OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE & ENGINEERING

A REVIEW PAPER ON AUTOMATED BRAIN TUMOR DETECTION AND SEGMENTATION BY USING CLUSTERING TECHNIQUES

JAGDISH GANGADHAR AHIRRAO[1], ASST.PROF. V. S. KARWANDE[2]

ME Student, Department of Computer Science & Engineering, EESGOI , India[1]

HOD, Assistant Professor, Department of Computer Science and Engineering, EESGOI, India. [2]

***Abstract*: Image segmentation has historically been thought of as the first step in image processing. A good segmentation result will make further image processing analysis much simpler. However, there are numerous image segmentation algorithms and approaches available. One of the most widely used image segmentation techniques is clustering. Medical experts perform tumour segmentation from magnetic resonance imaging (MRI) data, which is an essential yet time-consuming manual task. Because of the wide variation in the appearance of tumour tissues among patients and their sometimes close resemblance to normal tissues, automating this process is a difficult task. MRI is a type of advanced medical imaging that provides detailed details about the anatomy of the human soft tissues. To identify and segment a brain tumour from MRI images, various brain tumour detection and segmentation methods are used. The advantages and disadvantages of these methods for brain tumour detection and segmentation are discussed, with an emphasis on enlightening the advantages and disadvantages of these methods for brain tumour detection and segmentation. The application of MRI image detection and segmentation to various procedures is also discussed. A brief overview of various segmentation methods for detecting brain tumours from MRI scans of the brain is presented here & also use different Clustering Techniques.**

Keywords: Tumor Detection; Magnetic resonance imaging (MRI); Tumor Segmentation; Automated System; Pre-processing, Filtering; computed tomography (CT).

I INTRODUCTION

The Image segmentation is a technique for correctly classifying the pixels of an image in a decision-oriented application by partitioning it into a multiple number of segments. As a consequence, we may assume that image segmentation's aim is to simplify or alter an image's representation, or to transform an image's details into a more meaningful form, making it easier to analysis. It divides an image into a number of distinct regions, with high similarity between the pixels in each region and high contrast between the regions. It is a useful tool in a number of fields and can be used in a variety of applications, including health care, medical image processing, traffic image analysis, and pattern recognition. Image segmentation can be performed using a number of techniques and methods, such as threshold based, graph based, and morphological based, edged based, clustering based, neural network based, and so on. Both of these approaches have their own set of advantages and disadvantages, so one must choose an algorithm based on their own requirements. Clustering is one of the most widely used effective methods among these techniques. Clustering strategies are classified into many categories, including K-means clustering, Fuzzy C-means clustering, Subtractive clustering methods, and so on. In this article, we will go through some of the various clustering strategies and some of the recent research that has been done on them. Magnetic resonance imaging of brain image computing has greatly expanded the field of medicine by offering a variety of methods for extracting and visualizing information from medical data obtained through various retrieval modalities. The method of extracting information from complex MRI brain images is known as brain tumour segmentation. In today's medical world, diagnostic imaging is a very valuable method. Imaging techniques such as magnetic resonance imaging (MRI), computed tomography (CT), digital mammography, and others are useful in detecting various diseases. When the number of patients rises, automated detection methodologies enhance knowledge of normal and diseased examinations for medical testing and play an important role in diagnosis and treatment planning. For analyzing MRI of the brain, anatomical structures such as bones, muscles, blood vessels, tissue types, pathological regions such as cancer, multiple sclerosis lesions, and dividing an entire image into sub regions such as the white matter (WM), grey matter (GM), and cerebrospinal fluid (CS), segmentation has a wide range of applications in medical imaging. Thus, brain tumour segmentation from a brain image is important in the field of MRI, as MRI is especially well suited to brain studies due to its excellent contrast of soft issues, non-invasive nature, and high spatial resolution. Brain tumour segmentation divides a portion of the image into mutually special and pooped regions, ensuring that each area of interest is spatially contiguous and that the pixels within the region are homogeneous according to a predefined criterion. Concentration, texture, colour, range, surface normal, and surface curvatures are all examples of homogeneity conditions. Many researchers have prepared important research in the field of brain tumour segmentation in the past, and it remains one of the most important research fields today. Medical history, biopsy (in which a small amount of brain tissue is excised and examined under a microscope), and imaging scans are all essential for a brain tumour diagnosis. The diagnostic process can begin with standard x-rays and computed tomography (CT). MRI, on the other hand, is more useful because it offers more comprehensive details about the type, location, and size of the tumour. As a result, MRI is the imaging study of choice for the diagnostic workup as well as surgery and procedure outcome monitoring.

