

Detection of Brain Tumor in Human Brain – A Brief Review / Survey Aspects Considering Modern AI & ML Tools

Anjushree M.R¹ and Dr. Sapna P.J²

¹M.Tech. (PG) Student, IV Sem, Digital Electronics & Communication Engg., DSCE, Bangalore

²Associate Professor & Guide, Dept. of ECE, Dayananda Sagar College of Engg., Bangalore, Karnataka
Email : anjushreemr9@gmail.com

Abstract—This paper gives a brief review of the detection of brain tumor in human brain considering the modern AI & ML tools. In recent years, MRI images have proven to be quite beneficial in the investigation of brain tumor identification. The formation of aberrant cell/s in the human brain, some of which may progress towards the cancer disease, is known as a brain tumor. The MRI, often known as the “Magnetic Type of Resonance Imaging” scans are the viable common type of bio-medical imaging software tools for detecting brain tumours. Information on aberrant tissue growth in the brain is identified using MRI imaging. Machine Learning, Deep Learning algorithms, CNN Algorithms, and RELM Algorithms have all been used to detect brain tumors in various study publications. When these algorithms are applied to MRI pictures, they can predict brain tumours quickly and accurately, as well as classify them into different categories. Assists in the delivery of treatment to patients. These forecasts also assist the radiologist in making an informed decision. Tumor detection employs a variety of supervised and unsupervised classification system/s. The paper serves as a ready reckoner to all the researchers who want to pursue their research in this biomedical image tumor detection in the brain.

Index Terms— AI, ML, DL, CNN, RELM, disease detection and classification are some of the terms used in this paper.

I. INTRODUCTION

In this section, we present the basic introductory concepts to the work that is taken into consideration in this review / survey paper. One of the important organ in the humans is the brain, which is the most complex organ & is fully responsible for the thinking & day today functioning. Every human thought, action, memory, feeling, and experience are produced by it. All of these activities are carried out over a large number of connections and neurons.

The term tumour is a synonym for the term neoplasm, which refers to abnormal cell proliferation. The brain tumor is one of the abnormal disease in the human brain & is a mass of criss-crossed tissues wherein some of the cells will proliferate & then get replicated uncontrollably, thus seemingly un-affected by the normal functioning of the cell's controlling/regulation process. The tumor growth process in the brain. The tumor which grows will occupy a lot of space in the human skull, thus interfering the cerebrum part's normal activity of the brain. As a

result, early diagnosis of the tumour is critical. For the detection of brain tumours, various approaches have been developed.

MRI image/s are most important images in the field of bio-medical imaging & its processing to evaluate various results of the human brain's activity. The brain tumour is defined by the unlimited growing of the tissues and unregulated cell/s, resulting in the failure of the cell's natural patterns, its growth, developments & leading to the cell's death.

There are two phases to a brain tumour, viz., the initial stages & the secondary stages,

- The initial stage
- The second stage

The tumour can be eliminated in the first stage, but the tumour disease spreads in the secondary stage, and as a result, tumours rarely remain infrequently and come again, which is the major concern in the secondary stage of Tumor. The imaging of a brain tumour can be done to test detection approaches.

- Magnetic resonance imaging (MRI) scanning
- Computer tomography (CT) scanning
- Ultrasound, and so on.

There are various methods for diagnosing and detecting a brain tumour, including the CNN Algorithm and RELM, which are used to improve accuracy. The performance of a Convolution Neural Network (CNN) in detecting the existence of a brain tumour is examined. RELM (Regularize Extreme Type of Learning M/C) will be a classification & regression approach that has been employed in a variety of application due to the ability for overcoming few of the drawbacks of the back propagation method.

The work presented in this research survey type of article is presented in the following manner. The section no. 2 will explain the fundamental methodology used to detect brain abnormalities, section 3 Reviews the Relevant tumor Detection and segmentation and analysis using machine learning approach; section 4 concludes the paper.

II. PROPOSED METHODOLOGIES ADOPTED

The Figure 1 gives the fundamental block-diagrammatic representation of the brain's tumour identification and segmentation. For processing, 'MRI' pictures of the human brain's activities are acquired.

Image/Picture Acquisition Process : A patient's MRI scan images will be of coloured, gray-scale, or intensity pics, with a normal image size of (220 x 220) pixels. A gray scaled converted picture is well-defined if it is a colour image, by utilising a huge matrices wherein the entries of the matrices are number values lying b/w 0 & 255, wherein, the value 0 represents black value & the level 255 represents white colour, say, for example. The detection of a brain's tumour in a patient (under consideration) is then divided into two stages: segmentation of the images & detection of the edges in the captured biomedical brain image.

Preprocessing levels : This section comprises of removal of the noises, which could be accomplished utilizing a variety of spatial type of filters, both non-linear and linear types (mean, median image filters). Some morphological techniques remove other artefacts, such as text. At this point, RGB to grey conversion and reshaping take place.

