International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST229580

Brain Tumor Detection from CT Scan Images Using Watershed Segmentation Algorithm

Himanshu Pandey, Rishabh Jaiswal, Priyanshu Balmiki, Mr. Mukesh Chauhan
Department of Electronics and Communication Engineering Galgotias College of Engineering and Technology Greater Noida, Uttar Pradesh, India

Article Info
Volume 9, Issue 6
Page Number : 141-146

Publication Issue
November-December-2022

Article History
Accepted : 01 Nov 2022
Published : 12 Nov 2022

ABSTRACT

The field of medical imaging gains value by increasing the need for automatic, reliable, fast and effective diagnostics that can provide insight into the image better than the human eye. A brain tumor is the second leading cause of cancer-related deaths in men aged 20 to 39 and the fifth leading cause of cancer among women in the same age group. Diagnosis of a tumor is a very important part of its treatment. Images are obtained by Computed Tomography (CT) and are processed for medical and therapeutic purposes. This paper discusses Watershed algorithm that can inform the user of tumor details using basic image processing techniques. This process helps to determine the size, shape and shape of the tumor. It helps medical staff and the patient understand the seriousness of the tumor. The contour GUI of the tumor and its boundary can provide information to medical personnel by clicking the user selection buttons.

Keywords : Computed Tomography (CT), Digital Image Processing (DIP), Watershed Segmentation

I. INTRODUCTION

Brain Tumor, it is defined as a mass of cells showing extremely abnormal growth in the brain tissues.
There are two main types of tumors such as:

- Malignant(cancerous) tumor.
- Benign (non-cancerous) tumor.

The Malignant Tumor is categorised into two parts:

- Primary tumor
- Secondary tumor

In Primary tumor, as the term suggests that it is the origin of tumor within the brain, thus called as Original or the first tumor in that respective organ. In Secondary tumor, as the term suggests, it follows up the primary tumor and it is the most common tumor which spreads outside the brain. There are also other types other than this like tertiary, quaternary but all tumors have almost the same symptoms that vary, sometimes in wide ranges of the affected organ and the degree upto which it can spread, the anatomy of the organ, presence of blood vessels and a lot more

things. The symptoms can be headaches, seizures, having problems in visions, vomiting and mental changes are basic symptoms. Sometimes it might be the case that the headache becomes worse in the morning and goes away with emesis (also commonly known as vomiting) which is mostly the case. Some other symptoms include difficulty in walking and speaking or having sensations like dizziness, fatigue, lethargy, vertigo, nausea, numbness, irritability, drowsiness, lack of energy, difficulty in remembering things that is forgetfulness and a lot more. Medical imaging is used to create the visual representations of the organs and tissues of the body. Medical imaging such as MRI which is also known as Magnetic Resonance Imaging and CT scan which is also known as Computed Tomography are performed to view different body organs or it allows the medical professionals to recreate the visuals of human body in order to diagnose, monitor and treat severe medical conditions like carcinomas, gliomas etc. In order to predict exactly the presence of abnormal cell growth or increase the chances of predicting the presence of tumors, medical images require further processing. For this reason, watershed algorithm is proposed in this paper.

The proposed system employs CT scanner to detect the tissues inside the organs at various levels of intensity. The scanned image is then pre refined to remove the unwanted impulse noises like salt noise, random noise, Gaussian noise, Poisson's noise etc. Pre-processing involves a series of operations terminating the unwanted distortions and to enhance certain properties of the image. After pre-processing, the image is compartmentalized using watershed algorithm for further processing. Segmentation or Compartmentalization is a technique for dividing the image into multiple segments such that it is trouble free to analyse or process.

II. LITERATURE SURVEY

Nandhini V and Karthick G proposed a method for detecting tumors in the MRI images using clustering algorithms. A cluster or an assembly can be defined as a group of pixels where all the pixels in a particular group are defined by an alike relationship. K-means clustering algorithm for segmentation of the image followed by morphological filtering is used for tumor detection in this paper. Noise in the images, is removed using a filter as a decontamination device. morphological filtering is done to disclose them. This helps in removing unwanted features with respect to morphology. The classifier is based on PNN (Probabilistic Neural Network) algorithm.

Roy et al (2012) computed the tumor containing region for symmetrical investigation. They demonstrated its application with a few informational indexes with various tumor size, force and area. They demonstrated that their algorithm can naturally identify and section the brain tumor. Magnetic Resonance (or in short as MR) pictures gives better outcome contrast with different systems like Computed Tomography (or in short as CT) pictures and X-rays. Picture pre-processing incorporates change of RGB picture into grayscale picture and there after passing that picture to the high pass filter with the end goal to remove the respective noise present in image.

Padmakant Dhage(2015), presented a research, where watershed has been a proactive techniques to detect brain tumors, they specified that why watershed is a good approach to be implemented using MATLAB because it can be used to segment the MRI images quite competently.

