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Segmentation and Determination of Brain Tumor by Bounding Box Method

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Abstract:- An Intracranial Neoplasm (Brain Tumor) occurs when abnormal cells form within the brain. There are two main types of tumors: Malignant (Cancerous Tumors) and Benign tumors. Cancerous or non-cancerous mass and growth of abnormal cells in the brain leads to the formation of brain tumor. In order to reduce the increasing fatality rate caused by brain tumor, it is necessary to detect and cure the affected region early and efficiently. Initially, pre-processing is performed, in this phase image is enhanced in the way that finer details are improved and noise is removed from the image. During pre-processing, filters are applied on an input grey scale image to remove unwanted impurities. Filtered image thus obtained is free from impurities. Processing of an image is performed next. Image segmentation is based on the division of the image into regions. Division is done on the basis of similar attributes. Post processing is done using threshold and watershed segmentation. During post processing, the filtered image is forwarded for threshold segmentation along with SVM classifier. Threshold segmentation usually transforms the image in a binary format based on a threshold value. SVM analyze data for classification and regression analysis. Watershed segmentation groups the pixels of image based on their intensities. Morphological operations are applied to the converted image. Boundary extraction is a major part of research which uses fast bounding box algorithm which detects the affected area in motion.

Keywords:- **Brain Tumor; Segmentation; Bounding Box Method; SVM;**

I. Introduction

Digital Image processing [1] is a rising field during which doctors and surgeons are becoming completely different simple pathways for the analysis of advanced illness like cancer, brain tumor, breast cancer, kidney stones, etc. The detection of nervous disorder [2, 4] may be a terribly difficult task, during which special care is taken for image segmentation. A selected a part of body is scanned within the mentioned applications of the image analysis and techniques equivalent to MRI [2, 3], CT scan, X rays. The photographs are judged by physicians or surgeons to resolve the issues.

Brain tumor may be a huge reason behind incapacity and death worldwide and connected abnormalities represent for major changes in life [4].

A tremendous growth has been tired the last decade for brain tumor within the region of cerebral cancer diagnosing. Cerebral cancer [5] has been noticed that's spreading over the planet and lots of faculties and university medical analysis centers are specializing in the problem. The most effective and customary tool for diagnosis a neoplasm is that the use of a magnetic resonance imaging (MRI) scan, though computerized tomography (CT or CAT) scans also are used. A PET scan is employed initially to seek out additional a few neoplasm whereas a patient is receiving treatment or if the neoplasm comes back when treatment.

A. Classification of Brain Tumor

Astrocytomas : Astrocytomas are the foremost common kind of brain tumor in each adults and kids. They develop from cells known as atrocities. The atrocities are the cells of the brain that support the nerve cells (neurons) [6-11].

Oligodendrogliomas: About three out of each a hundred brain tumors (3%) are Oligodendrogliomas. These develop from cells known as oligodendrocytes. These cells create a white fatty substance that covers nerves, known as myelin. It helps the nerve signals.

Unspecified Gliomas: Unspecified brain tumor implies that the cells are brain tumor cells however the doctor cannot tell precisely the tumor grade or typically the cell of origin[12].

Meningiomas: About one in four brain tumors in adults (25%) could be a tumor. They're a lot of common in older individuals and in ladies. These tumors begin within the tissues covering the brain (membranes).

Vestibular Schwannomas: Vestibular schwannomas (VS) are known as acoustic neuromas. Neuromas begin within the nerve cells however VS really begin within the Schwann cells on the

surface of the nerve that runs from the ears to the brain and controls hearing and balance[13].

Cramiophayngiomas: Craniopharyngiomas are terribly rare benign tumors. These tumors tend to grow close to the bottom of the brain, simply higher than the pituitary. They're most frequently diagnosed in kids, teenagers and young adults [14-16].

Lymphomas: Lymphoma could be a cancer of the vascular system. These tumors are treated otherwise to different varieties of tumor.

Germ Cell Tumors: Germ cell tumors account for concerning a pair of out of a hundred (2%) of all brain tumors. Most occur outside the brain, within the chest or abdomen, however they'll occur within the brain. Within the brain they're most ordinarily found within the space on the point of the endocrine gland and also the pituitary[17].

II. RELATED WORK

Viswa Priya and Shobarani et al. [11] proposed work recognizes tumor utilizing another division technique and confinement in cerebrum MR pictures. The fundamental point of showing this Contextual Clustering based division strategy is the change of the division precision by the decrease of false divisions. In this work the cerebrum MRI is taken as the info picture and the portioned tumor area is got as the yield which utilizes this effective Contextual Clustering calculation which takes less time to section with minimum calculations in division and thus by enhances the division precision contrasted and all other officially utilized ordinary strategies.