Smoothing or enhancement of images is the process of increasing the resolution of the captured images, but retaining significant details. The idea is to eliminate noise and unnecessary features while minimising distortion to make further analysis easier.

The Fig. No. 1 presented as a data flow diagram gives the fundamental DFD or the block-diagrammatic flow chart of the detection & segmentation of the tumor of the brain in humans and could be used as a proposed method in the work which we are going to implement in our project work.

The procedural aspects of putting 2 or more than 2 more photographs into spatial correspondences is known as image registration (aligning them). Registration of images will allow for the simultaneous utilization of the pictures which are obtained with a no. of multiple modal parametric values (ex., CT, PET & MRI types of Images), at different periods, or using different positions of the humans (patient positions) in the context of medical imaging.

Images Segmentation: The most crucial stage in properly evaluating an image is segmentation, since it impacts the accuracy of the future processes. However, due to the various sizes and colours, as well as diverse skin kinds and textures, accurate segmentation is challenging. Several algorithms have been developed to solve this problem. Thresholding-edge type of region dependent type (either un-supervised or supervised classifying) methods or approaches are some of the most used.

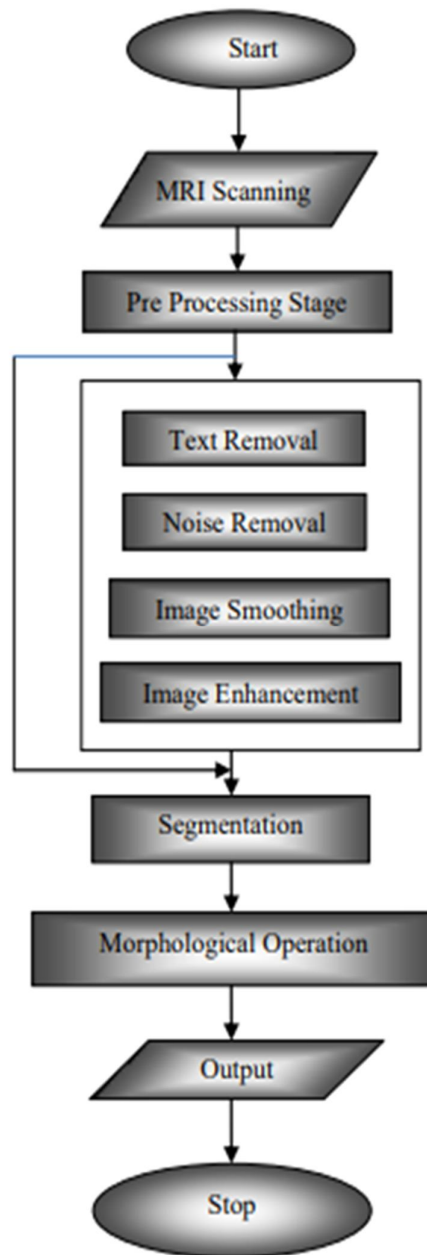


Fig 1. The fundamental DFD or the block-diagrammatic flow chart of the detection & segmentation of the tumor of the brain in humans

Morphological Operations: Morphological processing is used after segmentation to remove undesired parts. It includes processes such as picture opening, image closure, dilation, and erosion. Finally, a conclusion is made as to whether the MRI image contains any tumours and if it is normal or abnormal.

III. EXAMINATION OF THE MANY PAPERS

Machine Learning and other soft computing approaches were employed in many research to detect and classify brain tumours. A.A. Abdulla *et.al.* [1] introduced a Neural Network algorithm, which is a newly discovered technology. Neural networks are a “hot” study subject in fields such as cardiology, radiology, and cancer. Combining neurons into layers allows for artificial neural networks to handle exceedingly complicated problems.

In medical applications, neural networks are utilised for mapping an i/p in to a required output value, with an accuracy of 68.5 percent. In [8], the author presented a brief review of the various image processing tasks.

Watershed is a new technique for detecting brain tumours with very good results and accuracy, as proposed by Maiti and M. Chakraborty et al [2.] Watershed is a new technique for detecting brain tumours with very good results and accuracy, as proposed by Maiti and M. Chakraborty et al [2.] The edge detection procedure is integrated with the watershed method. The RGB image is converted into an 'HSV' color images, which are then divided into 3 areas known as saturation type, hue type & the intensity type. It produces a colour brain MRI image with high precision.

The very uneven borders of tumour tissues can be noticed in an MRI scan. The deformable modes and region basis approaches are used to segment medical images. The fundamental issue with MRI imaging is the tumor's indeterminate location. By employing an edge detection technique, the tumor's location or area may be discovered, and the tumour can then be seen clearly. The tumour can then be removed, and they achieved a 71.2 percent accuracy rate.

Suresh, Preetha et.al. in [3] established a Fuzzy clustering approach for image detection, which is widely utilised in biomedical. In aberrant MR brain picture segmentation, the effective fuzzy clustering approach is applied. Clustering can be used to correctly diagnose cancer in the brain tumour segmentation region. Magnetic resonance pictures are used to help identify brain tumours more accurately. The boundaries of tissues may be clearly recognised with this method, and they attained 71.6 percent accuracy.