Hui Zhang et al (2008), thought about abstract and administered evaluation approach for image division. Subjective assessment and supervised assessment, are impractical in numerous vision applications, so unsupervised strategies are important. Unsupervised assessment authorises the target examination of both

distinctive division techniques and diverse parameterizations of such a solitary method.

Unlike research on brain segmentation of Magnetic Resonance Imaging (MRI) data, research on Computed Tomography (CT) brain segmentation is relatively scarce as said by Alexandra Lauric and Sarah Frisken. Because MRI is better at differentiating soft tissue, it is generally preferred over CT for brain imaging. However, in some circumstances, MRI is contraindicated and alternative scanning methods need to be used. The methods for soft tissue segmentation of CT brain data with an aim of enhancing the utility of CT for brain imaging is contemplated. In this study, the effectiveness of existing algorithms for segmenting brain tissue in CT images are considered. Three methods (Bayesian classification, Fuzzy c-Means and Expectation Maximization) were used to segment brain and cerebrospinal fluid. While these methods surpassed the commonly used threshold-based segmentation, our results show the need for developing new imaging protocols for amending CT imaging to differentiate soft tissue detail and for designing segmentation methods tailored for CT.

Priyanka Shah (2017), reviewed and compared multiple clustering and segmentation techniques and suggested why watershed segmentation is a better and an accurate algorithm and they have shown how and why which algorithm is inadequate and behind in certain aspects of significance.

III. PROPOSED METHODOLOGY

Brain tumor detection's program code will be written and modelled in MATLAB image processing tool with the help of already present algorithms. At the start, the scanned CT images are pre- processed. Then watershed algorithm is taken up to segment the scanned image to make the processing more efficient and less time consuming, requiring low energy expenditure as well.

DATASET

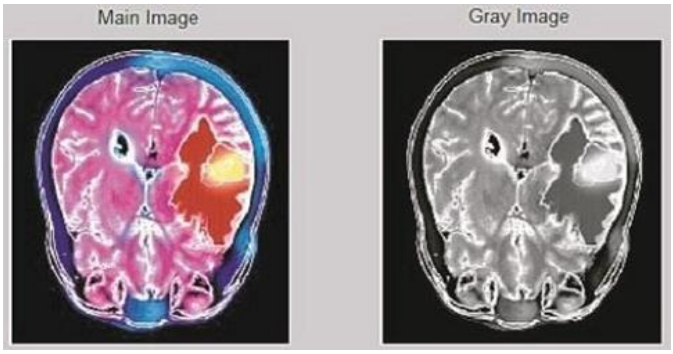
The datasets consist of 100 CT scan images of human brain of which 50 images contain tumor and rest without tumor. This data is obtained from Kraggle.com.

PRE-PROCESSING

Pre-processing is aimed to improve the image quality by removing the unneeded portions of the scanned image as well as the noise.

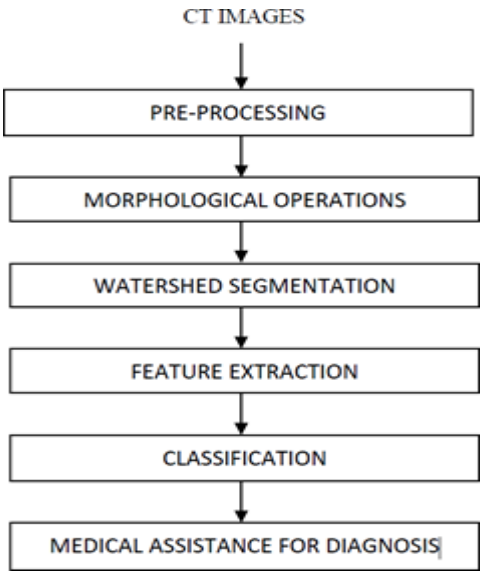
(a). Greyscale Conversion

The CT scan image is converted to grayscale to make it have a contrast in a way that is easier to provide the exact required information. This transformation is made to remove the tones and the colours, there after highlighting any tumors or abnormalities present in the respective organ which is scanned or kept under examination.



(b). Resizing

In image processing resizing is done to gratify the properties of display, storage and other such constraints. The resolution of display devices might have maximum size and the scanned images might all be of various range of sizes. So, to make it as a fixed or constant, we resize the image with specifications. The grayscale images are resized as 256x256 pixels.



Flow Chart

(c). Edge Detection and Sharpening

It constitutes of the detection of edges to determine the boundary or to authenticate the presence of tumor. The edges have to be contrast on the gray scale in order to make the image perception easy for both morphological operations and image segmentation. Edges are the boundaries of object surfaces. Sharpening refers to highlighting the edges such that if tumor is detected, its edges are clear.

