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IMAGE PROCESSING TECHNIQUES FOR THE ENHANCEMENT OF BRAIN TUMOR PATTERNS

Kimmi Verma[1], Aru Mehrotra[2], Vijayeta Pandey[3], Shardendu Singh[4]

Assistant Professor, Dept of Instrumentation & Control Engg, Galgotias College Of Engg & Tech, Greater Noida, India[1]

Student, Dept of Instrumentation & Control Engg, Galgotias College Of Engg & Tech, Greater Noida, India[2,3,4]

ABSTRACT: Brain tumor analysis is done by doctors but its grading gives different conclusions which may vary from one doctor to another. So for the ease of doctors, a research was done which made the use of software with edge detection and segmentation methods, which gave the edge pattern and segment of brain and brain tumor itself. Medical image segmentation had been a vital point of research, as it inherited complex problems for the proper diagnosis of brain disorders. In this research, it provides a foundation of segmentation and edge detection, as the first step towards brain tumor grading. Current segmentation approaches are reviewed with an emphasis placed on revealing the advantages and disadvantages of these methods for medical imaging applications. The use of image segmentation in different imaging modalities is also described along with the difficulties encountered in each modality**.**

Keywords: Brain tumor, MRI images, image processing, Edge detection, segmentation.

I. INTRODUCTION

Brain tumor is an abnormal growth of cells inside the skull. Normally the tumor will grow from the cells of the brain, blood vessels, nerves that emerge from the brain. There are two types of tumor which are- benign(non-cancerous) and malignant (cancerous) tumors. The former is described as slow growing tumors that will exert potentially damaging pressure but it will not spread into surrounding brain tissue. However, the latter is described as rapid growing tumor and it is able to spread into surrounding brain. Tumors can damage the normal brain cells by producing inflammation, exerting pressure on parts of brain and increasing pressure within the skull. Figure 1 shows the presence of tumor in the brain.

Radiologists examine the patient physically by using Computed Tomography (CT scan) and Magnetic Resonance Imaging (MRI). 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.

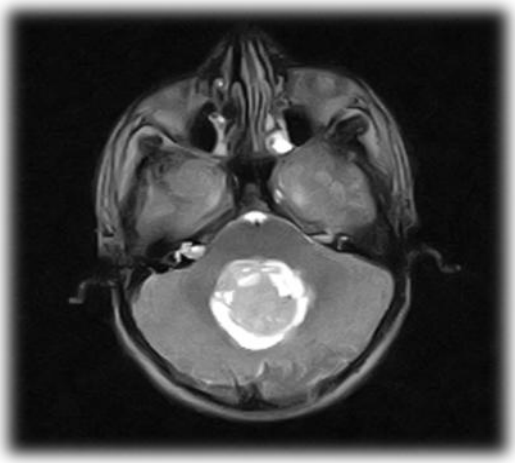

Figure 1. The presence of brain tumor

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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. 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 [24].

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.

II. LITERATURE REVIEW

The image segmentation is entailed with the division or separation of the image into regions of similar features. In this paper, we will discuss an illustrate a number of approaches and show improvements in segmentation performance that can be achieved by combining methods from distinct categories such as techniques in which edge detection s combined with thresholding. The definitive aim in image processing applications is to extract important attributes from the image data, from which a descriptive, interpretative, or understandable prospect can be obtained by the machine. Time-consumption during the segmentation of brain tumor from magnetic resonance imaging is a crucial drawback. Thus, we have studied the foundations of brain segmentation and edge detection, by various techniques employed by researchers. The segmentation & edge detection approaches were studied under 5 categories. These are as follows- 1) Thresholding approaches, 2) Region growing approaches, 3) Genetic Algorithm approaches,4) Clustering approaches ,5) Neural network approaches. Several authors suggested various algorithms for segmentation.

Jianping Fan,Yau Elmagarmid & Aref's [2] paper presents an automatic image segmentation method using thresholding technique. This is based on the assumption that adjacent pixels whose value (grey level, color value, texture, etc) lies within a certain range belong to the same class and thus, good segmentation of images that include only two opposite components can be obtained. **Jaskirat Kaur, Sunil Agrawal & Renu Vig.'s** paper presented thresholding and edge detection being one of the important aspects of image segmentation comes prior to feature extraction and image recognition system for analyzing images. It helps in extracting the basic shape of an image, overlooking the minute unnecessary details. In this paper using image segmentation (thresholding and edge detection) techniques different geo satellite images, medical images and architectural images are analyzed. To quantify the consistency of our results error measure is used [29]. **V. Dey, Y. Zhang, M. Zhong** proposed a method based on histogram thresholding [1]. They follow a concept that there is a uniform background and objects are irregularly placed on it. This makes image histogram the choice for object delineation & finding an appropriate threshold between object and background fulfils the task of object identification. **Zhang** presented the analysis and comparison of these evaluation methods are performed according to the classification and assessment criteria for methods and performance metrics proposed in that survey. The results reveal the advantages and limitation of these new methods, and provide additional understanding about the evaluation procedure. This review presents also some novel procedures for image generation under different conditions. **Dzung L. Pham, Chenyang Xu, Jerry L. Prince** proposed the basics that thresholding approaches segment scalar images by creating a binary partitioning of the image intensities. It attempts to determine an intensity value, called the threshold, which separates the desired classes. Segmentation is achieved by grouping all pixels with intensity greater than the threshold into one class, & all other pixels into another class. Determination of more than one threshold value is a process called multi thresholding.