Zuzana Bobotov'a et al. [12] exhibited programmed calculation for the division of cerebrum tumors from attractive reverberation pictures. The principle preferred standpoint of the exhibited calculation is its vigor. It is composed with the objective to process pictures from different gadgets for the MRI information securing and with different intensities. It gets to be conceivable utilizing the versatile thresholding and greyscale morphological remaking which get parameters as per the aftereffects of factual strategy Mixture of Gaussians. It is trailed by the diagram cut calculation. Versatile thresholding and Gray scale morphological reproduction are vital for the right results. The chart cut calculation builds the exactness of the division in some particular cases, however in synopsis the outcomes utilizing diagram cut division strategy are less fruitful contrasting and the technique which was managed without the chart cut.

Saumya Gupta et al. [13] examined the different strategies of mind tumor recognition and division. This investigation was led to watch cerebrum tumor utilizing restorative imaging methods. The fundamental system utilized was division, which is done utilizing a strategy in view of limit division, watershed division and morphological administrators. The anticipated division approach was explored different avenues regarding

D. Balasubramaniam, S. et al. [16] proposed new delicate processing approach in view of the Fuzzy C-Means calculation is in charge of the programmed division of capital MRI Volumetric information sets. These information sets are grouped to three primary classes (WM, GM, CFS).It gives the earlier data about the MRI tissues in the estimation procedure. The new strategy used to examination ordinary MRI cerebrum and MRI mind pictures with the tumor. Mind picture with the spatial data and the portioned an ordinary MRI cerebrum picture and MRI Brain picture is with tumor can be investigated effectively. We introduce a similarly investigation of various division approaches , the technique displayed in this paper utilized with new methodologies of the picture division for the better exactness and accuracy of the outcomes.

Niladri Halder et al. [18] executed system fragments the cerebrum tissues from alternate tissues of the human head in a programmed way. The convolutions of the mind are seen and white matter, dim matter, and CSF are isolated. The procedure makes up for power in homogeneities. Nonetheless, advancements can be made to the calculation to make it more vigorous and computerized. The introduction of the calculation must be moved up to make the procedure totally computerized. The inclination field remedy could likewise be created to get better results.

Ashima Anand et al. [19] investigated different division strategies for the discovery of mind tumor have been audited .Calculation of tumor's zone from MRI in quick, precise and reproducible way is a repetitive errand. Division has demonstrated adequately in this specific exploration range. Medicinal picture handling is a dynamic and quickly developing field. Mind tumor division systems have demonstrated it in recognizing and breaking down tumors in clinical pictures and it will proceed into what's to come. For recognizing tumors from typical tissues by their picture force, edge based or locale developing procedures can be utilized.

Sneha Dhurkunde and Shailaja Patil [20] displayed a technique for Image division, picture pre-handling utilizing middle channel, picture upgrade utilizing histogram balance, Segmentation utilizing grouping strategies, for example, K-implies bunching, fluffy C-implies bunching and thresholding with morphological operations then the identification of tumor. A portion of the components of the tumors are extricated which will be useful in restorative applications. Likewise we had contrasted every one of the three methods and the parameters, for example, territory, edge and centroid of mind tumor. In this examination thresholding with morphological operation

procedure is giving preferable precision over both grouping strategies.

K. Muthukarpagam et al. [21] highlight extraction based mind tumor discovery in MRI picture is proposed. Middle separating hones and histogram procedures are utilized for Pre-preparing. Brian tumor is identified by utilizing Segmentation strategy for Active form model in MRI pictures with the assistance of ROI. At last element values (Area, Contrast, Energy, and Homogeneity) are computed from the sectioned pictures. In future, Classification systems will be performed for arranges the phases of the mind tumors. For arrangement Support Vector Machine (SVM) generally Artificial Neural Network (ANN) will be utilized

Rajeev Ratan et al. [22] makes utilization of multi-parameter MRI investigation and the tumor can't be fragmented in 3D unless and until we have 3D MRI picture information set. Along these lines, a moderately straightforward strategy for identification of mind tumor is displayed which makes utilization of marker based watershed Segmentation with change to evade over and under Segmentation. The Segmentation of a picture involves the Segmentation or partition of the picture into comparative property. A definitive point in countless picture preparing applications is to remove critical highlights from the picture information, from which a depiction, elucidation, or comprehension of the scene can be given by the machine. The Segmentation of cerebrum tumor from attractive reverberation pictures is an imperative however time consuming errand performed by therapeutic experts.

