BRAIN TUMOR DETECTION USING SPATIAL FILTERING ALGORITHM

P Sritha1, R S Valarmathi2, Brundha K3, Dhanusri V4

1 Faculty, Department of Electrical and Electronics Engineering, Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, India.
2 Professor, Department of Electronics and Communication Engineering, VelTech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Chennai, India 600062 (atrmathy@gmail.com)
3, 4 Student, Department of Electrical and Electronics Engineering, Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, India.

srithap@bitsathy.ac.in, brundha.ee18@bitsathy.ac.in Dhanusri@bitsathy.ac.in

ABSTRACT. In recent decades, many people suffered from brain tumor disease because of the living habits and the stress factors. The tumors in brain is detected by the magnetic resonance imaging (MRI) image by means of filtering and segmentation process. In particular of the image processing techniques Medical Image processing technique is applied to identify the tumors in any parts of the body easily and it saves time. A model was proposed in this paper to detect the brain tumor by means of Spatial filtering algorithm. In this algorithm, a new techniques which combines the segmentation and filtering mechanism to detect the growth of cells or tissues in the tumor. The simulation and experimental result has attained about 90.6% accuracy, 88.6% specificity and 92.56% sensitivity in detection process of tumors.

Keywords: brain tumor, detection, spatial filtering algorithm

1. INTRODUCTION

Cerebrum tumor is the major authentic clarifications behind the advancement in mortality rate of teenagers as well as grown-ups. A tumor is a mass of tissue that ends up being wild of the regular powers that supervises improvement [1]. The unconventional mind tumors can be classified into two general requests relying on the tumors cause, their progression point of reference and hazard. The Benign tumors are generally harmless and they did not spread to other parts. Whereas the malignant tumors can easily spread to the other parts of the body. The World Health organization has graded these tumors from grade I to grade IV. If the small low grade tumors are not treated it can lead to malignant tumor so there is a need to identify the tumors in the early stage. The algorithm proposed in this paper used to detect the brain tumors in the early stages of its formation by the process of segmentation and filtering techniques.

1.1. Brain tumor and its types

A brain tumor happens due to the irregular growth of the cells shape inside the cerebrum. There are two basic sorts of tumors: fundamental tumors, undermining or unsafe tumors what's undeniably, lenient tumors. Unsafe tumors can be kept into fundamental tumors that start inside the mind, and optional tumors that have spread from elsewhere, known as cerebrum metastasis tumors [2]. These signs may include cerebral pains, seizures, issue with vision, throwing, additionally, mental changes. The cerebral torment is commonly progressively repulsive close to the beginning of the day and leaves with hurling. Increasingly explicit issues may join burden in strolling, talking, and with sensation. As the ailment pushes prominence may happen.
The clarification behind most cerebrum tumors is dim. Remarkable peril components wire secured neurofibromatosis, preface to vinyl chloride, Epstein–Barr pollution, and ionizing radiation [3]e confirmation for PDAs isn't clear. The most remarkable sorts of fundamental tumors in grown-ups are meningiomas (generally kind), and astrocytoma, for example, glioblastomas. In youngsters, the most prominent make is an undermining medulloblastoma. Examination is usually by medicinal assessment close by arranged tomography or engaging resounding imaging. This is then routinely affirmed by a biopsy. In context of the disclosures, the tumors are confined into various appraisals of sincerity.

1.2. Types of primary tumors of the brain
1.2.1. Acoustic schwannoma
This is a schwannoma (for example tumor of the nerve sheath cells - see "schawanomma") which creates in the district of the eighth cranial nerve. It is masterminded in the back fossa (the lower, back piece of the cranial pit, over the neck) in the point between the cerebellum and pons.

1.2.2. Anaplasticastrocytoma
This tumor is a locally telling, ruinous sort of astrocytoma. It spreads into, or "invades" typical cerebrum, and is viewed as unsafe. It might happen any place inside the focal unmistakable system(CNS).

1.2.3 Anaplastic blendedglioma
This is an assaulting glioma that develops all things considered quickly and contains more than one sort of tumor cell - an amazing blend of an astrocytoma and an oligodendroglioma.