MORPHOLOGICAL OPERATIONS

Morphological operations are aimed to remove deformities or flaws. The binarized images are further processed by this technique. The Closing reconstruction is a dual operation which performs Dilation followed by erosion; dilation is a process of dilating the pixels so as the small holes on the respective object and the foreground are filled. This process is important before performing the segmentation.

WATERSHED SEGMENTATION

A grey-level image may be observed as a topographic relief in which the grey level of a particular pixel is decoded as its altitude in the relief. A drop of water dripping on a topographic relief rush along a path to reach a local minimum at last. Inherently, the watershed of a relief looks after the limits of the adjacent catchment bowls or containers of the drops of water. In image processing, different watershed lines may be computed. In graphs, few may be defined on points called nodes, on the edges, or some lines often referred to hybrid lines on both nodes and edges. The watershed segmentation uses the pixel map to originate a gradient map and then the technique is used for image segmentation and object separation. Representing a 2D visual in the form of 3D with the support of valleys and hills in the area of the working. This technique can be used efficiently with the suggested method in the paper, as the unique feature can be used to get extra detail about the tumor.

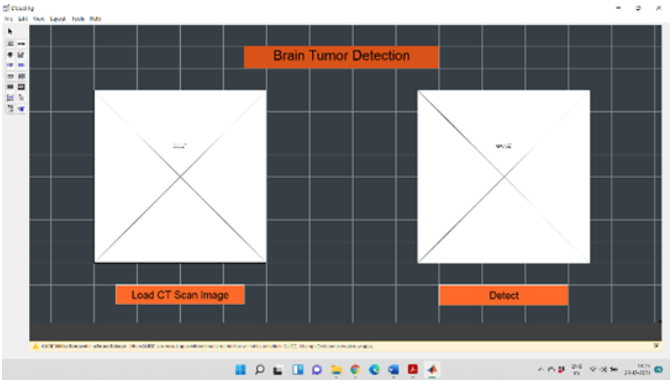
IV. SIMULATION AND RESULT

This paper emphasises upon the detection and observation of a tumour in the brain from CT images. By advancing the proposed architecture, the demarcation of the tumor in the CT image is obtained.

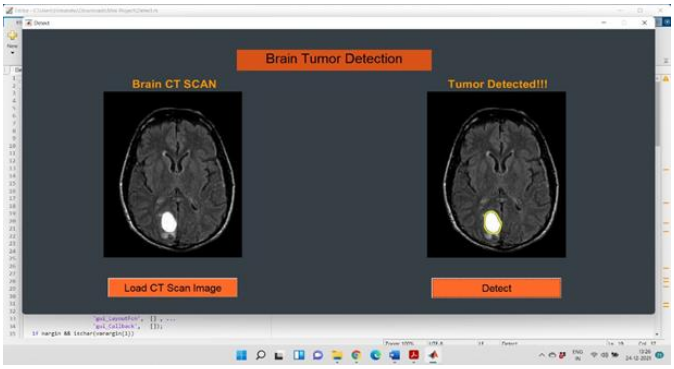
In old times without the help of medical imaging tumors were recognised manually and boundaries were marked around it by an expert which always had issues related to manual error. Thus, to get rid of this error, the next step includes producing a clear boundary of the tumor in the CT scan image if any tumor is identified.

GUI INTERFACE

The prototyping of the GUI is done in MATLAB. Here, the authority can select the “Load CT Scan Image” and the program will usher him to the folder where the CT scan images are stored.



GUI Prototyping



Detected Tumor

V. RESULTS AND DISCUSSION

We have tested the proposed system for a number of CT scan images. The system successfully identifies the tumour and produces a contrast border for its identification.

VI. CONCLUSION AND FUTUREWORK

Previous researches shows that brain tumors can be detected at an earlier stage using various medical image processing techniques. The medical image processing techniques which they used to examine the position of tumor in the brain and other organs as well. For image segmentation watershed segmentation method is used successfully. Automated systems have achieved a huge level of attention in medical imaging for analysis and classification. Recognition of tumors is one such research area where it is diagnosed and the types of such tumors can be detected. The system has been successfully trained with Brain CT images plus segmentation part is performed in order to find the Region of Interest, that is the region containing the tumor. The boundaries of regions are found to be continuous, subsequently there was a problem of over- segmentation. Once there is a presence of tumor, it can be classified for the types making it a multi-classification problem. As an extension to this segmentation the next phase includes the respective classification. If the tumors are detected their features are extracted to find its type.

