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Brain Tumor Detection from MRI Images: A Survey

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ABSTRACT

Brain is the core organism of the human body which supremacy nervous system. In medical domain, the recognition of brain abnormalities is a very important and crucial task. Medical image processing provides basic information of irregularity of brain and it assistance the doctor for premier treatment organization. There are numerous techniques which are used to detect brain tumor for example SVM, K-means, Fuzzy C-means, Genetic algorithm, Image processing and many more. For brain tumor detection image processing method contain many steps like Pre-processing, Segmentation, Feature Extraction, and Classification. This paper provides a quick perception of diverse methods and endowment of different researchers for detecting brain tumor. Different methodologies are executed by individual researchers. One thing is very interesting is that MRI scan image observed as a high standard input for experiments as compared to other scans. With momentum of time deep learning based automated brain tumor detection system artificial intelligence can also be used for better detection and accuracy.

Keywords: Brain Tumor, MRI, Machine Learning, Accuracy

1. INTRODUCTION

One of the universal health issues is cancer. According to the report by World Cancer Researcher, main reason of demise is cancer. Practising mobiles phones at high rate is cause of brain tumor among youth. Brain tumor is caused by anomalous cell formation in brain. The main types of tumor are: malignant (fast growing) and benign (slow growing) tumor. Primary brain tumor (malignant) affects the neighbouring tissues. Secondary brain tumor extends to other parts of the body from brain. According to the position and type of tissue adopted for detection of brain tumor is classified. Around 120 types of tumor are known and classified by World Health Organization. Detection of tumor at early stage perhaps can increase the life period of a person..

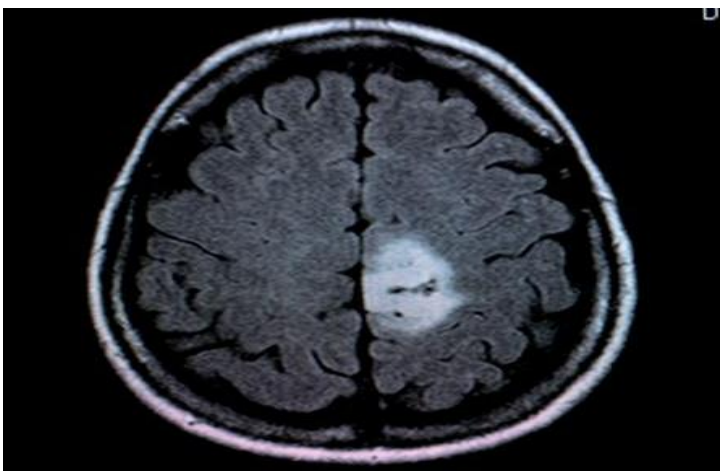

Figure 1 Anatomy of Brain of Human

In the diagnosis of brain tumor imaging has crucial role. Analysis of brain tumor can be done with CT and MRI scans. Brain is the fundamental part of the human anatomy that regulates their nervous system [7]. Brain controls many other activities like heart, breathing, communication, walking, thinking ability, consciousness and unconsciousness balance, etc. The anatomy of the human brain has shown in Fig 1.

Brain tumor is the uneven production of cells in human brain. A brain tumor has two types, benign which is noncancerous and malignant which is cancerous. Malignant brain tumor has two type primary tumor and secondary tumor. Primary brain tumor grows in the brain and secondary brain tumor grows in the other parts of body and extends to brain [3].

The only way of medication is the surgery and medical imaging techniques like neurological exam, Computer tomography (CT), Medical Resonance Imaging (MRI), Positron Emission Tomography (PET) etc. are used to diagnose the brain tumor. The primary test used for diagnosing brain tumor is MRI. It provides detailed info from pictures of brain with the help of pulses of radio wave energy. Then the medical professional examines and concludes the abnormality of the organ. Diagnosing brain tumor is very difficult and challenging work for expert in starting stage due to diverse shapes, appearances, metabolism, divergent sizes of tumor, low contrasted noisy images, diffused and overlap due to tentacle like structure. The segmentation is the most important preprocessing step for detecting brain tumor. It increases the capability and correctness of automatic detection of brain tumor. Many types of machine learning based technologies and set of rules are utilized with MRI and CT images to detect the brain tumor at the first stage.

