Robust tumor detection in MRI image with edge-enhanced maximally stable extremal regions

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Research Article

Keywords: MRI, Magnetic resonance imaging, brain tumor, detection

Posted Date: March 29th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1467004/v1

Abstract

In the paper, we combine an intelligent algorithm for recognizing letters in an image and analyze its steps for tumor extraction in an MRI image. Successfully identify the border of the tumor, determine the location tumor with a limited circle, and determine whether the tumor is present or absent. Tumors vary in shape, size, and location, and may appear in different places with different intensities, so it is difficult to find the exact brain tumor. There are many algorithms, techniques, and applications for brain tumor segmentation and the overall internal structure of the brain in medical imaging, but in the proposed algorithm method, it can be extracted with high accuracy and sensitivity and extremely stable areas of maximum edge.

Introduction

MRI is a radiographic method in medical and veterinary diagnostic imaging that has become very widespread in recent decades.[1] An MRI scans can be used to study the amount of blood in the brain. Hence MRI technology becomes an important tool diagnose abnormalities, track progress or growth disease and for diagnosis as well. Digital image processing by the tools of a digital computer include a digital image processing domain [2]. The brain is one of the most important organs in the body the human body is responsible for all the actions and reactions of our body. Is a key factor which distinguishes us from other animals. Therefore, brain imaging is important in medicine imaging because it helps doctors examine and understand the inside of the brain is active. Magnetic resonance imaging is one of the brain imaging techniques.[3] The current generation is witnessing a fundamental change in technology with the advent of artificial intelligence intelligence The application of artificial intelligence in various fields shows this extensive participation of this technology in the coming years. One of these programs is on classification of medical images such as classification of brain tumors.[4] Brain tumor segmentation is an important task in medical image processing. Early detection brain tumors play an important role in improving and enhancing treatment facilities survival rate of patients with manual division of brain tumors for cancer diagnosis, from the large number of MRI images produced in the clinical routine, it is difficult and time consuming duty. There is a need for automatic division of the brain tumor image.[5]

Because we used text-to-image algorithms to detect tumors[6], these visual algorithms are generally divided into two categories: tissue-based and component-based (CC).[7], [8], [9]

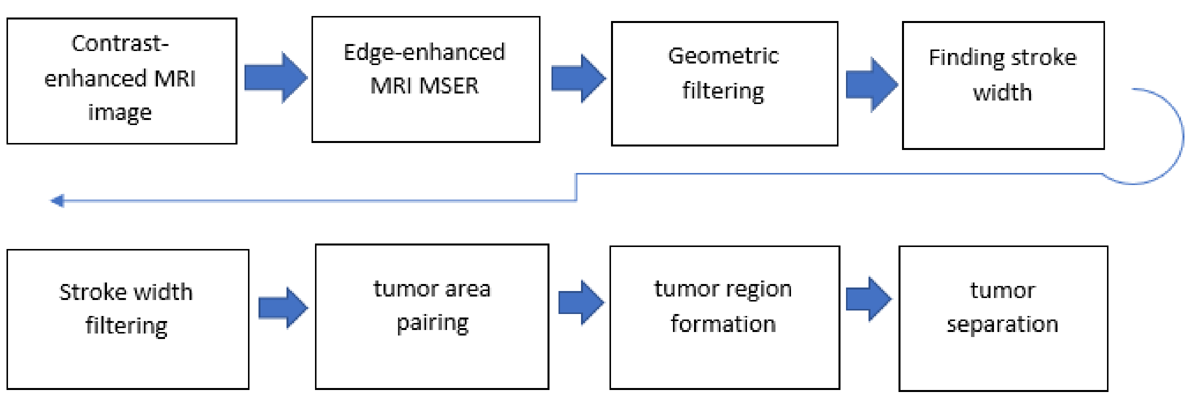
Materials And Methods

1. In the first step, we enter the MRI image data of the brain tumor into MATLAB software to display the pixel size and the image itself. Of course, we can rotate the tumor at this stage, but significant off-screen rotations may require additional preprocessing.

2. Since tumor ranges are usually a solid color, we begin by finding areas with similar intensities in the image using the MSER area detector. Some of these areas contain additional background pixels. Use the Canny Edge Detector to further segment the tumor. Because the tumor is usually located on the background of a clear MRI image of the brain, it tends to respond highly to edge diagnosis. In addition, the intersection of the MSER areas with the edges creates areas that are most likely to belong to the tumor.

