper. Along with brain tumour detection, segmentation is also done automatically using this method.

Padole and ChaudhariJune 2012 [8] proposed an efficient method for brain tumor detection. One of the most important steps in tumor detection is segmentation. Combination of two standard algorithms, first mean shift and second normalized cut is performed to detect the brain tumor surface area in MRI. By using mean shift algorithm pre-processing step is performed in order to form segmented regions. In the next step region nodes clustering are processed by normalized cut method. In the last step, the brain tumor is detected through component analysis.

Roy and Bandyopadhyay June2012 [9] propose automatic brain tumor detection approach using symmetry analysis. They first detect the tumor, segment it and then find out the area of tumor. One of the important features is that after performing the quantitative analysis, we can identify the status of an increase in the disease. They have suggested multi-step and modular approached to solve the complex MRI segmentation problem. Tumor detection is the first step of tumor segmentation. They have obtained good results in complex situations.

Z. Shi et al. 2009 [10] employed neural networks for medical image processing (MRI), including the key features of medical image pre-processing, segmentation and object detection and recognition. The study employed hopfield and feed-forward neural networks. The feed-forward and Hopfield neural networks are simple to use and easy to implement. The advantage of Hopfield neural networks is that it does not require pre-experimental knowledge. The time required to resolve image processing is reduced by using trained neural network.

Luts et al. may 2009 [11] propose a technique to create nosologic brain images based on MRI and MRSI data. This technique uses colour coding scheme for each voxel to differentiate distinctive tissues in a single image. For this purpose, a brain atlas and an abnormal tissue prior is acquired from MRSI data for segmentation.The detected abnormal tissue is then classified further by employing a supervised pattern recognition method followed by calculating the class probabilities for diverse tissue types. The proposed technique offers a novel way to visualize tumor heterogeneity in a specific image. The study result shows that combining MRI and MRSI features improves classifier’s performance. A prior for the abnormal tissue along with a healthy brain atlas further improves the nosologic images. Despite its usefulness, the proposed methodology, however, only provides the one-dimensional image features.

Yu et al. 2008 [12] state that image segmentation is used for extracting meaningful objects from image. They propose segmenting an image into three parts, including dark, gray and white. Z-function and S-function are used for fuzzy division of the 2D histogram. Afterwards, QGA is used for finding combination of 12 membership parameters, which have maximum value. This technique is used to enhance image segmentation and significance of their work is that three-level image segmentation is used by following the maximum fuzzy partition of 2D Histograms. QGA is selected for optimal combination of parameters with the fuzzy partition entropy. The proposed method of fuzzy partition entropy of 2D histogram generates better performance than one- dimensional 3-level thresh holding method. Somehow, a large number of possible combinations of

12 parameters in a multi-dimensional fuzzy partition are used, and it is practically not feasible to compute each possible value; therefore, QGA can be used to find the optimal combination.

J. Sing and K. Basu et al.2005 [13] propose fuzzy adaptive RBS based neural network (FARBS-NN) for MR brain image segmentation. Hidden layer neuron of FARBF-NN neurons has been fuzzifies to reduce noise effect. T h i s asserts that medical image segmentation approach involves combination of texture and boundary information. The authors maintain that geometric algebra can be used to obtain volumetric data using spheres, non- rigid registration of spheres and real time object tracking. Major contribution of the proposed approach is that the use of marching cube algorithm reduces the number of primitives to model volumetric data and uses lesser number of primitives for the registration process, and thus makes registration process faster.

Li et al.Nov. 2007 [14] report that edge detection, image segmentation and matching are not easy to achieve in optical lenses that have long focal lengths. The wavelet function can be improved by applying discrete wavelet frame transform (DWFT) and support vector machine (SVM). In this paper, authors experimented with five sets of 256- level images. Experimental results show that this technique is efficient and more accurate as it does not get affected by consistency verification and activity level measurements. However, the paper is limited to only one task related to fusion and dynamic ranges are not considered during calculation.

III. Conclusion

Rough set theory encompasses an extensive group of methods that have been applied in the medical domain and that is used for the discovery of data dependencies, importance of features, patterns in sample data, and feature space dimensionality reduction. Most of the current literature on rough-set-based methods for medical imaging focuses on classification and dimensionality reduction issues. A number of papers also deal with medical imaging problems such as image segmentation, image filtering, and voxel representation. From what has been presented in the literature, it is obvious that the rough set approach provides a promising means of solving a number of medical imaging problems. It should be observed that rough set or near set by them or in combination with other computational intelli- gence technologies work remarkably well in separating medical images into approximation regions that facilitate automated image segmentation and object recognition. The task now is to develop near set-based methods that offer an approach to classifying perceptual objects by means of features. It is fairly apparent that near set methods can be useful in object recognition, especially in solving medical imaging problems. The near set approach to object description, feature selection, and automatic image segmentation based on the partition of an image into equivalence classes offer a practical as well as straight- forward approach to classifying images. It is in the domain of medical image segmentation that the near set approach holds the greatest promise for medical imaging.

A combination of various computational intelligence technologies in pattern recognition and, in particular, medical imaging problems has become one of the most promising avenues in image processing research. From the perspective of rough sets, further explorations into possible hybridizations of rough sets with other technologies are necessary to build a more complete picture of rough-set- or near-set-based applications in medical imaging. What can be said at this point is that the rough set and near set approaches pave the way for new and interesting opportunities of research in medical imaging and represent an important challenge for researchers.

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