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BRAIN TUMOR DETECTION FROM MRI IMAGES USING ANISOTROPIC DIFFUSION FILTER AND SEGMENTATION IMAGE PROCESSING

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Abstract:

The human brain is the major controller of the humanoid system. The abnormal growth and division of cells in the brain lead to a brain tumor, and the further growth of brain tumors leads to brain cancer. Brain Tumor cannot be confidently detected without MRI. Magnetic Resonance Imaging (MRI) is a technique which is applied to display the detailed image of the attacked brain location. In this paper, tumor image processing having mainly three stages namely preprocessing, segmentation and morphological operation. In these days to extract the abnormal tissues from the normal tissues image segmentation is used. MRI brain image is given as input in the introduced method, Anisotropicdiffusion filtering for noise removal, By using watershed segmentation with the help of gray scale image on MRI images followed by thresholding and morphological operations the tumor is detected. The affected part of the brain, tumor from MRI image is identified with the help of MATLAB 2022a.

Key words:BRAIN TUMOR, MRI, WATERSHED, THRESHOLD, MORPHOLOGICAL OPERATOR, MATLAB.

1. Introduction

MRI is considered now as an important tool for surgeons. It delivers high quality images of the inside of the human body. One should be careful when dealing with sensitive organs like the brain. A brain tumor is any intracranial mass created by abnormal and uncontrolled cell division. Tumors can destroy brain cells or damage them indirectly by causing inflammation, compressing other parts of the brain, inducing exerting internal pressure as they grow. Tumor is defined as the abnormal growth of the tissues. BrainTumors are generally classified into two types benign and malignant tumors. MRI helps in tumor analysis, diagnosis and treatment planning. The detections of Brain tumor using MRI images is a challenging task because of the complex structure of the brain.MRI images provide better result than CT scan, Ultrasound and X-Ray because it is an advanced medical imaging technique and it uses powerful magnets to produce high resonance images of all parts of the body.MRI images are processed and detect the Brain tumor using image processing technique by automation detection process using various algorithms because the manual detection may give human error.To elite the brims which are affected in any part of human body, segmentation is widely used for better diagnosis. Doctors can identify the tumor with the help of image segmentation which helps in detection of tumor. To improve the quality of the image, extract information from image which is acquired, for this Image processing technique is widely used. In human beings,the dangerous disease which is commonly found is Brain tumor. So to find out the tumor at early stage is the goal of this, which reduces the death of patient.

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2. Literature Review

There are different research works that were carried out in past and contributed to this field of brain tumor detection. So many approaches are developed for the detection of brain tumor which were played important role to carry out this work.

[1] Pooja Dang and JyotikaPruthi "Detection of Brain Tumor from MRI Images Using MATLAB"International Journal of Computer Science and Mobile Computing, Vol.5 Issue.2, February- 2016.In this paper They have presented some noise removal functions, and three types of segmentation and morphological operations.

[2] Deepika G.L "Brain tumor Segmentation of Noisy MRI Images using Anisotropic Diffusion Filter" International Journal of Computer Science and Mobile Computing (IJCSMC) Vol.3,Issue.7, July 2014, pg.744-750.In this paper, Segmentation of noisy MRI images using anisotropic diffusion filter for brain tumor is presented. In this method, Gaussian noise is added to the gray image and to denoise the image three filters are added.

[3] Survey on Brain Tumor Detection Techniques Using Magnetic Resonance. Images The brain tumor is an abnormal growth of cells inside the skull which causes damage to the other cells necessary for functioning human brain. Brain tumor detection is a challenging task due to the complex structure of the human brain. MRI images generated from MRI scanners using strong magnetic fields and radio waves to form images of the body which helps for medical diagnosis. This paper gives an overview of the various techniques used to detect the tumor in the human brain using MRI images.

[4] AnamMustaqeem , Ali Javed, Tehseen Fatima , conducted research to detect brain tumour using medical imaging techniques. The main technique used was segmentation, which is done using a method based on threshold segmentation, watershed segmentation and morphological operators. The proposed segmentation method was experimented with MRI scanned images of human brains, thus locating tumor in the images. Samples of human brains were taken, scanned using MRI process and then were processed through segmentation methods thus giving efficient end results.

3. Proposed Method

The detection and classification of tumor from MRI images undergo various stages include pre-processing of MRI images, post-processing segmentation of suspicious portion, and morphological operators.