3. Note that the main MSER regions in mserMask still contain pixels that are not part of the tumor. We can use the edge mask along with the edge gradient to remove those areas. Using the image gradients around the edge locations, we grow the edges outwards. This mask can now be used to remove pixels that are in MSER areas but may not be part of the tumor. At this stage, the tumor image is mostly isolated from the background and many non-tumor areas from the MRI image.

4. Filter tumor candidates using parser analysis. Some remaining components can now be removed using area features. The thresholds used below may vary for different tumors, image sizes or imaging.
5. Filter tumors candidates using the hit width image. The stroke width image is calculated using the helper Stroke Width function. Note that most non-tumor areas show great variation in stroke width. They can now be filtered using the impact width change factor.
6. Specify boxes to restrict tumor areas to calculate a finite box in a tumor area, we first merge the separate areas into a single connected component. This can be done using morphological closing and then opening to clean each outlet and find the border boxes of large areas.
7. Finally, we apply the algorithms to two MRI images with and without tumors. We will see that the tumor MRI image of the isolated tumor with high accuracy and sensitivity and our algorithm detects the tumor-free image.



First, we follow the algorithm implementation steps and display two MEA images of a tumor-free brain and a tumor brain.

Figure 1. A is an MRI image of a tumor brain and B is an MRI image of a tumor-free brain

In this section, we apply the MSER algorithm to find areas with a similar intensity to MSER.Of course, we can also use several other segmentation algorithms to do this, some of which we will provide next to MSER in the image.

Figure 2. The algorithm is to obtain the same resolution of corners and areas **.**Applying algorithms of different types of zoning on MRI images, the four images above belong to tumor brain images and the bottom images of zoning with different methods on MRI images of tumor-free brain

Figure 3. A) Apply MSER algorithm on tumor brain MRI image. B) Apply MSER algorithm on division of intensity in tumor brain MRI image

Figure 4. Use the Canny Edge Detector to further segment the MRI images of the brain

Figure 5. We use the MSER areas in mserMask that contain pixels that are not part of the tumor with an edge mask with an edge gradient to remove those areas.

Figure 6. In this image, tumor have been further separated from the background and many of the non-tumor regions have been separated from MRI image.

Figure 7. Filter tumor Candidates Using Connected Component Analysis.
In these two images, we see that our algorithm detects the tumor well at this stage and extracts it from the MRI image of the tumor brain and shows it, while the MRI image without the tumor shows a blank, which indicates the absence of a tumor. So far, our algorithm has met our goal of elucidating and detection of brain tumors in MRI image with the help of intelligent algorithms in the form of high quality artificial intelligence.

Figure 8. Stroke width images are calculated using the helper helperStrokeWidth function, where A represents the image of the brain tumor and the blank screen indicates the absence of the tumor in the MRI image.

Figure 9. We visualized the effect of stroke width filtering for the MRI image and for the tumor. A is the tumor MRI image and B is the tumor-free MRI image.

Conclusions

Efficient MRI image division is an important step in brain care and treatment tumors Early detection of tumor cells enables physicians to evaluate the best treatment, thus increasing the patient's chances of recovery. In this article, with the help of MATLAB software and combining a clever suggestion and using the text recognition algorithm in the images, we implemented it on the MRI image of the brain tumor. The intelligent algorithm was able to detect and isolate the tumor from the MRI image of the tumor brain, as well as the tumor-free image, and the result was a blank image that would indicate the absence of a tumor in the patient's brain.

Declarations

ACKNOWLEDGEMENT

The authors would like to thank Dr. Punith Kumar V and Dr. Mohammadreza Jafarfard for their valuable feedback and suggestions. We also sincerely thank Negar Yalan at department Iran University of Science and Technology Chemical Engineering, for insightful discussions.

Competing interests

There is NO Competing Interest.