Abnormal brain picture segmentation was proposed by D.J Hemanth et al [4]. Because brain tumours could be visualized as the prime dangerous disease in the world today, its identification, detection should be quick & more accurate in detection process. It is possible to achieve this using automated tumour detection techniques on medical imaging, with MRI scans being one of the automated tumour detection techniques. When compared with other types of detection procedures, this one provides an accurate, superb technique of detecting the disease & utilized for removing of the tumour from the brain and it will provide an abnormal MR brain's segmentation of the image with an accurate detection of the region of cancer and identifying it properly (in the sense accurately), with a 75 percent accuracy.

Charutha and Jayashree et.al. in [5] devised an automatic and effective methodology to detection the brain tumours. This proposed strategy is effective in the treatment and elimination of brain tumours.

Image pre-processing by crop methods, reduction of noise & scaled process with histogram equalization, extraction of the features utilizing GLCM & histogram technique & classifying utilizing the process of RF-Random Forest method of classification, etc... were proposed by Praveen and Agrawal et al [6]. Their methodology was tested with a data base of a large data-set comprising of more than 120 no. of patients & it was shown that their work was very accurate upto the tune of 87.62 percent. The Table 1 gives a comparative statistics of the research work by various researchers across the world and is given in the form of a tabular comparisons.

TABLE I. THE COMPARATIVE STATISTICS OF THE WORK DONE BY VARIOUS AUTHORS IN THE FORM OF A TABULAR COMPARISON

Researchers	year	Techniques	Accuracy	Results
A. Abdulla	2012-13	Neural Network	68.5%	Solution of high complicated problems & it utilization for mapping an i/p to a required o/p/
Chakraborty & Maiti	2012	Watershed and Edge Detection Algorithm	71.2%	Result – color brain image using MRI means with satisfactory accuracy results.
R. Preetha & G.R. Suresh	2014-15	Automatic detection of brain tumor using fuzzy c type of algo	71.6%	Tissue boundaries could be identified very clearly.
D.J Hemanth	2016	Abnormal segmenting of the brain images	72.1%	Segmentation of the brain images (MR type) which gives an abnormal status of the parts which are affected (region where cancer cells are accumulated) & giving a satisfactory identification of the human brain part which is affected, i.e., in the final cancerous stage.
S. Charutha and M.J Jayashree	2016	Automatic & efficient method of tumor detection in the brain	79.1%	More efficient methodology in the brain tumor treatment & also highly accurate detection process & removal of the tumor.

IV. CONCLUSIONS / CONCLUSIVE REMARKS OF THE SURVEY

In this research paper, the authors have presented a brief review of the works done by various researchers across the world in the field of tumor detection in the human brain. For detecting brain tumours, MRI pictures are the best option. Different approaches for detecting brain tumours are employed in this study. To extract tumor we

used different techniques such as neural network, watershed edge and detection algorithm, CNN algorithm and RELM. It can be observed that several approaches are used to detect brain tumours from MRI scans, and that in the future, different ways will attain greater accuracy and efficiency.

REFERENCES

- [1] A. Abdullah, *et.al.*, "Implementation of an improved cellular neural network algorithm for brain tumor detection", *2012 International Conference on Biomedical Engineering (Isobel)*, pp. 611- 615, 2012.
- [2] I. Maiti and M. Chakra barty, "A new method for brain tumor segmentation based on watershed and edge detection algorithms in HSV color model", *2012 National Conference on Computing and Communication Systems (NCCCS)*, pp. 1-5, 2012.
- [3] R. Preetha and G.R. Suresh, "Performance Analysis of Fuzzy C Means Algorithm in Automated Detection of Brain Tumor", *2014 World Congress on Computing and Communication Technologies (WCCCT)*, pp. 30-33, 2014.
- [4] Bandana Sharma *et.al.*, "Review Paper on Brain Tumor Detection Using Pattern Recognition Techniques", *International Journal of Recent Research Aspects*, ISSN: 2349-7688, Vol. 3, Issue 2, pp. 151-156, June 2016.
- [5] G. Huang, X. Ding and H. Zhou, "Optimization method based extreme learning machine for classification", *Neurocomputing*, Vol. 74, pp. 1-3, 2010.
- [6] G.B. Huang, H. Zhou, X. Ding, and R. Zhang, "Extreme learning machine for regression and multiclass classification", *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics)* vol. 42, no. 2, pp. 513-529, 2012.
- [7] Pereira S., Pinto A., Alves V., Silva C.A., "Brain tumor segmentation using convolutional neural networks in MRI images", *IEEE Transac. Med Imaging*, vol. 35, pp. 1240-1251, 2016.
- [8] Dr. Sapna P.J., "Efficient visual cryptographic techniques", *Ph.D. Thesis*, VTU, Belagavi, Karnataka, 2020.