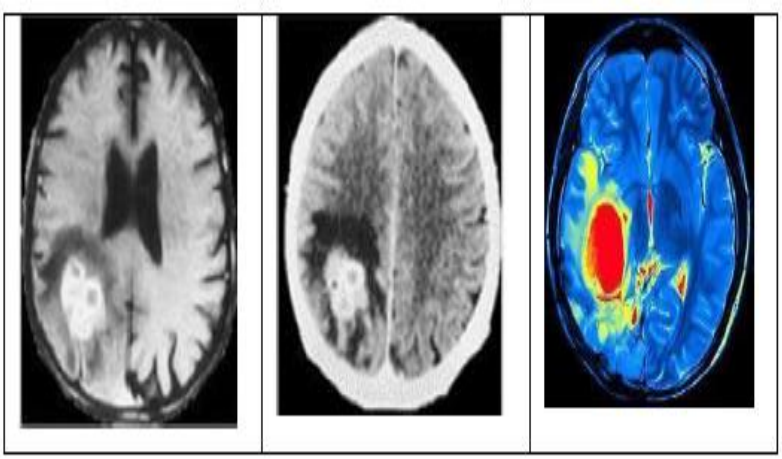

Figure 2 Images of MRI Scan, CT scan and PET [3]

The automated brain tumor system consists of step stages as shown in Fig. 3. The image acquisition step consists of conquering scanned images and some free datasets. The pre-processing step consists of many techniques of digitization of images, noise removal, image improvement and sharpening. Likewise, different techniques use for isolation and separation of the region of interest in segmentation step and some free tools for segmentation are applicable. Statistics, structured or universal features are selected in the step of features extraction. Finally, different kinds of machine learning models are required for classification or clustering for grouping the affected and non-affected parts of the brain and output image display to the physician or professional in diagnosing and making final medical judgment. Steps involved in brain tumor system are depicted below:

- Image Acquisition
- Pre Processing
- Segmentation
- Feature Extraction
- Machine Learning Model
- Output

Brain tumor can be a main tumor or a metastasis from a tumor in another body part. Any damage to the brain tissue will cause ailment of the focal sensory system, as engine unsettling affects, tangible, faculties, and even psychological capability [6]. Brain is the centre of human central nervous system. The brain is a very complex structure as it contains 50-100 billion neurons forming a giant network. Segmentation of MRI images is challenging due to poor image contrast and artifacts resulting in missing or diffused tissue boundaries. Discrete wavelet based genetic algorithm is used to detect the MR brain Images. First, MR images are enhanced using discrete wavelet descriptor, and then genetic algorithm is applied to detect the tumor pixels. [8]

2. LITERATURE SURVEY

A. Navpreet Kaur, Manvinder Sharma: Brain tumor detection is an important diagnostic process in medical field. MRI is the prime imaging technique while analyzing the brain/skull with respect to brain tumor localization and detection. Earlier the numbers of cluster are defined by user using K-means algorithm and this limitation is overcome by implementing self-adaptive K-means clustering algorithm to detect brain tumor accurately and in minimal execution time. In self-adaptive k-means clustering, the numbers of clusters are computed by computing the peaks in histogram. A sobel edge detection method is followed to extract the edges of the segmented brain tumor from its surroundings. The segmented part is then processed to binary image format for its size and location estimation. The gray version is used to extract textural and color based features for nature of growth analysis. The final segmented part is applied the size estimation algorithm for tumor area and perimeter estimation [1].

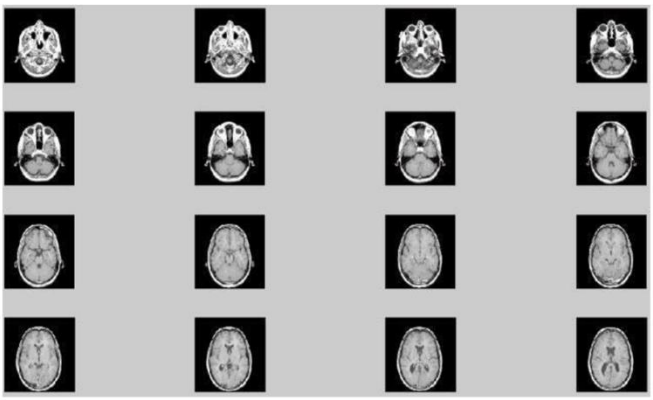

Figure 3 First 16 slices of MRI image

Uma-e-Hani, et al: Brain is the central organ of the human body which controls nervous system. In this paper, we give a brief insight of different techniques and contribution of different people for segmentation and detection of brain tumor. Different methodologies are proposed by different researchers. The MRI scan image considers as a high quality input for experiments as compared to other scans. In the future, we will develop a deep learning based automated brain tumor detection system and will compare with the existing state of the art techniques for better and more accurate results [3].