Flow Chart:

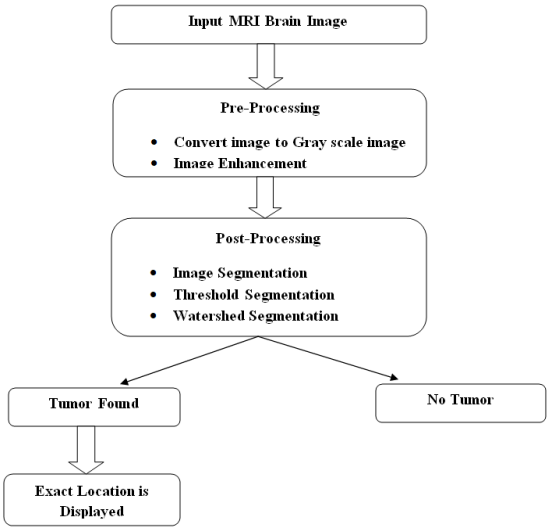

Fig 1: Flow Chart

3.1 Pre-Processing: In this the image is pre-processed by suppressing the unwanted distortions which enhances the image features which will be helpful for further processing. Pre-processing aims to remove the noise from the image and to provide Contrast Enhancement which improves quality of the image the image quality. The functions performed by pre-processing process are:

• Gray scale conversion

• Noise removal

• Contrast Enhancement

3.2 Gray Scale Conversion: A grayscale image only consists of gray scale values, but MRI images consist

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of primary colours (RGB) content. In Gray colour,the red, green and blue components are equal. To specify the single intensity value for each pixels, Apply gray scale intensity in RGB space.

3.3 Filtering: Filtering is technique for modifying or enhancing an image. This step is to remove the noise from the given input image. MRI images include image and some noises. This noises cause some disorders in the image. They should be removed for improvement in the segmentation process without destroying the edges of an image and also to decreasing its clarity. Here, anisotropic diffusion filter (ADF) is applied on the image for removing noise from entire image.

3.4 ANISOTROPIC DIFFUSION FILTER: Anisotropic diffusion, also called Perona– Malik diffusion, is a technique aiming at reducing image noise without removing significant parts of the image content, typically edges, lines or other details that are important for the interpretation of the image. Anisotropic diffusion resembles the process that creates a scale space, where an image generates a parameterized family of successively more and more blurred images based on a diffusion process. Each of the resulting images in this family are given as a convolution between the image and a 2D isotropic Gaussian filter, where the width of the filter increases with the parameter. This diffusion process is a linear and spaceinvariant transformation of the original image. Anisotropic diffusion is a generalization of this diffusion process: it produces a family of parameterized images, but each resulting image is a combination between the original image and a filter that depends on the local content of the original image. As a consequence, anisotropic diffusion is a non-linear and space-variant transformation of the original image. In its original formulation, presented by Perona and Malik in 1987, the space-variant filter is in fact isotropic but depends on the image content such that it approximates an impulse function. close to edges and other structures that should be preserved in the image over the different levels of the resulting scale space. This formulation was referred to as anisotropic diffusion by Perona and Malik even though the locally adapted filter is isotropic, but it has also been referred to as inhomogeneous and nonlinear diffusion or Perona-Malik diffusion by other authors. A more general formulation allows the locally adapted filter to be truly anisotropic close to linear structures such as edges or lines: it has an orientation given by the structure such that it is elongated along the structure and narrow across. Such methods are referred to as shape-adapted smoothing or coherence enhancing diffusion. As a consequence, the resulting images preserve linear structures while at the same time smoothing is made along these structures. Both these cases can be described by a generalization of the usual diffusion equation where the diffusion coefficient, instead of being a constant scalar, is a function of image position and assumes a matrix value.Anisotropic diffusion is normally implemented by means of an approximation of the generalized diffusion equation: each new image in the family is computed by applying this equation to the previous image. Consequently, anisotropic diffusion is an iterative process where a relatively simple set of computation are used to compute each successive image in the family and this process is continued until a sufficient degree of smoothing is obtained.

3.5 Threshold Segmentation: Nowadays threshold segmentation is the flexible and easiest method which is normally used which is based on obtaining the binary image from the gray scale image. Segmentation of abnormal tissue from the normal tissues can be done by using threshold segmentation algorithm. For initial segmentation select a threshold value.

3.6 Watershed Segmentation: In thisimage is considered as a topographic surface, in which the gray level represents the altitudes. In that image region with a constant gray level constitute flat area and region edges represent high watersheds and low rise region represent catchment basis.Watershed lines represent the boundaries of the object in the image.