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Figures

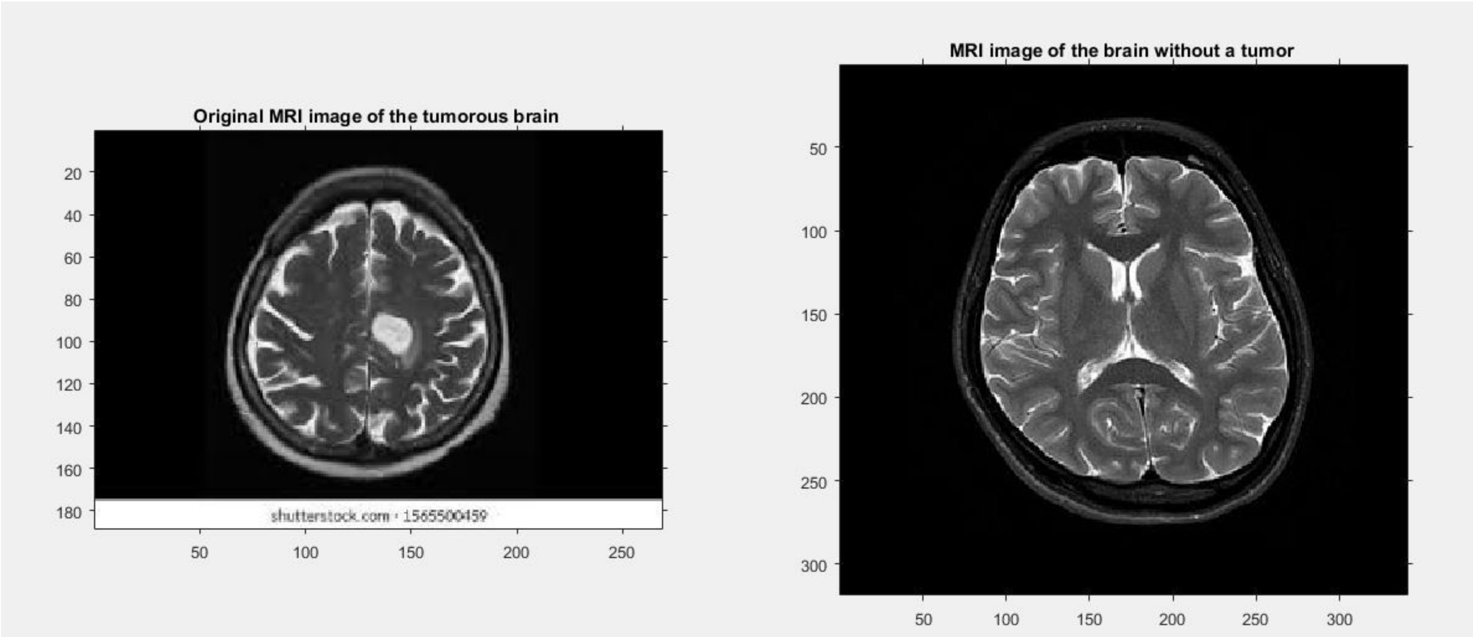

Figure 1

A is an MRI image of a tumor brain and B is an MRI image of a tumor-free brain