Ka Hei Loka, et al: In this paper using singed pressure force, SBGFRLS technique enhanced with diverse image information and achieved effectiveness result on medical data set. In original Selective Binary Gaussian Filtering Regularizing Level Set (SBGFRLS) model the contour evolution direction mainly depends on the SPF. By introducing a directional term in SPF, the metric could control the evolution direction. The SPF is altered y statistic values enclosed by the 24 contour. This concept can be extended to jointly incorporate multiple image information. The new SPF term is expected to bring a solution for blur edge problem in brain tumor segmentation. The proposed method is validated with clinical images including pre and post-contrast magnetic resonance images [4]

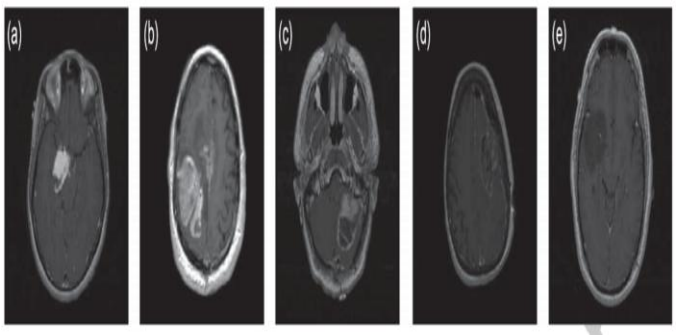

Figure 4 Iconic slice from (a) homogeneously-enhancedtumor,(b)heterogeneously-enhancedtumor,(c)ring-enhancedtumor, (d) diffuse tumor and (e) non-enhanced tumor.

Reema Mathew A, et al: In medical fields, the detection of brain abnormalities is a very important and crucial task. Medical image processing provides basic information of abnormality of brain and it helps the doctor for best treatment planning. Image processing technique used for brain tumor detection contains several steps. The steps include Pre-processing, Segmentation, Feature Extraction, and Classification. In this article diverse methods for feature extraction are assessed [5]**.** Feature are classified according to

- Shape Based
- Intensity Based
- Texture Based

Jide J. Popoola, et al: With pace of time, various image segmentation algorithms have been developed and employed in segmenting or analysing brain MRI scans in the clinical applications for the detection of brain tumor. However, accurate detection, compression and transmission of brain tumor data remain parts of the challenging tasks militating against brain tumor telemedicine services due to the complex nature of brain tumor MRI scans. In overcoming this challenge, five different brain tumor segmentation algorithms were developed for this study. The result of the comparative performance compression rate efficiency evaluation test carried out shows that the developed hybrid threshold watershed segmentation algorithm outperforms others in terms of compression efficiency [9].

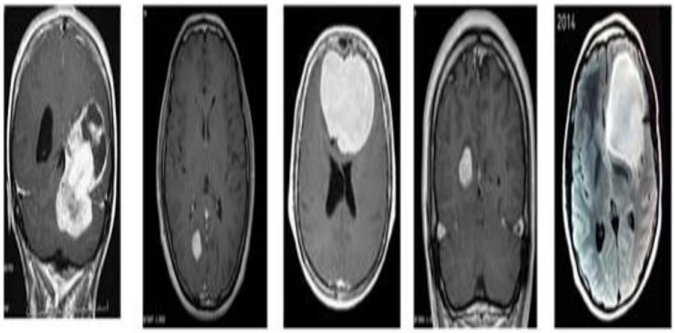

Figure 5 Typical samples of magnetic resonance (MR) images used

3. BASIC METHODOLOGIES

Image Acquisition: MRI image of patient can be gray or color or intensity images displayed with a default size of 220×220. If MRI image is color image, then it must be converted into gray-scale using a large matrix whose entries are numerical values between 0 and 255, where 0 corresponds to black and 255 white for instance. Then the brain tumor detection of a given patient consist of two main stages namely, image segmentation and edge detection [2].