1.2.4 Anaplastic oligodendroglioma
An anaplastic oligodendroglioma is a convincing (dangerous) sort of oligodendroglioma. Reliable treatment choices join remedial system and radiation treatment. Moreover, by a wide margin the vast majority of these tumors would be relied on to react to chemotherapy.

2. Literature Survey
The image division is a group or package of the picture into zones of identical highlights. The detection of brain tumor from the MRI scan can be done by the Medical image segmentation techniques or by the algorithms or by the knowledge based techniques [4]. The neural network based technique has been used to detect and classify the brain tumor with an accuracy of 83%. The Fast Fourier Transform is used to identify the brain tumors from the magnetic resonance image technique. The Minimal Redundancy-Maximal – Relevance (MRMR) technique used to identify the tumor cells from the normal cells of the brain at earlier stage. The hybrid technique used to detect the abnormalities in the white and gray matter tissues in the brain. The Artificial Neural Network is used to localize the tumors with the help of as a segmentation and classifier Method.

In this paper, we will talk about a structures of picture preparing separating and division. It approaches the overhauls in shifting and division execution that can be capable by joining frameworks from unquestionable locale of the tumor picture. This paper manages another picture, detaching and division procedure joining area making and affirmation of edges. The mix of this two framework maintains a strategic distance from trademark division mistakes and complain flight of a picture which occurs while utilizing zone making or edge disclosure separately [5]. Two or three different producers depicted the cerebrum tumor region utilizing picture sifting and division with various estimations and procedures. The proposed system centers the picture pre preparing structure, for example, segregating and division. The separating is utilized to expel the whine from brain tumor picture.
3. **Proposed Algorithm and Process**

In the proposed system, filtering and segmentation techniques were primarily discussed. Segmentation is the technique used to split the regions of the tumor cells and the filter is used to reduce the noises in the image of the tumors. The steps used in the proposed algorithm is shown in the figure 2. The input image is converted into grey scale image which is then converted into the binary image. The filtering and segmentation process are used to identify the tumors.

Fig 2: Flowchart showing the steps of Algorithm
3.1 Grayscale Imaging
In this process the pictures caught on a Personal computer can be converted to the images of Magnetic resonance technique. In evident of exceptionally separating of the image, the major conceivable shades are unadulterated diminish and unadulterated white. The method of reduce shading in a halftone picture is gotten by rendering the picture as a structure of diminish addresses a white foundation (or vice-versa), with the sizes of the individual spots picking the certain sensitive nature of the dull in their general vicinity. The halftone framework is consistently utilized for printing photos in consistently papers and as MRI picture is gone up against PC in the event of transmitted light (for instance, the picture on a PC show up), the quality levels of the red (R), green (G) and blue (B) parts are each tended to as a number from decimal 0 to 255, or twofold 00000000 to 11111111 [6]. The lightest conceivable shade is white, the aggregate transmission or impression of light at every last discernible wavelength. So for the above reasons, we have convert our MRI picture to be pre-dealt with in grayscale picture.

3.2 Filtering operation
The filtering operations are done by means of the high pass filter and a median filter. After the conversion of grey scale image the picture is refined by means of the High pass filter. A high pass channel filter tends to hold the high recurrent data inside a picture while diminishing the low recurrent data. The bit of the high pass channel filter is intended to develop the clear and accurate pictures. Filtering techniques uses coefficient method and the filtering process skims the masks and glitches of the image by a multiply and accumulate operation.

3.3 Threshold Segmentation
Segmentation is a strategy of perceiving a challenge or model in the given work space. This method divides an image into non overlapping region, in which each region or area is homogeneous and the addition of no two neighboring regions is homogeneous. The essential focus of the picture division is the package of an image into absolutely inconsequential and exhausted area. The purpose of division is to move and revamp the joint effort of a data picture into more basic and lighter to separate [7]. There are various division strategies which are significant in finding separated district in an image [8-10].