Ramya K and Joshila Grace L.K [1] proposed a brain tumor detection technique based on watershed with gradient magnitude with morphological open image. Two important features such as foreground and background image to identify the tumor were used.

III. PROPOSED METHODOLOGIES

This work used watershed and thresholding algorithm for segmentation and detection of the tumor of brain. A block diagram shows in figure 1 for different processing of the system.

A. Image Acquisition

Images are obtaining using MRI scan and these scanned images are display in a 2D matrices having pixels as its element. These matrices are dependent on matrix size and its field of view. Images are store in MATLAB and displayed as a gray scale image of size 256 x 256. The entries of a gray scale image are range from 0-255, where 0 shows total black color and 255 shows pure white color. Entries between these ranges vary in intensity from black to white Most usually used improvement and noise decrease techniques are implement that can provide finest possible results. Enhancements will outcome in more prominent edges and a sharpened image is obtain, noise will be reduced thus reducing the blurring effect from the image. In addition to improvement, image segmentation will also be applied. This improved and enhanced image will help in detecting edges and improving the quality of the overall image.

B. Noise Removal

Many filters were used to remove the noise from the images. Linear filters can too serve the idea like Gaussian, averaging filters. For example average filters be thereto be used to eliminate noise out of the image data file. Since in such filter pixel's significance is substituted with its neighborhood standards. Median filter was also used to remove the noise like salt and pepper and weighted average filter is the difference of this filter and can be implement easily and give good results. In the median filter value of pixel is determined by the median of the neighboring pixels. This filter is less responsive than the outliers.

C. Image Sharpening

Sharpening of the image can be achieved by using special high pass filters. As now noise is been removed by using various low pass filters, need to sharpens the image as we need the sharp edges because this was help to detect the boundary of the tumor.

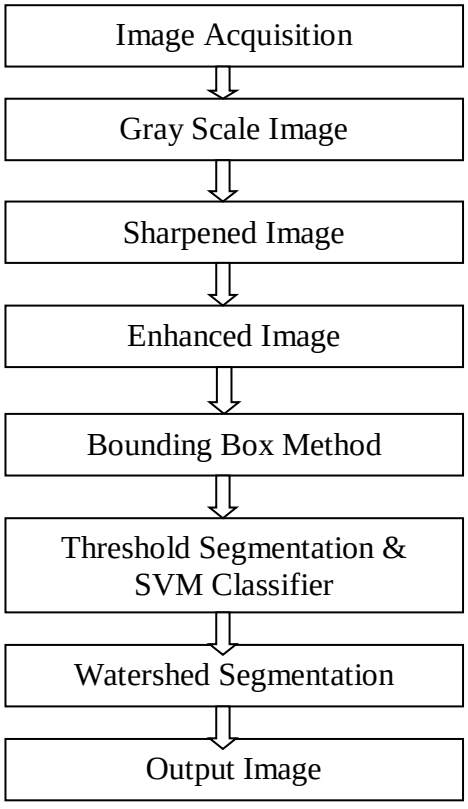

Figure 1: Stages of operation to detect the tumor

D. Processing

Image segmentation is based on the division of the image into regions. Division is done on the basis of similar attributes. Similarities are separated out into groups. Elementary purpose of segmentation is extraction or the removal of vital features from the image, out of which statistics can easily be observed. Brain tumor segmentation from MRI images is an interesting but challenging task in the field of medical imaging.

E. Post-Processing

Threshold segmentation is one among the only segmentation strategies. The input grey scale image is born-again into a binary format. The strategy relies on a threshold worth which can convert grey scale image into a binary image format. The most logic is that the choice of a threshold price Some common strategies used beneath this segmentation embody most entropy methodology and k- means that clump methodology for segmentation. [10]

Watershed Segmentation: It is one in all the most effective ways to cluster pixels of a picture on the idea of their intensities. Pixels falling below similar intensities square measure sorted along. It's an honest segmentation technique for dividing a picture to separate a neoplasm from the image Watershed may be a mathematical morphological operative tool. Watershed is generally used for checking output instead of victimization as an input segmentation technique as a result of it always suffers from over segmentation and below segmentation.

For using watershed segmentation different methods are used. Two basic principle methods are given below:

- The calculated local minima of the image gradient are selected as a indicator. In such technique an in excess of segmentation happens. Afterward selecting marker area integration is completed as additional stage;
- Watershed transformation by means of indicators exploits the precisely distinct indicator locations. These locations are whichever defined explicitly by a user or they can be determined spontaneously by means of morphological tools.