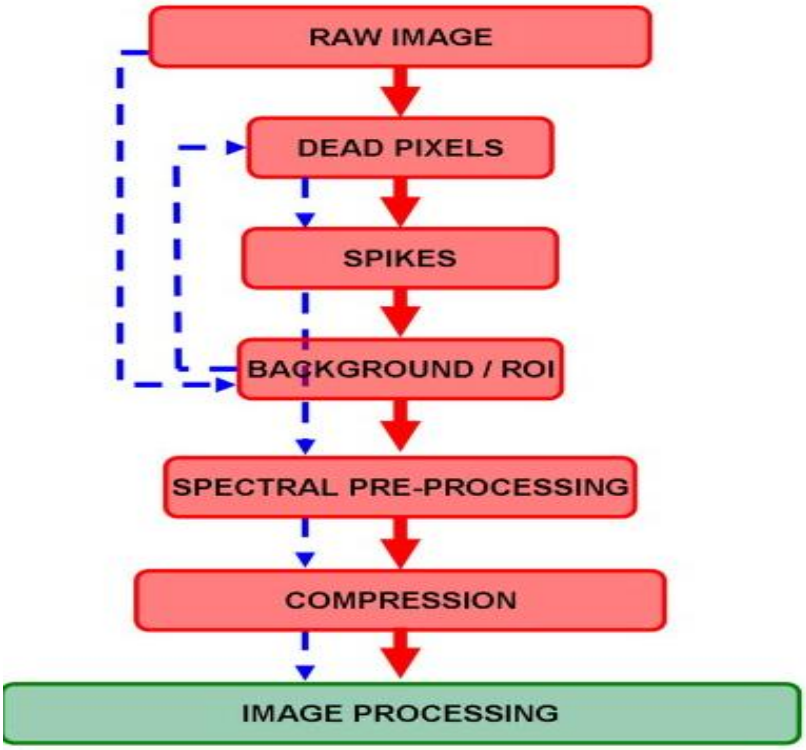

Figure 6 Image pre processing step

Pre-processing stage: Noise removal or dead pixel from noise extracted using different spatial filters as shown above in figure 8. Filter may be linear or nonlinear filters. Pre processing stage also consist operation like RGB to gray conversion and reshaping. It includes median filter for noise removal. The possibilities of arrival of noise in modern

MRI scan are very less. It may arrive due to thermal Effect. It is the action of simplifying an image while preserving important information. The aim is to decrease noise without introducing too much distortion so as to simplify subsequent analysis.

Image Registration: Image registration is the process of bringing two or more images into spatial correspondence. In the context of medical imaging, image registration allows for the concurrent use of images taken with different modalities at different times. In surgery, for example, images are acquired before (preoperative), as well as during (intra-operative) surgery. Because of time constraints, the real-time intra operative images have a lower resolution than the pre-operative images obtained before surgery. Moreover, deformations which occur naturally during surgery make it difficult to relate the high resolution pre-operative image to the low resolution intra-operative anatomy of the patient. Image registration attempts to help the surgeon relate the two sets of images [8].

Image Segmentation: The segmentation is the most important stage for analyzing image properly since it affects the accuracy of the subsequent steps. However, proper segmentation is difficult because of the great verities of the lesion shapes, sizes, and colors along with different skin types and textures. In addition, some lesions have irregular boundaries and in some cases there is smooth transition between the lesion and the skin. To address this problem, several algorithms have been proposed. They can be broadly classified as thresholding, edge-based or region-based, supervised and unsupervised classification techniques

- Threshold segmentation
- Water shed segmentation
- Gradient Vector Flow (GVF)
- K-mean Clustering
- Fuzzy C-means Clustering