3.7 Morphological Operators: Morphological Operators like erosion and dilation. After changing the image in binary format, morphological operations like erosion and dilation methods are applied on the image i.e. binary image. The motivation of the morphological operation is to discrete the tumor in the image. Now just the tumor segment ofthe image is visible, which is shown with white color. Tumor region has the highest intensity in that image than the other regions of the image. Always morphological operations are applied after the watershed segmentation. In this paper, erosion which is one of the morphological operation which is applied to detect the tumor.

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4. Algorithm Used for Detection for Tumor

Step 1: Input the image

Step 2: Convert the RGB image to grey

Step 3: Use the filters for removing noise for Contrast enhancement.

Step 4: Apply Watershed Segmentation for tumor detection.

Step 5: Perform morphological operations to find the tumor.

5. Results and Discussions

The detail procedure of obtaining the result step by step is shown here and we tried to accurately detect the tumor from MRI brain images. To fulfill the required intention noise removal using Anisotropic filtering, segmentation using watershed and morphological operations are performed.

Sample 1:

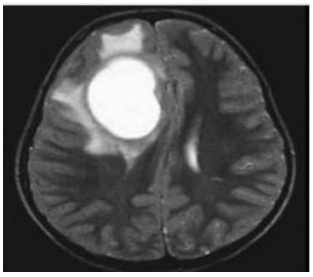


Fig 5.1: Input Image

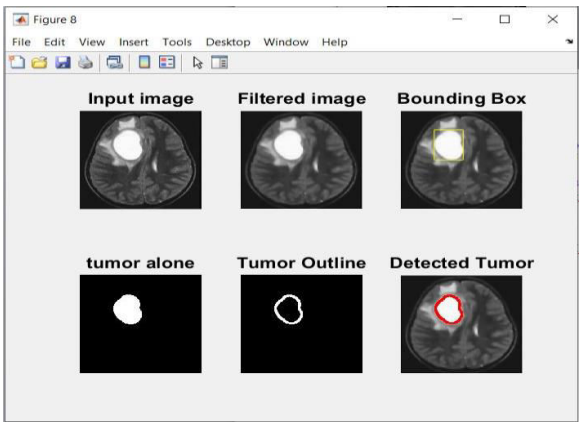


Fig 5.2: Output Image

Sample 2:

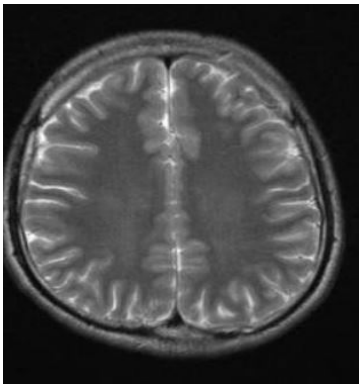
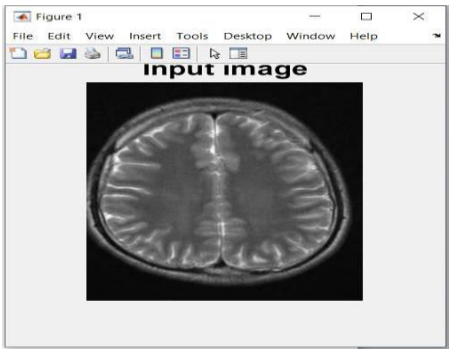


Fig 5.3: Input Image

Outputs of sample 2:



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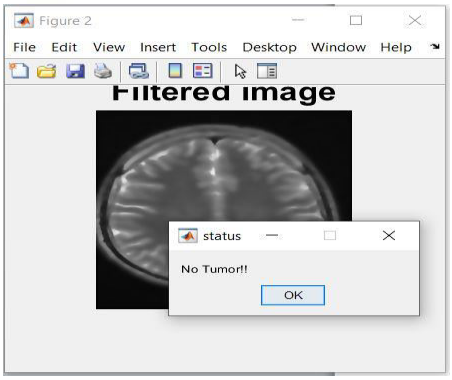

6.Conclusion

Medical Image processing is the most challenging and emerging field now a days . Processing of MRI Images is one of the parts of this field. This project makes MRI Image analysis accessible to more people who need not have to be a specialist on MRI Imaging .MRI Imaging is less harmful than X-rays .It is less attenuated by bones. This project can make MRI Image processing and tumor detection process faster and cheaper. The objective to detect if there is tumor in the given MRI Image scan of Brain using Image processing is completed. If the tumor existed, the application successfully detected and specified the tumor location by highlighting the area.It can be noted that anisotropic diffusion filter outperforms other filtering technique in denoising in medical images. Further, denoising performance can be improved by modifying some parameters of filtering technique.Itcan be extended to color images.

7. References

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