IV. RESULT ANALYSIS

Firstly, Gaussian filter is applied on an input grey scale image to remove several types of noises such as Gaussian noise, Salt-and-pepper noise, shot noise, Quantization noise etc. The output thus obtained is a filtered image. This becomes the input to Threshold segmentation which converts this filtered image into binary format based on a threshold value which is usually taken as a histogram. After this, Watershed segmentation is performed which groups pixels on an image on the basis of their intensities. The output image is white in color. Fast bounding box algorithm is thus applied to extract the boundary of affected area. Fast bounding box algorithm detects the dimensions of the tumor in the form of square shape which is in motion. The exact shape and size of the tumor is obtained by using Support vector machine. Figure 2 shows the GUI of the proposed work. The comparison of the existing work with proposed work for validation is shown in Table I and II. In this validation segmented area of existing work is compared with proposed work and comparative graph is shown in figure 3 and 4.

Table I. Comparison table of Segmented Area of techniques

Image No.	Existing Techniques (in mm^2)	Proposed Techniques (in mm^2)
1	88.2520	97.6250
2	95.5889	100.6250
3	488.6550	578.8750
4	467.5690	564.1250

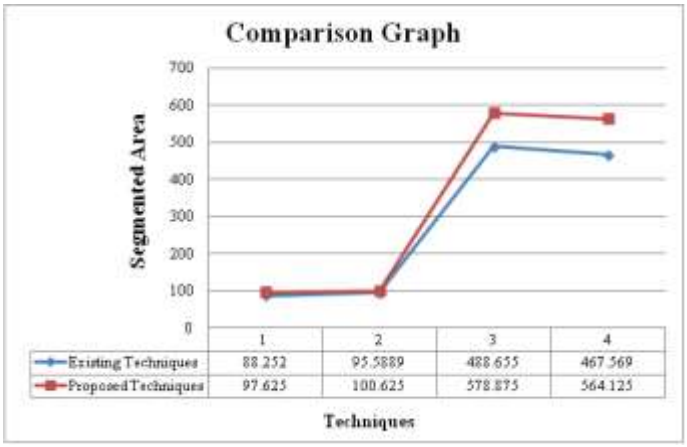

Figure 3: Comparison Graph for Segmented Area

Table II. Comparison table of Execution Time (Sec.) of techniques

Image No.	Existing Techniques (in sec)	Proposed Techniques (in sec)
1	5.151	4.913
2	5.789	4.852
3	5.025	4.458
4	4.985	4.504

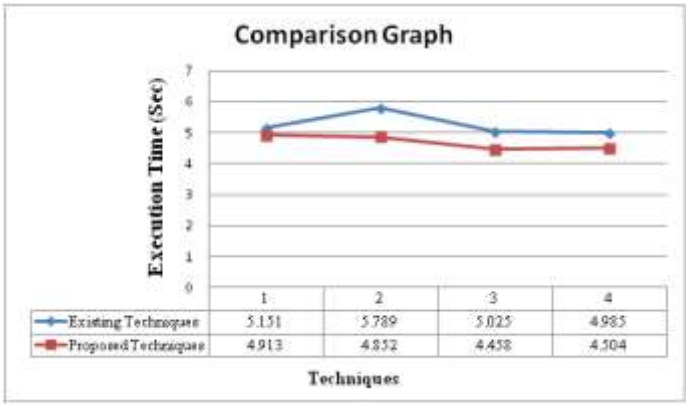

Figure 4: Comparison Graph for Execution Time (Sec)

V. CONCLUSION

In this thesis, the concepts related to image segmentation, basics of MRI, clinical applications of MRI and MRI of brain tumors are described first. In the literature survey, various segmentation techniques used in medical image analysis are discussed. Threshold based techniques, Region based techniques, Edge based techniques, Pixel classification techniques like FCM, KM clustering and ANN are discussed. From the literature survey, it would be desirable to have an unsupervised fully automatic segmentation method to avoid the use of patient specific training. Initially, pre-processing is performed in which MRI image enhancement is performed and noise is removed/ filtered. Further Image segmentation based on the division of the image into regions is performed. Division is done on the basis of similar attributes. Post processing is done using threshold and watershed segmentation. Boundary extraction is a major part of this research. After getting the boundary of the tumor, finally we compute the shape and size of the tumor using support vector machine classifier. In this way the proposed work shows the enhanced result as compared with existing techniques. Using this algorithm one could segment the brain tumors accurately from an MR brain image. This algorithm was also used to classify the tumors into benign and malignant. Finally based on the analysis it has been found that the overall accuracy of classification is above 90%.

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