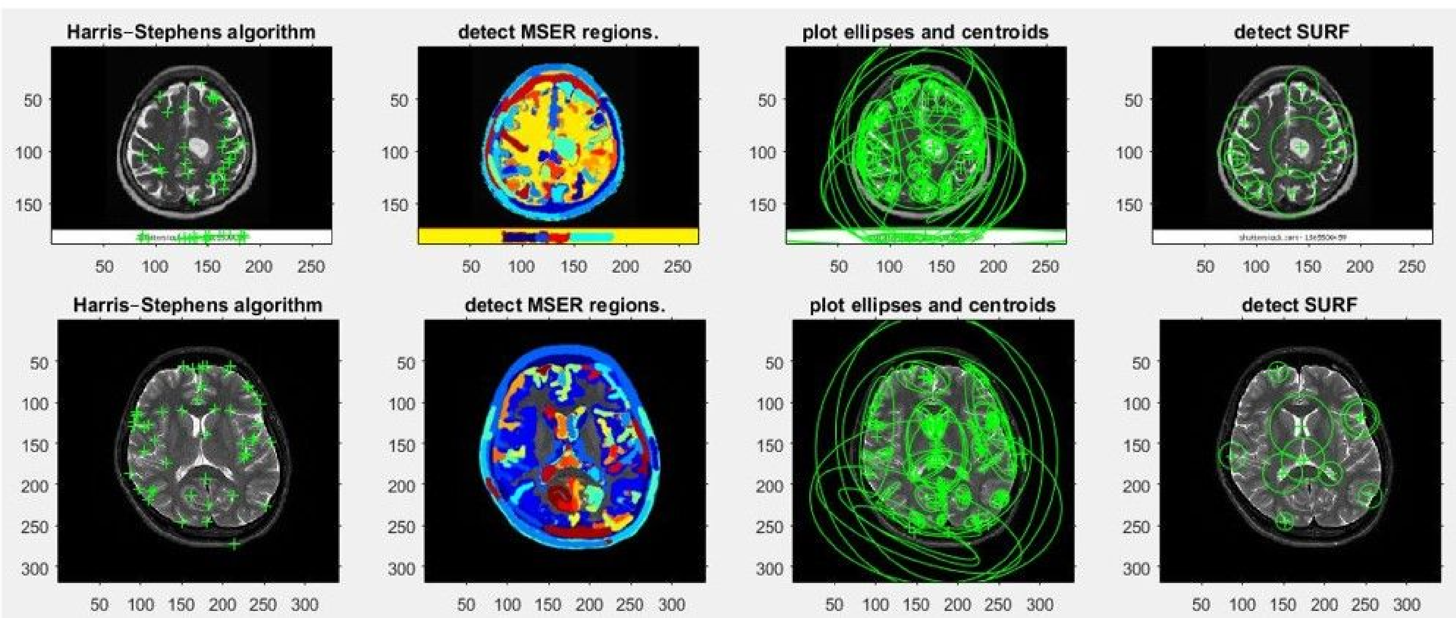

Figure 2

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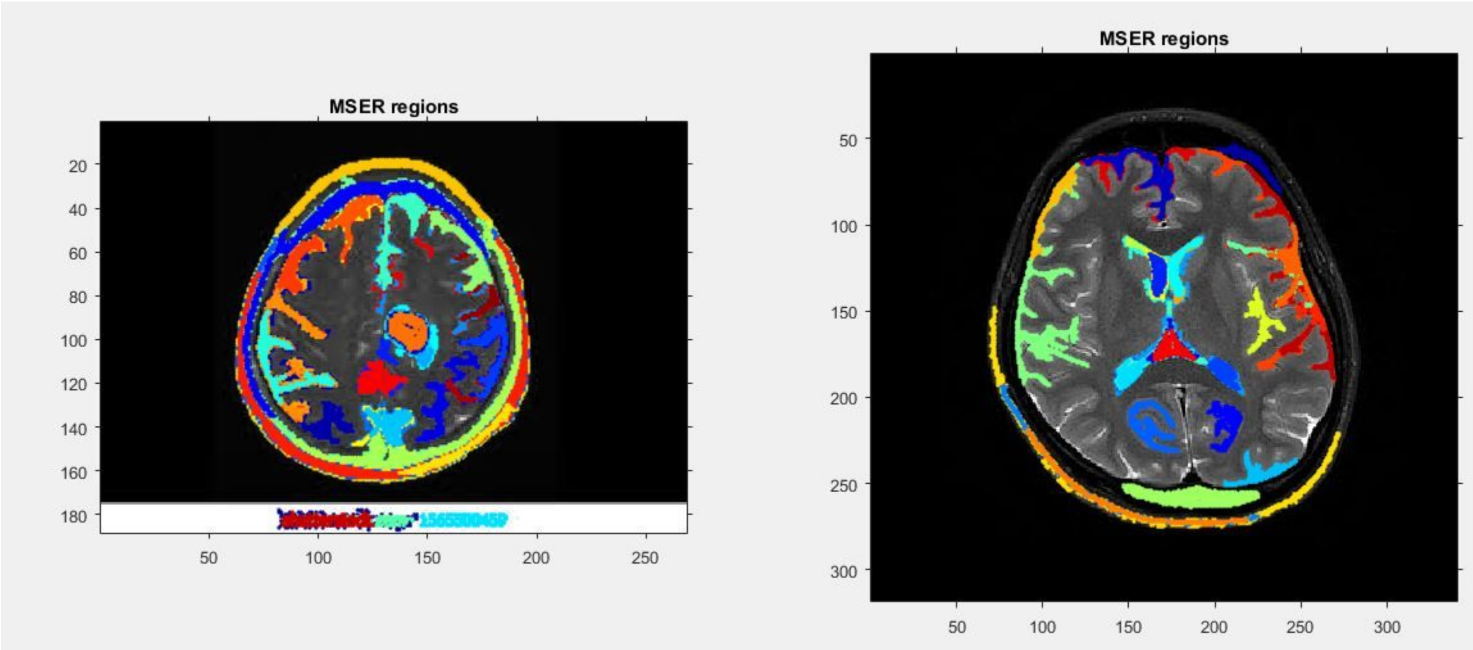