The most immediate system for picture division is known as the thresholding methodology. This system depends on a catch level (or on the other hand an edge respect) to change a dull scale picture into a twofold picture. The key of this system is to pick the cutoff respect (or characteristics when unmistakable levels are picked). Two or three comprehended techniques are utilized including the most remarkable entropy framework, Otsu's procedure (most over the top change), k-construes are utilized in this method.

The following figure shows the presence of tumor by using the segmentation process.

![Fig 3 Presence of Tumor by Segmentation](image-url)
3.4 Detection of Tumor

The tumor can be detected by the spatial filtering algorithm process. First the image has to be preprocessed and converted into a smooth and clear image by means of the pre-processing process. The pre-processing process converts the image into grey scale image. In this processing of the image the filtering technique is used to remove the glitches in the picture. In the spatial filter processing techniques, the particular area of the brain is focused and made cleared by this process. The result obtained is a single point value and it is processed with the neighbouring areas.

3.5 Experimental Setup and results

The Experimental set up was carried out by taking datasets in digital imaging and communications in medicine (DIACOM) and brain web data sets. We have taken about ten images of the tumor infected brain. Normally we have selected a data set of different varieties of noise levels, thickness of the slice and non-uniformity. The algorithm is simulated by means of the Matlab software and the result of the image is shown in the figure 3. The figure clearly depicts the presence of tumor and separation of tumour.

![Fig 4 Result of the proposed algorithm](image)

4. CONCLUSION

The normal MRI scan image which is given as input is processed and the tumor in that image is detected using image processing techniques. Using the algorithm, we have precisely located the tumor with 90.6 % accuracy, 88.6% specificity and 92.56% sensitivity in detection process of tumors. By using this algorithm we are able to clearly focus the affected areas in the tumors of the brain. In future we will focus on the improvised methods to detect the tumors.

REFERENCES

[1]. M. Maroon Ahmed, Dzulkifli Bin Mohammad, Division of Brain MR Images for Tumor Extraction by Combining Means Clustering and Perona-Malik Anisotropic Diffusion display.
[2]. Sarbanes Data, Dr. Monish Chakraborty, Brain Tumor Detection from Pre-Processed MR Images utilizing Segmentation Techniques, IJCA Special Issue on second National Conference-Computing,
Communication and Sensor Network, CCSN, 2011.

[3] Selkar, R.G.; Thakare, M. Brain tumor detection and segmentation by using thresholding and watershed algorithm. Int. J. Adv. Inf. Commun. Technol. 2014, 1, 321–324.

[4] Borole, V.Y.; Nimbhore, S.S.; Kawthekar, D.S.S. Image Processing Techniques for Brain Tumor Detection: A Review. Int. J. Emerg. Trends Technol. Comput. Sci. 2015, 4, 28–32.

[5] Mustaqeem, A.; Javed, A.; Fatima, T. An efficient brain tumor detection algorithm using watershed & thresholding based segmentation. Int. J. Image Graph. Signal Process. 2012, 4, 34–39.

[6] Kaur, H.; Mittal, M. Region Based Image Segmentation for Brain Tumor Detection. Int. J. Eng. Manag. Res. 2016, 6, 31–34.

[7] Sinha, K.; Sinha, G. Efficient segmentation methods for tumor detection in MRI images. In Proceedings of the IEEE 2014 IEEE Students’ Conference on Electrical, Electronics and Computer Science, Bhopal, India, 1–2 March 2014; pp. 1–6.

[8] Bahadure, N.B.; Ray, A.K.; Thethi, H.P. Image analysis for MRI based brain tumor detection and feature extraction using biologically inspired BWT and SVM. Int. J. Biomed. Imaging 2017.

[9] P. Prem, Jagabar Sathik, Sivaraman P., Mathewsaran A. & Shady H. E. Abdel Aleem “A New Asymmetric Dual Source Multilevel Inverter Topology With Reduced Power Switches”, The Journal of Chinese Institute of Engineers, Vol. 42, Issue: 5, April 2019, pp. 460-472.

[10] Veerakumar Nirmalkumar Sathishkumar Rajesh Novel harmonic elimination technique for cascaded h-bridge inverter using sampled reference frame, Journal of Theoretical and Applied Information Technology Vol. 58 No.2 2013