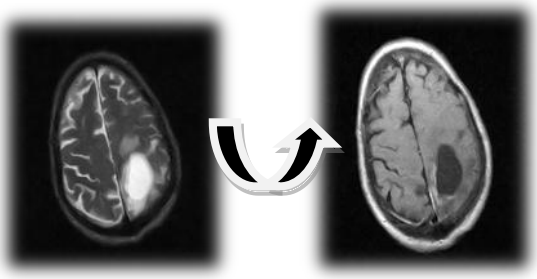

Figure 2. Segmentation through thresholding

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Yu Xiaohan & Yla-Jaaski presented a paper on a new image segmentation technique combining region growing & edge detection. The combined method helps to avoid characteristic segmentation errors which occur when using region growing or edge detection separately. Boundary smoothing is also introduced to ensure more realistic region boundaries. **Fan & Yau** proposed region-based techniques with an assumption that adjacent pixels in the same region have similar visual features such as grey level, color value, or texture. Split and merge approaches were used & its performance largely depends on the selected homogeneity criterion [18]. Instead of tuning homogeneity parameters, the seeded region growing (SRG) technique is controlled by a number of initial seeds. **Theo Pavlidis** assumed the number of regions were approximately known & used it to estimate the corresponding parameters of an edge detection process. It combines region growing and edge detection for image segmentation. **Mark Tabb and Narendra Ahuja, Fellow, IEEE** This paper addresses the classical problem of detecting low-level structure in images, or image segmentation. This problem involves the identification of local areas (regions) in an image that are homogeneous and dissimilar to all spatially adjacent regions. Homogeneity may be measured in terms of color, texture, motion, depth, etc., but for the purposes of this paper it is measured by gray level similarity [33]. **Rajeshwar Dass, Priyanka, Swapna Devi's** paper describes the different segmentation techniques used in the field of ultrasound and SAR Image Processing. Firstly this paper investigates and compiles some of the technologies used for image segmentation. Then a bibliographical survey of current segmentation techniques is given in this paper and finally general tendencies in image segmentation are presented [30].

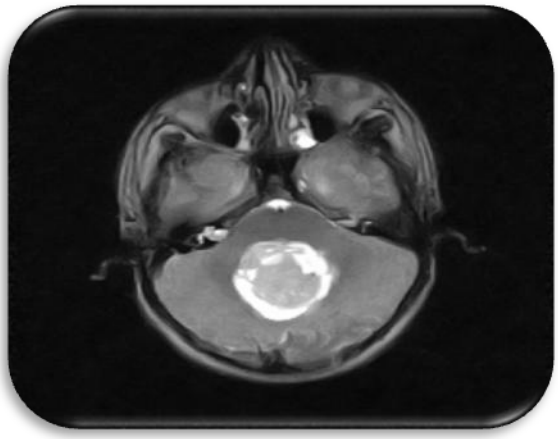

Figure 3. Brain tumour view inside brain

Ahmed Kharrat & Karim Gasmi proposed a hybrid approach for classification of brain tissues in MRI based on genetic algorithm. The optimal texture features are extracted from normal and tumor regions by using spatial gray level dependence method. The choice of features, which constitute a big problem in classification techniques, is solved by using GA [16]. These are then used to classify the brain tissues into normal, benign or malignant tumor. **N. Senthilkumaran & R. Rajesh** proposed that GA perform efficiently for detecting edges in certain anatomical structure, but they can't be generalized to other anatomic structures. Gas are robust in that they are not affected by spurious local optima in the solution space & is backed up by a strong mathematical foundation. **Gudmundsson** proposed an algorithm that detects well-localized, unfragmented, thin edges in medical images based on optimization of edge configurations using a genetic algorithm (GA) [15]. Several enhancements were added to improve the performance of the algorithm over a traditional GA.

