

Final Project Proposal

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1 Paper Information

The paper I have decided to base my final project on is Automatic Human Brain Tumor Detection in MRI Image Using Template-Based K Means and Improved Fuzzy C Means Clustering Algorithm. This paper was published by Big Data and Cognitive Computed in 2019. The paper can be found at <https://www.mdpi.com/2504-2289/3/2/27>.

2 Problem Information

The problem I will be investigating using the paper is brain tumor detection. In my life, I have known people who have had brain tumors. Because they were detected early, luckily, they have been able to have their tumors removed and have been cancer free for a few years. The paper mentioned the importance of detecting brain tumors, and that currently it is done manually by a professional, which can be a long process. I am interested in learning how image processing can help resolve that issue and save lives.

After reading the paper, I have concluded that this problem will be challenging. Although in class, I have studied some of the processes mentioned, they are combined in a way I have not used them before. Luckily, the paper provides algorithm and details the steps taken to achieve their results. I believe that even through these difficulties, I will be able to complete this project with a more detailed analysis of the paper and possibly some extra research.

3 Data Information

Although the data is not available for download, I can extract the data mentioned in the paper. The paper provides links to where they extracted data and provides a figure with each image in their 40-image dataset that I can most likely extract the data from. If this method provides a problem, I will use the provided links and extract the data similarly to the paper.

4 The Approach

The main method of the approach mentioned in the paper is as following, Image data acquisition from database, image pre-processing, image enhancement, required features extraction, and improved fuzzy C means clustering based segmentation. The image acquisition includes extracting the images into .jpg files that can be loaded into MATLAB. Next, the image pre-processing will produce an image that converts the image into a gray scale image as a 2-dimensional matrix with reduced noise. To reduce noise, a median filter will be used. Next, Image enhancement will produce an image as a 2-dimensional matrix with improved contrast. To complete this enhancement, adjusted operation, histogram-based operation, and adaptive histogram-based operation will be used. Next features extraction will produce a grayscale image as a 2-dimensional matrix. This will be accomplished by T-means segmentation and an additional median filter. Next the improved fuzzy C means clustering based segmentation algorithm described in the paper will be applied on the images until a tumor is detected producing an image with a marked position where the found tumor was.

5 Assumptions

The only assumption mentioned in the paper is that each brain scan they produce after following the algorithm does include a tumor that is too hard for common people to detect easily.

6 Advantages and Contributions of the Approach

The main advantage mentioned in the paper is that this method is more accurate, insensitive to noise, and is faster than previous automatic tumor detection techniques using thresholding, edge-based segmentation, support vector machine, and the previous fuzzy C-means algorithm.

7 Shortcoming of the Approach and Future Improvement

The shortcomings mentioned in the paper is the complexity of the proposed algorithm. Although it is computationally faster, yields in less errors, and is insensitive to noise, the algorithm is a lot more complex than previous algorithms. The future improvement the authors are planning are including more features which can be used for detection and accuracy increment, reducing the required computational time, modifying the complexity of the algorithm, and more specification and standardization for CT, PET, SPECT, and neuro imaging.

8 Author's Evaluation Method

To evaluate the results of the proposed algorithm, the authors compared their method with Thresholding, Region Growing, K-means, and Fuzzy C-means based on finding true positives, false positives, true negatives, and false negatives, by comparing the sensitivity, specificity, and accuracy, and by comparison of computational time.

9 Plans to Improve

As I am a CS 5680 student and not a CS 6680 student, I have no plans to improve the proposed method.

10 Result Evaluation Method

To evaluate my results, I will show the image with the marked area in a figure with intermittent steps and the paper's results. I will also time the algorithm and compare my computational times to the paper's computational times acknowledging the differences in machines. Finally, I will show the numbers of true positives, true negatives, false positives, and false negatives of my images and compare that to the paper's.

11 Weekly Schedule

Nov. 19th – Nov. 28th: I will reread the paper in more depth, extract the images from the paper, load them into MATLAB, preprocess the images as described in the picture, and push code periodically to GitHub.

Nov. 29th – Dec. 5th: I will create the proposed algorithm as a function in MATLAB, troubleshoot this algorithm, and push code periodically to GitHub.

Dec. 6th – Dec. 12th: I will do any additional troubleshooting, display my results with figures and performance metrics, push results to GitHub with a ReadMe file on how to download and run the program, and write necessary project conclusions and paper if necessary.

12 Additional Information

I will be using MATLAB, Git, GitHub, and MATLAB built-in functions to perform this project.