II LITERATURE SURVEY

Anomaly prediction inaccuracies have become a serious problem in the field of medical image analysis, and these problems have grown as a result of errors caused by the operator, instrument/device, and environment, all of which can be resolved with the introduction of a novel segmentation method proposed in this paper. The new method combines the functions of the Spatially Constrained Fish School Optimization algorithm (SCFSO) and the Interval TypeII Fuzzy Logic System (IT2FLS) techniques to correct incorrect predictions of anomalies in different topographical locations in MRI (Magnetic Resonance Imaging) brain subjects. The developed method can easily interfere and analyse large datasets and complex tumours (anomalies), and this may be a proactive measure for being applied or integrated in clinical practise for the betterment of both doctors and patients, and it can provide a profound experience to the doctors. The proposed SCFSOIT2FLS technique was applied to the BRATS-SICAS dataset, and the evaluation metrics, namely the Dice overlap index (DOI) and sensitivity value, were delivered by the proposed technique as 962.1 and 981.1, respectively. These findings are superior to those obtained using traditional methods, and the proposed approach can be used to segment T1-weighted (T1-W), T2-weighted (T2W), and Flair (Fluid Attenuated Inversion Recovery) MRI (Magnetic Resonance Imaging) sequences of various axes coordination. The proposed technique allows for a simple separation of tumour and non-tumor regions (edoema), and therapeutic pre-planning can often be done with such a provision/advantage [1].

The identification and analysis of brain tumours are important in medical diagnosis. Since this format has the advantage of preserving comprehensive metadata, the proposed study focuses on segmenting abnormalities in axial brain MR DICOM slices. The axial slices assume that a Line of Symmetry separates the left and right halves of the brain (LOS). In a DICOM analysis, a semi-automated device is used to extract normal and abnormal structures from each brain MR slice. Fuzzy clustering (FC) is used to extract various clusters for different k from DICOM slices in this study. The silhouette fitness function is then used to obtain the best-segmented image with the highest inter-class rigidity. Theclusteredboundariesofthetissueclasseswerenhancedfurther bymorphologicaloperations Standard image post-processing techniques such as marker regulated watershed segmentation (MCW), area rising (RG), and distance regularised level sets are combined with the FC technique (DRLS). This technique was checked on the renowned BRATS challenge dataset of different modalities as well as a clinical dataset of axialT2weightedMRimages of a patient. The metadata information in the DICOM header is used to conduct the quantitative analysis of the slices. The validation of these segmentation procedures against ground truth images confirms that DRLS enhanced brain images with FC obtain the highest Jaccard and Dice similarity coefficients. For segmenting tumour parts, the average Jaccard and dice scores for ten patient studies in the BRATS dataset are 0.79 and 0.88, respectively, and 0.78 and 0.86 for the clinical study. Finally, DICOM data is used to perform 3D visualization and tumour volume estimation [2].

Human inspection has traditionally been used to classify and detect computerized tomography (CT) and magnetic resonance brain images. Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI) images produce an unnecessary sound (noise) induced by operator output, which may result in severe classification inaccuracies. The use of a Back Propagation Neural Network (BPNN) with Fuzzy C Means (FCM) is proposed in this paper as a new approach for Brain Tumor Classification. The following steps are followed to complete the work: Decision Making is split into two stages: pre-processing and decision-making. After that, analysis is performed using I high level segmentation (using FCM) and ii) low level segmentation (using BPNN). To conduct the evaluation, 25 brain tumour images were used. [3].In the field of biomedical applications, image segmentation plays a critical role. For the diagnosis and staging of Alzheimer's disease, magnetic resonance brain scans with and without the disease have been preferred. Clustering is a widely used image segmentation concept that distinguishes groups in such a way that samples from the same group are compared to each other rather than samples from separate groups. Recently, there has been a lot of controversy about using fuzzy clustering approaches, which hold more detail from the input image than the clustering theory. Because of its versatility, the Modified Fuzzy C Means (MFCM) algorithm is commonly preferred because it allows pixels to belong to different groups of varying degrees of membership. The MFCM was used to initialise the clusters, and the Binary Gravitational Search algorithm was used to boost the efficiency of the segmentation algorithm. For the identification of Alzheimer's disease, various brain subjects such as White Matter (WM), Grey Matter (GM), the hippocampus area, and Cerebrospinal Fluid (CSF) are segmented. When compared to various existing techniques, the BGSA with MFCM algorithm has shown better results. The proposed technique has a 93.3 percent accuracy rate

[5].Medical experts perform tumour segmentation from magnetic resonance imaging (MRI) data, which is an essential yet time-consuming manual task. Because of the wide variation in the appearance of tumour tissues among patients and their sometimes close resemblance to normal tissues, automating this process is a difficult task. MRI is a type of advanced medical imaging that provides detailed details about the anatomy of the human soft tissues. To identify and segment a brain tumour from MRI images, various brain tumour detection and segmentation methods are used. The advantages and disadvantages of these methods for brain tumour detection and segmentation are discussed, with an emphasis on enlightening the advantages and disadvantages of these methods for brain tumour detection and segmentation. The application of MRI image detection and segmentation to various procedures is also discussed. A brief overview of various segmentation methods for detecting brain tumours from MRI scans of the brain is presented here. [6].

