

GUI FOR SEGMENTATION OF MEDICAL IMAGES

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Abstract

In the paper is presented software for segmentation of medical images and its graphic user interface (GUI). It works in the MATLAB environment and uses IMAGE TOOLBOXES defined functions. Two basic methods for image segmentation such as region-growing and split & merge algorithms are used, regarding to process different medical modalities of the images. The GUI proposes also an interactive option to choose region of interest (ROI) in the processed image and some parameters of the applied methods.

The proposed GUI can be applied to real medical images attempt to make diagnostic more precise. The presented GUI is suitable also to engineering education for studying of this processing.

1. INTRODUCTION

The medical images provide important anatomical information to physicians and specialist upon which can be made diagnoses [1]. Segmentation is a classical problem in image processing; it can be described as the process of partitioning an image into a set of non-overlapping homogeneous regions. The goal of segmentation is to simplify and to change the representation of an image into something that is more easier to analyze. Image segmentation is typically used to locate objects as organs and tumors and their boundaries (lines, curves, etc.) in medical images. This is a process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. Region growing is one of the simplest approaches to image segmentation; neighboring pixels of similar amplitude are grouped together to form a segmented region. However, in practice, constraints, some of which are reasonably complex, must be placed on the growth pattern to achieve acceptable results [2]. Split and merge segmentation techniques are based on a quad tree data representation whereby a square image segment is broken (split) into four quadrants if the original image segment is no uniform in attribute. If four neighboring squares are found to be uniform, they are replaced (merge) by a single square composed

of the four adjacent squares [3]. This approach tends to be computationally intensive.

The software is created in MATLAB 7.12 environment by using IMAGE PROCESSING TOOLBOX.

The graphic user interface consists of checkboxes, buttons, edit boxes, pop-up controls, which make it easy to use. Users enter or choose input data in a single form, because input information changes and visualizations are easier and faster in this way. The processed image can be saved on the disk and so can be used to another processing or its visualization.

2. THE GUI FOR SEGMENTATION OF MEDICAL IMAGES

The GUI for region segmentation of medical images is shown on Fig. 1. It is divided in several areas, where the user applies different settings, concerning image segmentation techniques and theirs parameters and areas for universal application.

The area "Input Image Path" is for entering an image file name with an image file extension. The user can navigate among the folders in the work folder and choose image by using "Browse" button and view the image by using "View Image" button. The segmentation technique can be selected in area "Image segmentation", shown in Fig. 2.

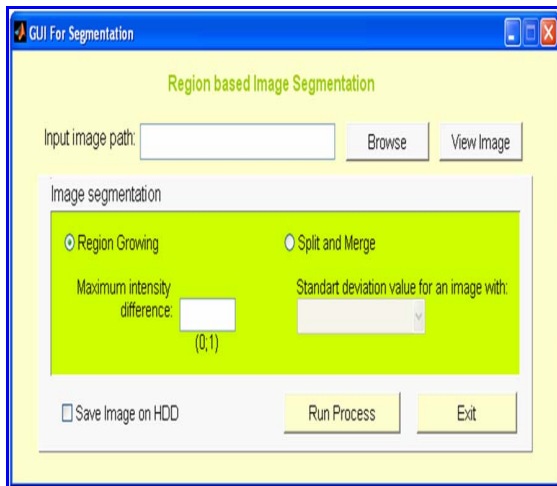


Figure 1. GUI for segmentation of medical images

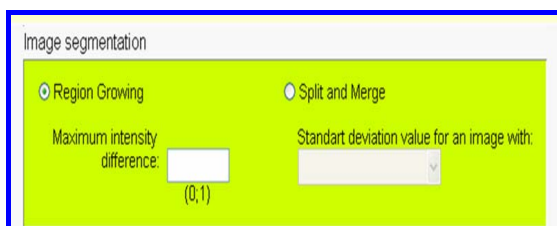


Figure 2. Area "Image segmentation"

The user can select two different segmentation techniques: region-growing and split and merge algorithms. The important parameters of these methods are maximum intensity difference (threshold) with values between 0 and 1. It can be input manually. Another parameter is a standard deviation. It is specific for the split and merge algorithm.

"Save Image on HDD" is checked to save results in image files in 'jpg' format. After choosing all input information the procedure of processing begins, when the user clicks on button "Run Process". Then the final result is shown – original image, and processed images. When button "Exit" is pressed the program can be closed.