Figure 3

A) Apply MSER algorithm on tumor brain MRI image. B) Apply MSER algorithm on division of intensity in tumor brain MRI image

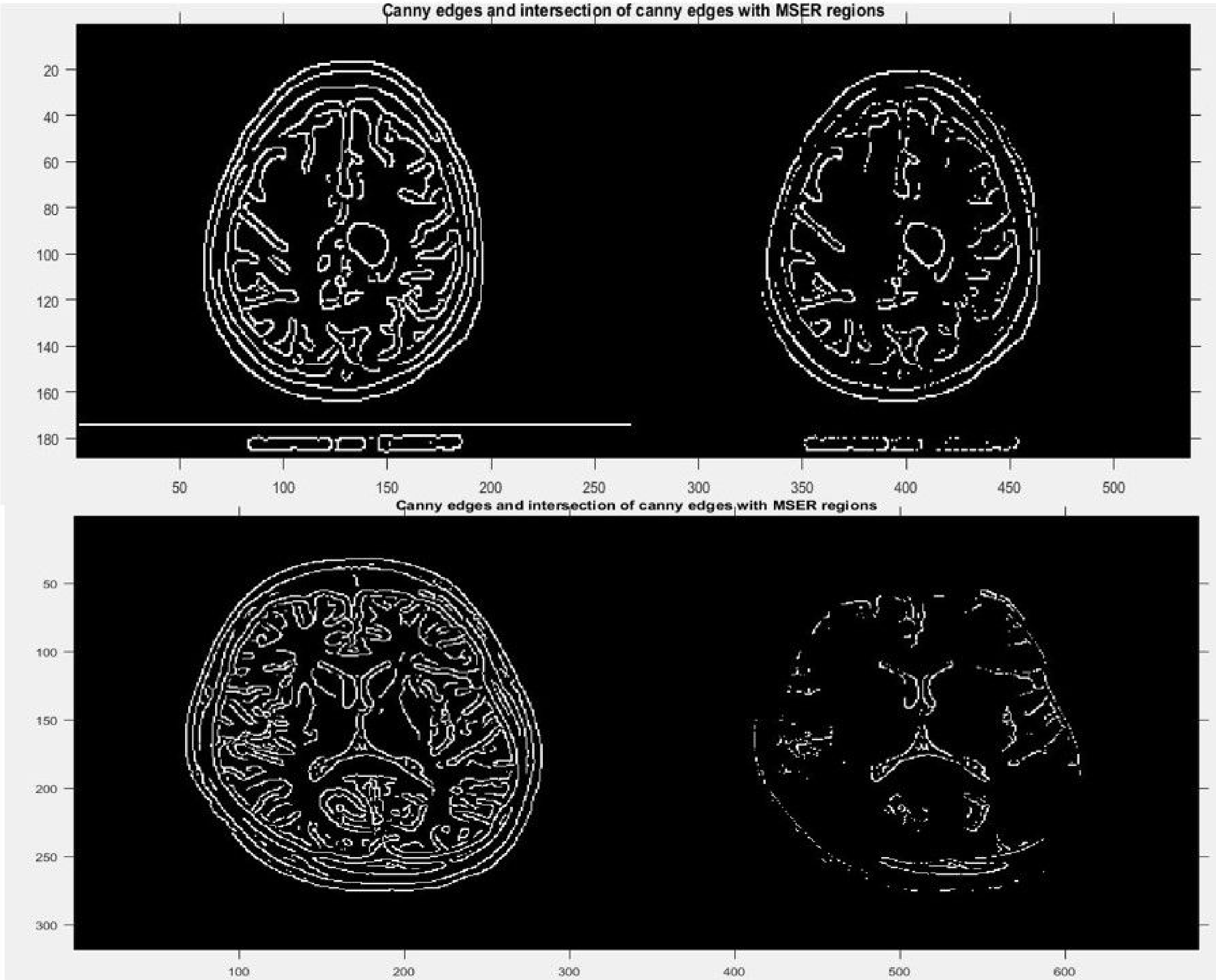

Figure 4

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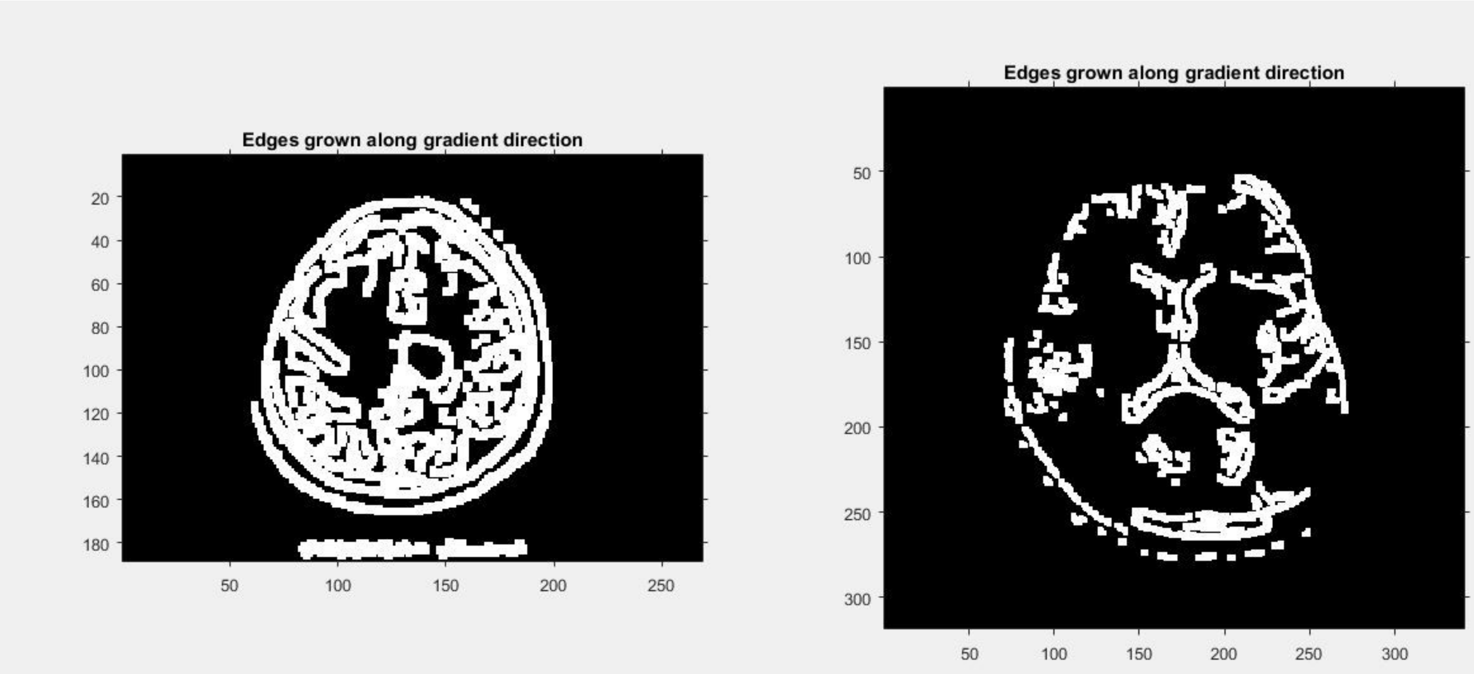