III. SYSTEMS ARCHITECTURE

The system designed to detect brain tumors at early stages and classify them as benign and malignant is composed following phases. These phases includes system architecture show in Figure 3.1 the project flow.

A) Image Pre-processing: The use of a digital computer to process digital images using an algorithm is known as image processing. Digital image processing, as a subcategory or field of digital signal processing, has a number of advantages over analogue image processing. It enables a much broader variety of algorithms to be applied to the input data, as well as avoiding issues like noise and distortion during processing. Image processing may be modelled as multidimensional systems because images are defined in two dimensions (or more). Three factors influence the generation and production of image processing: first phase, the development of computers; second phase, the development of mathematics (especially the creation and improvement of discrete mathematics theory). Third phase, there has been a rise in the demand for a wide range of applications in the environment, agriculture, military, manufacturing, and medical science.

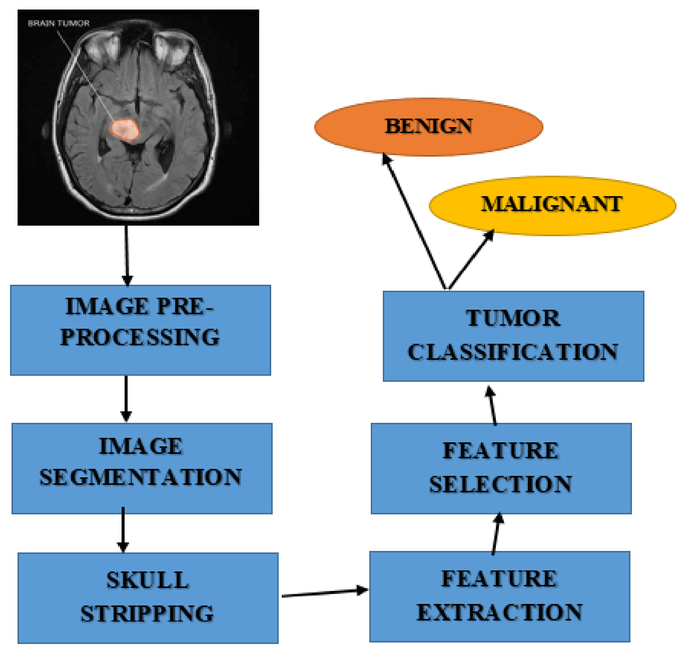

Figure No 3.1: System Architecture

B) Image pre-processing: Image pre-processing can have a substantial positive impact on the quality of feature extraction and image analysis performance. The mathematical normalization of a data set, which is a common step in many feature descriptor methods, is analogous to image pre-processing.

C) Skull Stripping of MR Brain Images: The five types of skull stripping methods mentioned in the literature are mathematical morphology-based methods, intensity-based methods, deformable surface-based methods, atlas-based methods, and hybrid methods. For various brain image applications such as volumetric analysis, study of anatomical structure, localization of anatomy, diagnosis, treatment planning, surgical planning, and computer-integrated planning, the MRI system produces brain image as 3D volumetric data represented as a stack of two-dimensional slices, and it is important to use computer-aided tool to explore the information contained in these brain slices.

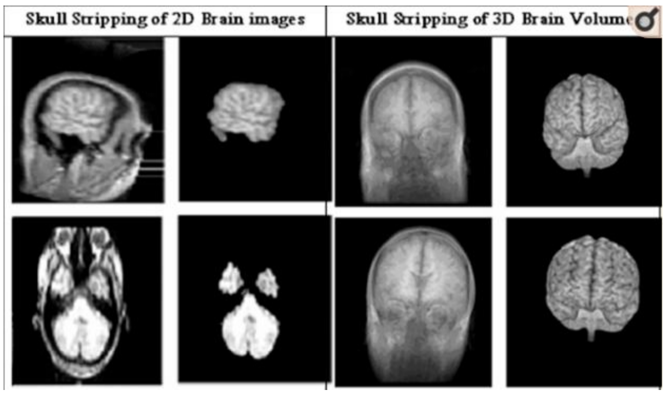

Figure No 3.2: Skull Stripping 2D & 3D Brain Images.

D) Image Segmentation: Picture Segmentation is the method of partitioning a digital image into different subgroups (of pixels) called Image Objects, which reduces the image's complexity and makes image analysis easier. To break and group a particular collection of pixels from an image, we use various image segmentation algorithms. Through doing so, we're simply assigning labels to pixels, and pixels with the same label are grouped together because they have something in common. We can define borders, draw lines, and distinguish the most important objects in an image from the rest of the less important ones using these marks.