VII. REFERENCES

[1]. Zhang, Y., L. Wu, and S. Wang, "Magnetic resonance brain image classification by an improved artificial bee colony algorithm," Progress in Electromagnetics Research, Evelin Sujji, Y.V.S. Lakshmi, G. Wiselin Jiji, "MRI Brain Image Segmentation based on Thresholding": International Journal of Advanced Computer Research (ISSN (print): 2249-7277 ISSN (online): 2277-7970) Volume-3 Number-1 Issue-8 March2013

[2]. K.Selvanayaki, Dr.P.Kalugasalam Intelligent Brain Tumor Tissue Segmentation From Magnetic Resonance Image (Mri) Using Meta Heuristic Algorithms Journal Of Global Research In Computer Science Volume 4, No. 2, February 2013

[3]. S.Roy And S.K.Bandoyopadhyay, "Detection And Qualification Of Brain Tumor From Mri Of Brain And Symmetric Analysis", International Journal Of Information And Communication Technology Research, Volume 2 No.6, June 2012.

[4]. Igor Bisio, Alessandro Fedeli, Fabio Lavagetto, Matteo Pastorino, Andrea Randazzo, Andrea Sciarrone, Emanuele Tavanti (2017) "Mobile Smart Helmet for Brain Stroke Early Detection through Neural Network based Signals Analysis" in IEEE Global Communications Conference.

[5]. Mohammed Sabbih Hamoud AlTamimi Ghazali Sulong, "Tumor Brain Detection Through MRI Images: A Review of Literature", Journal of Theoretical and Applied Information Technology 20th April 2014.

[6]. Rupali Mahajan, Dr. P. M. Mahajan (2016) "Survey on Diagnosis of Brain Haemorrhage by Using Artificial Neural Network" in DETECTED TUMOR "International Journal of Engineering Research Online" Vol 4 Issue 4.

[7]. C.S.Ee, K.S.Sim, V.Teh, F.F.Ting "Estimation of Window Width Setting for CT Scan Brain Images Using Mean of Greyscale Level to Standard Deviation Ratio".

[8]. Chiun-Li Chin, Bing-Jhang Lin, Guei-Ru Wu, Tzu- Chieh Weng, Cheng-Shiun Yang, Rui-Cih Su, Yu- Jen Pan (2017) "An Automated Early Ischemic Stroke Detection System using CNN Deep Learning Algorithm" in Icast2017.

[9]. Yanran Wang, Aggelos K Katsaggelos, Xue Wang, Todd B Parrish (2016) "A Deep Symmetry Convent for Stroke Lesion Segmentation" in IEEE International Conference on Image Processing 2016.

[10]. S.Roy And S.K.Bandoyopadhyay, "Detection And Qualification Of Brain Tumor From Mri Of Brain And Symmetric Analysis", International Journal Of Information And Communication Technology Research, Volume 2 No.6, June 2012.

[11]. Igor Bisio, Alessandro Fedeli, Fabio Lavagetto, Matteo Pastorino, Andrea Randazzo, Andrea Sciarrone, Emanuele Tavanti (2017) "Mobile Smart Helmet for Brain Stroke Early Detection through Neural Network based Signals Analysis" in IEEE Global Communications Conference.

[12]. Mohammed Sabbih Hamoud AlTamimi Ghazali Sulong, "Tumor Brain Detection Through MRI Images: A Review of Literature", Journal of Theoretical and Applied Information Technology 20th April 2014.

[13]. Rupali Mahajan, Dr. P. M. Mahajan (2016) "Survey on Diagnosis of Brain Haemorrhage by Using Artificial Neural Network" in DETECTED TUMOR "International Journal of Engineering Research Online" Vol 4 Issue 4.

[14]. C.S.Ee, K.S.Sim, V.Teh, F.F.Ting "Estimation of Window Width Setting for CT Scan Brain Images Using Mean of Greyscale Level to Standard Deviation Ratio".

[15]. Chiun-Li Chin, Bing-Jhang Lin, Guei-Ru Wu, Tzu- Chieh Weng, Cheng-Shiun Yang, Rui-Cih Su, Yu- Jen Pan (2017) "An Automated Early Ischemic Stroke Detection System using CNN Deep Learning Algorithm" in Icast2017.

[16]. Yanran Wang, Aggelos K Katsaggelos, Xue Wang, Todd B Parrish (2016) "A Deep Symmetry Convent for Stroke Lesion Segmentation" in IEEE International Conference on Image Processing 2016.

[17]. Vishal R.Shelke, Rajesh A.Rajwade, Dr. Mayur Kulkarni (2013) "Intelligent Acute Brain Hemorrhage Diagnosis System" in "Proc. of Int. Conf. on Advances in Computer Science, AETACS" Elsevier page 522 – 528.

Cite this article as :

Himanshu Pandey, Rishabh Jaiswal, Priyanshu Balmiki, Mukesh Chauhan, "Brain Tumor Detection From CT Scan Images Using Watershed Segmentation Algorithm", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 6, pp. 141-146, November-December 2022. Available at doi : https://doi.org/10.32628/IJSRST229580
Journal URL : https://ijsrst.com/IJSRST229580