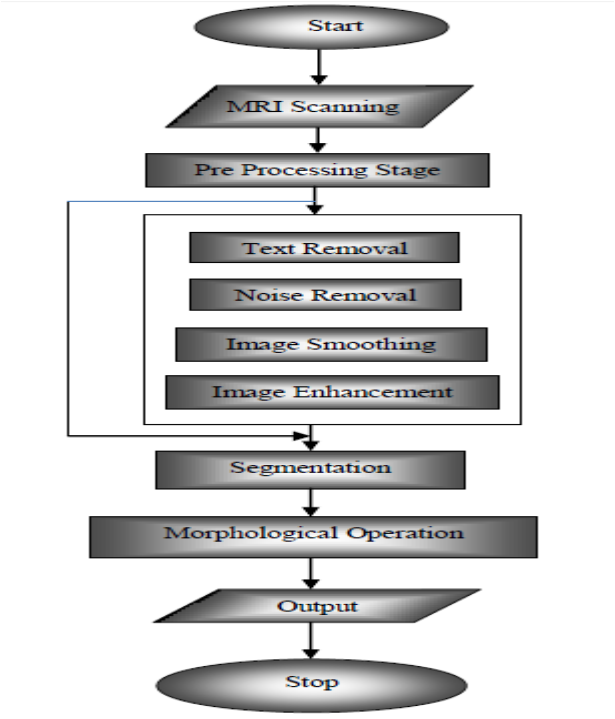

Figure 7 Basic Block diagram of brain tumor detection and segmentation [2]

Morphological Operations: after segmentation morphological processing is applied to remove unwanted part. It consists of image opening, image closing, dilation, erosion operations. At the end the decision has taken weather that MRI image consists of any tumor or not and weather it normal or abnormal.

4. OBJECTIVE AND METHODOLOGY

Objective: The proposed system is classified the brain MRI and breast MRI images. In this process, detect the portion of tumor from MRI image. Using the Level set algorithm, detect only circle portion of the image on the basis of connected component. The experimental dataset contains brain MRI and breast MRI images.

Methodology:

- Improved K-means Algorithm
- Level Set method

The outcomes will calculate on the perimeter, area, mean (M), standard deviation (STD) and entropy (E). This algorithm will compare with the self adaptive K-means approach.

CONCLUSION

With time huge development came into existence especially in healthcare. In medical domain, the recognition of brain abnormalities is a very important and crucial task. This paper gives detailed study of brain tumor detection using different techniques. To extract and segment the tumor distinct techniques are reviewed which are k-mean clustering followed by sobel edge detection, Selective Binary Gaussian Filtering Regularizing Level Set, Image segmentation from MRI images. Besides these techniques there are various methods available which can be used as per desired application. Brain tumor can be cured to a great extent if found in initially stage.

REFERENCES

[1]. Navpreet Kaur, Manvinder Sharma, "Brain Tumor Detection using Self-Adaptive K-Means Clustering", International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS-2017)

[2]. Ms. Priya Patil, Ms. Seema Pawar, Ms. Sunayna Patil, Prof. Arjun Nichal, "A Review Paper on Brain Tumor Segmentation and Detection", International Journal of Innovative Research in Electrical, Electronics,Instrumentation and Control Engineering, Vol. 5, Issue 1, January 2017.

[3]. Uma-e-Hani, Saeeda Naz, Ibrahim A Hameed, "Automated Techniques for Brain Tumor Segmentation and Detection: A Review Study", Conference: 2017 International Conference on Behavioural, Economic, Socio- cultural Computing (BESC), DOI: 10.1109/BESC.2017.8256397

[4]. Ka Hei Loka, Lin Shib,c, Xianlun Zhud and Defeng Wanga, "Fast and robust brain tumor segmentation1 using level set method with multiple image information", Journal of X-Ray Science and Technology, DOI 10.3233/XST-17261, IOS Press

[5]. Reema Mathew A, Achala Prasad, Dr. Babu Anto P, "A Review on Feature Extraction Techniques for Tumor Detection and Classification from Brain MRI", 2017 International Conference on Intelligent Computing Instrumentation and Control Technologies (ICICICT)

[6]. Hapsari Peni Agustin Tjahyaningtijas, "Brain Tumor Image Segmentation in MRI Image", Materials Science and Engineering 336 (2018) 012012 doi:10.1088/1757-899X/336/1/012012, IOP Publishing

[7]. Sanjay M. Shelke, Dr. Sharad W. Mohod, "A Survey on Automated Brain Tumor Detection and Segmentation from MRI", International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 04 | Apr-201

[8]. S. Josephine, "Brain Tumor MRI Image Detection and Segmentation Using Genetic Algorithm", International Journal of Computer Sciences and Engineering, Volume-6, Special Issue-2, March 2018

[9]. Jide J. Popoola, Thompson E. Godson, Yekeen O. Olasoji, and Michael R. Adu, "Study on Capabilities of Different Segmentation Algorithms in Detecting and Reducing Brain Tumor Size in Magnetic Resonance Imaging for Effective Telemedicine Services", EJERS, European Journal of Engineering Research and Science Vol. 4, No. 2, February 2019