E) Feature Extraction: Feature extraction is a step in the dimensionality reduction process, which separates and reduces a wide collection of raw data into smaller classes. As a result, processing would be simpler. The fact that these massive data sets have a large number of variables is the most important aspect.

F) Feature Selection: When creating a predictive model, feature selection is the method of reducing the number of input variables. The number of input variables should be reduced to reduce the computational cost of modelling and, in some cases, to increase the model's accuracy.

G) Tumor Classification: SVM is used in the proposed system for classification process to distinguish between benign and malignant tumours. In classification problems, SVM is an efficient learning process. To differentiate the two groups, an SVM classifier assists in obtaining the equation of the best linear classifier. When separating classes with a lot of details, SVM uses kernel functions. In applications with less data and higher dimensionality, SVM achieves better performance. In this analysis, an SVM classifier structure that can distinguish between benign and malignant tumours was used.

IV CONCLUSION

Using MRI pictures, this study proposed an automated framework that successfully classifies brain tumours as benign and malignant. On MRI images, image processing and image segmentation techniques were used. Brain tumours were segmented using s-FCM during the segmentation process. For feature extraction, the FIF, SF, and GLCM techniques were used, and the PCA approach was used for feature selection. In the classification process, the SVM method was used. Increased training database size can result in improved detection efficiency. This research is part of an integrated framework that allows for the identification of tumours, the classification of benign and malignant tumours, tumour rating, tumour tracking, and patient management phases. In future research, we'll concentrate on adding new features and building an interactive platform.

REFERENCES

[1]. Saravanan Alagarsamy, Yu-Dong Zhang, Vishnuvarthanan Govindaraj, Murugan Pallikonda Rajasekaran, Sakthivel Sankaran, "Smart Identification of Topographically Variant Anomalies in Brain Magnetic Resonance Imaging Using a Fish School based Fuzzy Clustering Approach," IEEE TRANSACTION ON FUZZY SYSTEMS VOL.12 NO.08 JULY 2020.

[2] Suresh Kanniappan , Duraimurugan Samiayya , Durai Raj Vincent P M , Kathiravan Srinivasan , Dushantha Nalin K. Jayakody , Daniel Gutiérrez Reina and Atsushi Inoue, "An Efficient Hybrid Fuzzy-Clustering Driven 3D-Modeling of Magnetic Resonance Imagery for Enhanced Brain Tumor Diagnosis," Electronics, 2020.

3] Sangeeta Sehrawat, Ritu Khatri, "Brain Tumor Detection Using FCM and BPNN," International Journal of Basic and Applied Biology (IJBAB), Volume 2, Number 1; October, 2014.

[4] Nameirakpam Dhanachandra, Yambem Jina Chanu, "Segmentation of Brain Subjects in MR Images using Hybrid Segmentation Technique," International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-9 Issue-1S4, December 2019.

[5] Sudipta Roy, Sanjay Nag, Samir K. Bandyopadhyay,Indra Kanta Maintra "A Review on Automated Brain Tumor

Detection and Segmentation from MRI of Brain," International Journal of Advanced Research in Computer Science and Software Engineering, June - 2013.

[6] P. Kalavathi, V. B. Surya Prasath, "Methods on Skull Stripping of MRI Head Scan Images—a Review," j Digital Imaging,Volume 23(3),2016.

[7] Hooda, Heena, Om Prakash Verma, and Sonam Arora. "Optimal Fuzzy C-Means Algorithm for Brain Image Segmentation." In Applications of Artificial Intelligence Techniques in Engineering, pp. 591-602. Springer, Singapore, 2019.

[8] Valverde, Sergi, Arnau Oliver, Eloy Roura, Sandra González-Villà, Deborah Pareto, Joan C. Vilanova, Lluís Ramió-Torrentà, Àlex Rovira, and Xavier Lladó. "Automated tissue segmentation of MR brain images in the presence of white matter lesions." Medical image analysis 2017.

[9] Kumar, P. Rajesh, et al. "Brain Subject Estimation Using PSO K-Means Clustering-An Automated Aid for the Assessment of Clinical Dementia." International Conference on Information and Communication Technology for Intelligent Systems. Springer, Cham, 2017.

[10] P. Tamije Selvy, V. Palanisamy, T. Purusothaman, "Performance Analysis of Clustering Algorithms in BrainTumor Detection of MR Images", European Journal of Scientific Research, Vol.62 No.3 ,2011.

[11] K.Selvanayaki , Dr. P. Kalugasalam , "Pre-Processing And Enhancement Of Brain Magnetic Resonance Image (Mri)" Ijrcm, Volume No. 2, Issue No. 10 October, 2012.