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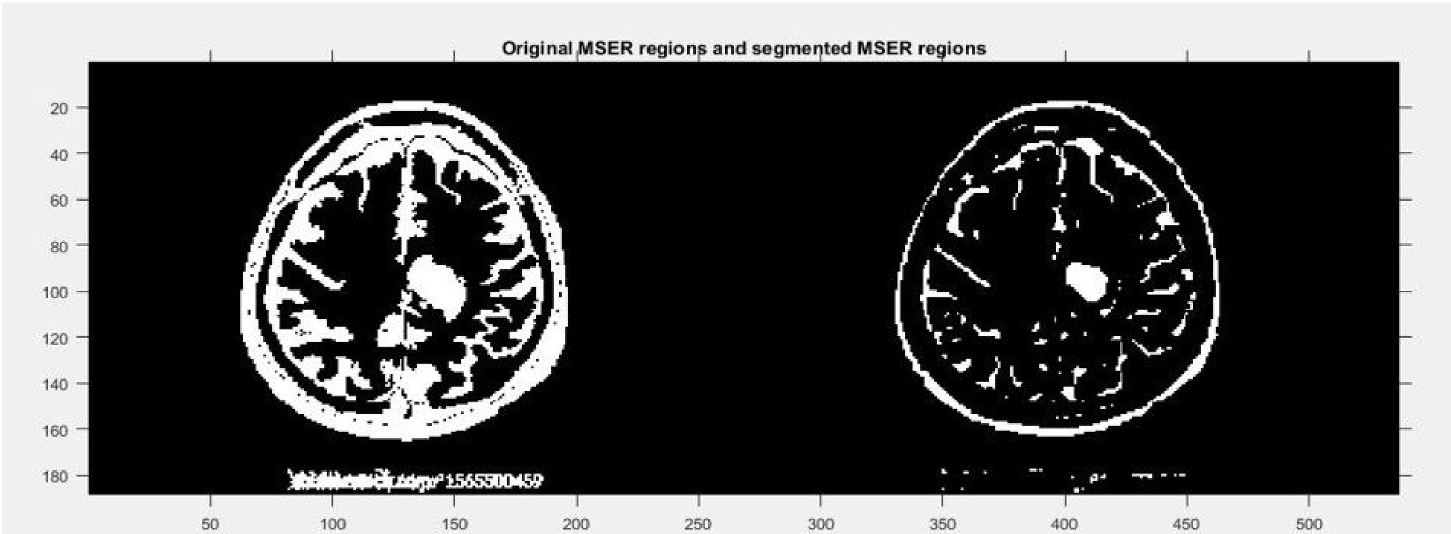

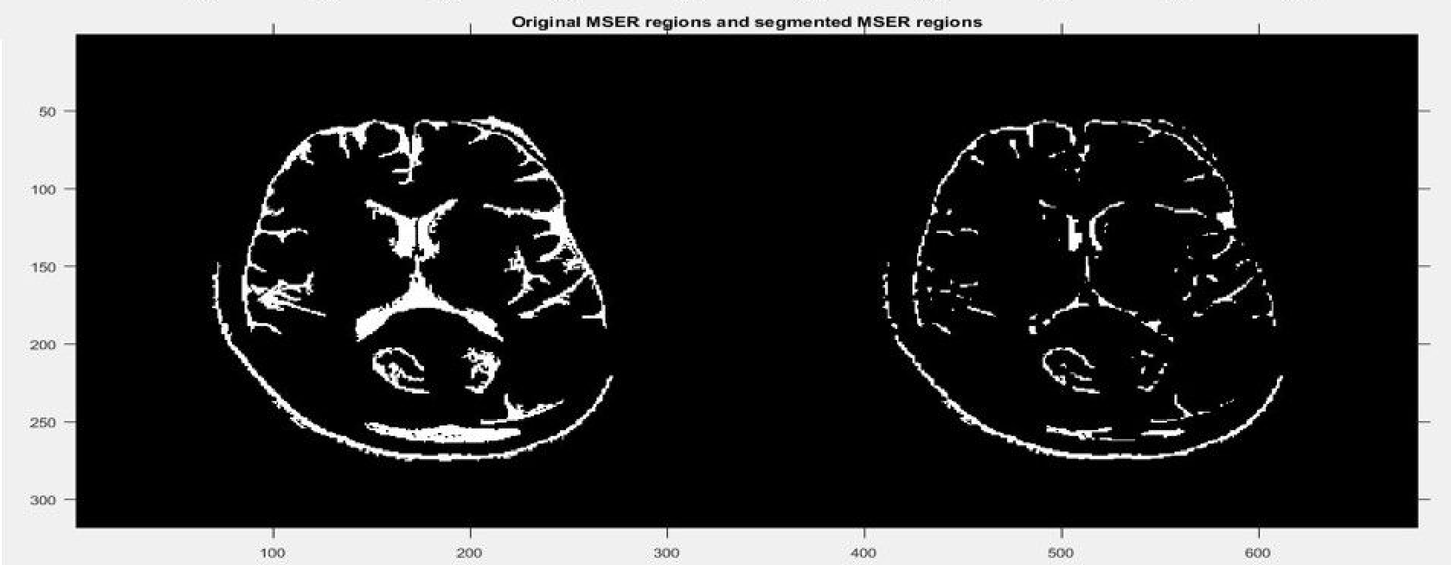

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Filter tumor Candidates Using Connected Component Analysis.

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