Selvakumar's paper deals with the implementation of Simple Cluster Algorithm [4] for detection of range and shape of tumor in brain MR images. This uses computer aided method for segmentation (detection) of brain tumor based on the combination of two algorithms. At the end of the process the tumor is extracted from the MR image and its exact position and the shape also determined & the tumor's stage is displayed based on the amount of area calculated from the cluster. **Gopal & N.N.** proposed in the paper an intelligent system which is designed to diagnose brain tumor through MRI using image processing clustering algorithms [24] such as Fuzzy C Means along with intelligent optimization tools, such as Genetic Algorithm (GA), and Particle Swarm Optimization (PSO). The detection of tumor is performed in two phases: Pre processing and Enhancement in the first phase and segmentation and classification in the second phase. **Indah Soesanti & Adhi Susanto** proposed an optimized fuzzy logic method for Magnetic Resonance Imaging (MRI) brain images segmentation is presented. It is a technique based on a modified fuzzy c-means (FCM) clustering algorithm [22] & incorporates spatial information into the membership function is used for clustering. The advantages of the algorithm are that it is less sensitive to noise than other techniques, and yields regions more homogeneous than those of other methods. **Bakalexis, Boutalis & Mertzios** proposed a pixel based clustering scheme for color image segmentation, which incorporates Perona-Malik diffusion filtering. Preliminary experimental results

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show a significant improvement in the segmentation results. The diffusion coefficient varies spatially in such a way that intra-region smoothing is preferred to inter-region smoothing, thus preventing edge blurring and edge dislocation. **S. Thilagamani and N. Shanthi's** paper is a survey on different clustering techniques to achieve image segmentation. In order to increase the efficiency of the searching process, only a part of the database need to be searched. For this searching process clustering techniques can be recommended. Clustering can be termed here as a grouping of similar images in the database. Clustering is done based on different attributes of an image such as size, color, texture etc. The purpose of clustering is to get meaningful result, effective storage and fast retrieval in various areas [32].

Pham, Chenyang Xu, L. Prince represented that ANNs show a paradigm for machine learning and can be used in a variety of ways for image segmentation [10]. The most widely applied use in medical imaging is as a classifier where the weights are determined using training data, and the ANN is then used to segment new data. They can also be used in an unsupervised fashion as a clustering method as well as for deformable models. **S. Murugavalli and V. Rajamani** proposed implementation of a neuro-fuzzy segmentation process of the MRI data to detect various tissues like white matter, gray matter, csf and tumor. The advantage is to classify the image layer by layer. A higher value of tumor pixels is achieved by this neuro-fuzzy approach. Neuro fuzzy technique shows that MRI brain tumor segmentation using HSOM-FCM also perform more accurate one. **Ghosh Et al** proposed that neural networks are massively connected networks of elementary processors. It defines the extraction of objects in a noisy environment. It takes into account the coiontextual information. **Catalin Amza** presented in the paper that image segmentation is the most important step in modern computer vision. Its output is crucial for all the other stages of computer vision. The literature is very rich in segmentation techniques and neural-network based methods have been applied successfully due to their signal-to-noise independency, their ability to achieve real-time results and the ease of implementing them with massive VLSI processors [24]. **Dr. V. Seenivasagam, S. Arumugadevi** proposed that in the image segmentation field, traditional techniques do not completely meet the segmentation challenges for color images. Soft computing is an emerging field that consists of complementary elements of fuzzy logic, neural networks and Genetic algorithms. Soft computing deals with approximate models and gives solution to complex problems. In this paper, the main aim is to survey and compare the various conventional algorithms and soft computing approaches i.e. fuzzy logic, neural network and genetic algorithms for color image segmentation [33].

III. FUTURE SCOPE

Future research in the segmentation of medical images will lead towards improving the accuracy, exactness, and computational speed of segmentation approaches, as well as minimising the amount of manual interaction. These can be improved by incorporating discrete and continuous-based segmentation methods. Computational effectiveness will be crucial in real-time processing applications. Segmentation methods have proved their utility in research areas and are now emphasizing increased use for automated diagnosis and radiotherapy. These will be particularly important in applications such as computer integrated surgery, where envision of the anatomy is a significant component.

IV. CONCLUSION

Relevance of these approaches is the direct medical application for segmentation and edge detection. We have reviewed the techniques of the MRI image enhancement in terms of tumor pixels detected. We have studied several digital image processing methods and discussed its requirements and properties in brain tumor detection .This paper gives enhanced information about brain tumor detection and segmentation. The marked area is segmented and the assessment of this tool from the radiologist, whom the project is concerned with, is positive and this tool helps them in diagnosis, the treatment procedure and state of the tumor monitoring.

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