3. TASKS CARRIED OUT FROM THE MAIN PROGRAM

The basic algorithm that works behind is shown in Fig. 3.

By acting of component from GUI can be implemented a callback-function from the main program. Every graphic component can be treated to object. Every object can be referred to handle. The objects referred a complex of attributes, which can be manipulated from the software. The multifarious attributes can be leaved for using in MATLAB environment, such as "Enabled", "Value", "Visible", "On", "Off" etc. [4]. Every attribute can be enabling in the

presence of corresponding handle or reference to the object. Every graphic component can be reiterated to a cycle of events for the MATLAB environment by initialization of the graphic application. It submits addresses of the callback-functions, associated to a given event, which are important. By its identification can be called out a corresponding callback-function. One of the important tasks that the main program has is input data validation. The execution is canceled if an error concerned with wrong information occurs. Another essential purpose of the main program is presenting the input information in appropriate data structures. It is necessary for the next steps in the processing strategy, in this step the processing is made with appropriate input data. Wrong information prevents segmentation from carrying out or may lead to wrong output.

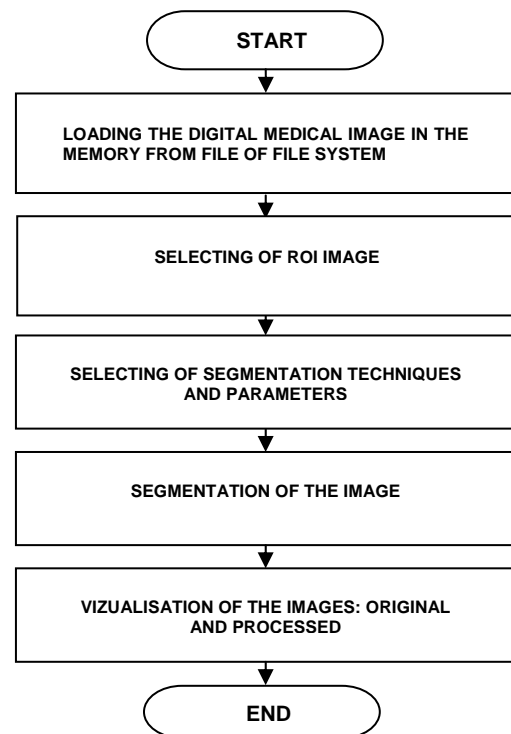


Figure 3. Block diagram of the algorithm

Some results from simulation, which illustrate the working of the program, are presented in the next figures below. In Fig.4 is shown the original CT image of size 650x650 pixels from abdominal organes.

In Fig.5 are presented the selected CT ROI image of size 460x375 pixels from spleen and its modifications, obtained by region growing and split & merge region segmentation algorithms. The best result is obtained for the value 0.2 of the parameter threshold by region growing algorithm. The value of standard deviation by split and merge algorithm is defined in the case of better contrast.



Figure 4. Original CT image

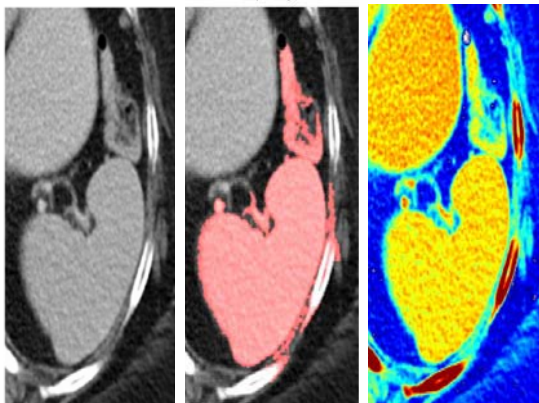


Figure 5. CT ROI image and its modifications obtained by region growing and split & merge algorithms

In Fig. 6 is presented only the segmented spleen extracted from whole CT image of abdominal organs, obtained by region growing algorithm.



Figure 6. Segmented CT image with extracted spleen

4. CONCLUSION

In the paper is presented a GUI for region segmentation of medical images. It uses MATLAB defined function and works in MATLAB 7.12 environment. The processing can be used to locate objects as organs and tumors and their boundaries by using of region growing and split and merge algorithms. The GUI can be used in engineering education for studying this process. It can be used also in real time to provide important anatomical information in medical images to physicians and specialist upon which can be made diagnoses of different diseases. The results by segmentation of sequences of CT images can be used for future application in 3D visualization.

Acknowledgments

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