Design of Novel Algorithm for Brain Tumor Detection: A Review

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***Abstract* – Papers in the literature show that various algorithms were applied on MRI images for detection of brain tumor. However, not all of them were found to be effective in terms of parameters like efficiency, computational complexity, reliability & execution time. So the proposed work is to design a novel algorithm by combining best features of various algorithms, so that the accuracy, execution time, reliability & efficiency is improved.**

I. INTRODUCTION

Brain is the center of human Central nervous system [19]. Along with the spinal cord, it forms the Central Nervous System (CNS). The Cranium, a bony box in the skull protects it [20]. Magnetic resonance imaging (MRI) is an important diagnostic imaging technique for the early detection of abnormal changes in tissues and organs [32]. Detection of anatomical brain structures with their exact location is important for treatments like radiation therapy and surgery. MRI is widely used as it provides much greater contrast between the different soft tissues of the body compared to computed tomography (CT) [16].

A tumor is termed for a neoplasm or a solid lesion formed by an abnormal growth of cells which looks like a swelling [19]. It is one of the most common brain diseases, so its diagnosis and treatment plays an important role. Brain tumor can be benign or malignant, benign being non-cancerous and malignant are cancerous. Malignant tumors are classified in to two types like Primary and Secondary tumors. Benign tumor is less harmful compared to malignant as in malignant tumor it spreads rapidly invading other tissues of brain, progressively worsening the condition causing death.

The pre-processing stages needs to be done on the image initially, followed by clustering algorithms and towards the fag end thresholding be done for the extraction of the tumor which is the region of interest (ROI) from the entire image [1].

II. LITERATURE REVIEW

V. Zeljkovic, C. Druzgalski, Y. Zhang, Z. Zhu, Z. Xu, D. Zhang, P. Mayorga [3] have presented the Automatic Brain Tumor Detection and Segmentation in MR Images. This method was tested on 60 brain MR images with the tumor and also on healthy brain MRIs. This method allows the segmentation of tumor tissue with an accuracy and reproducibility comparable to manual segmentation. The results show 93.33% accuracy in abnormal images and full accuracy in healthy brain MR images. This method for tumor detection in MR images also provides information about its exact position and documents its shape.

Alan Jose, S.Ravi, M.Sambath [6] have discussed Brain Tumor Segmentation Using K-Means Clustering & Fuzzy C-Means Algorithms & Its Area Calculation. The performance of brain tumor segmentation is evaluated based on K-means clustering.

Sneha Khare, Neelesh Gupta & Vibhanshu Srivastava [7] have presented Genetic Algorithm Employed to Detect Brain Tumor in MRI Image. In this paper, Genetic Algorithm, Curve Fitting and Support Vector Machine has been employed to detect the image which shows the location where tumor is present.

T.Logeswari and M.Karnan [11] have presented An Enhanced Implementation of Brain Tumor Detection Using Segmentation Based on Soft Computing. Several methods in medical image processing and requirements and properties of techniques in brain tumor detection are discussed.

Suchita Yadav, Sachin Meshram [14] have discussed Brain Tumor Detection Using Clustering Method. This paper focuses on a new and very famous algorithm for brain tumor segmentation of MRI images by k means algorithm to diagnose accurately the region of cancer because of its simplicity and computational efficiency.

Dina Aboul Dahab, Samy S. A. Ghoniemy, Gamal M. Selim [18] have presented Automated Brain Tumor Detection and Identification Using Image Processing and Probabilistic Neural Network Techniques.

Rohini Paul Joseph, C. Senthil Singh, M.Manikandan [19] have proposed Brain Tumor MRI Image Segmentation and Detection in Image Processing. In this work, a computer aided system for brain MR image segmentation was proposed for detection of tumor location using K - means clustering algorithm followed by morphological filtering.

P. Tamije Selvy, V. Palanisamy, T. Purusothaman [20] have discussed Performance Analysis of Clustering Algorithms in Brain Tumor Detection of MR Images. In this system brain tumors have been segmented with the help of four methods. In this system, the axial view of the human brain is taken for tumor detection.

M. Masroor Ahmed & Dzulkifli Bin Mohammad [21] have proposed Segmentation of Brain MR Images for Tumor Extraction by Combining K-means Clustering and Perona-Malik Anisotropic Diffusion Model. This paper describes an efficient method for automatic brain tumor segmentation for the extraction of tumor tissues from MR images. The proposed method uses T1, T2 and PD weighted gray level intensity images.

Sushma Laxman Wakchaure, Ganesh Dynandev Ghuge, Dyandev S. Musale [23] have discussed The Detection & Visualization of Brain Tumors on T2-Weighted MRI Images Using Multiparameter Feature Blocks. This method was effectively

capable of identifying tumor areas in T2-weighted medical brain images taken under different clinical circumstances which showed high deviations that clearly indicated abnormalities in areas with brain defects. The time required to obtain the response for processing system is 176 milliseconds for each image analysis.

Juha Vesanto and Esa Alhoniemi [27] have presented Clustering of the Self-Organizing Map. In the experiments, agglomerative and partitive clustering algorithms were run both directly for data and for SOM trained using the data using three data sets. The experiments indicated that clustering the SOM instead of directly clustering the data is computationally effective approach.

Richard J. Hathaway, Member, IEEE, and James C. Bezdek, Fellow, IEEE [28] have discussed Fuzzy c-Means Clustering of Incomplete Data. Four different approaches for doing FCM clustering of incomplete data sets were considered.

III. PROPOSED WORK

A. To study various algorithms used to detect brain tumor.
B. Performance analysis of various algorithms w.r.t. computational complexity, the optimal cluster number, reliability, execution time & efficiency.
C. Implementation of novel algorithm on brain tumor.
D. Comparison & validation of Results.

IV. METHODOLOGY

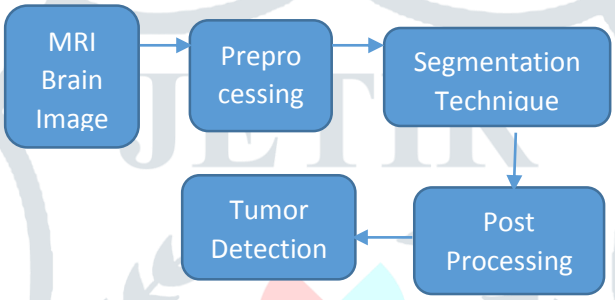

Fig. 1. Block diagram for tumor detection

As shown in the block diagram, these steps are applied for various algorithms (C-means, Self-Organized map & Hierarchical clustering). From this, factors like computational complexities, execution time, reliability & efficiency for these algorithms is required to compute.

Analysis of these parameters is to be done. Finally design the novel algorithm to overcome the deficiencies of these algorithms & obtain best results.

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