

GUI for Properties Measurement of Medical Images

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Abstract – In the paper is presented software for measurement of some statistic properties, which can be used by analyses of medical image objects and its graphic user interface (GUI). It works in the MATLAB environment and uses IMAGE TOOLBOXES defined functions. The investigated properties can be obtained on the base of shape measurements and pixel value measurements 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 presented GUI is suitable to engineering education for studying of this processing. The proposed GUI can be applied also to real medical images attempt to make diagnostic more precise.

Some experimental results are presented, obtained by computer simulation in MATLAB Environment.

Keywords – Medical images, Analyse of medical objects, Shape measurement, Pixel value measurement, and Graphic user interface.

I. INTRODUCTION

The medical imaging technologies exploit the interaction between the human anatomy and the output of emissive materials or emissions devices. These emissions are then used to obtain pictures of human anatomy. The most popular technologies are ultrasound (US), X-rays, Computed tomography (CT) and Magnetic resonance imaging (MRI). These images provide important anatomical information to physicians and specialist upon which can be made diagnoses. In order for pathology or any tissue for that matter to be visible in a medical image there must be obtain some information about statistic properties of the specific objects in the analyzed regions[1].

The paper presents an application and GUI for measurement of set of properties of MRI images. In clinical practice, MRI is used to distinguish pathologic tissue from normal tissue. MRI provides detailed images of the body in any plane. It provides much greater contrast between the different soft tissues of the body than CT does, making it especially useful in neurological (brain), musculoskeletal, cardiovascular, and ontological imaging. The GUI can be applied also to different medical modalities images.

The image analyses functions include: Calculation of histograms for detailed visual analysis, computing of shape measurements such as area, bounding box (as the smallest rectangle containing region), center of mass of the selected

region, based on location and intensity value, perimeter and orientation of the selected object and the distance between different points in the medical objects [2]. In this case are used fast algorithms to compute the true Euclidean distance transform, especially in the 2-D case [3]. The orientation is the angle in degree between the X-axis and the major axis of the ellipse that has the same second-moments as the region.

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.

II. GUI FOR PROPERTIES MEASUREMENT OF MEDICAL IMAGES

The proposed GUI for properties measurement of medical images is presented on Fig.1. It is divided in several areas, where the user applies different settings, concerning image analyzing functions and theirs parameters.

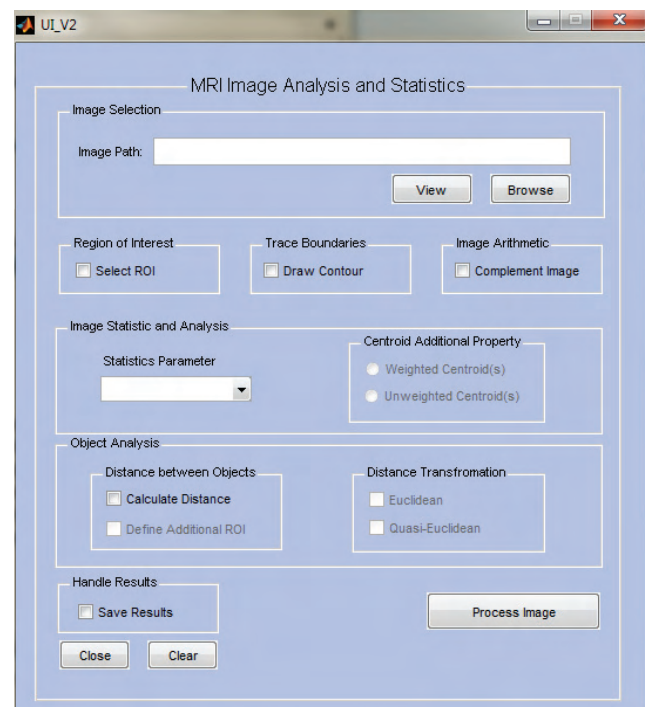


Fig.1. GUI for properties measurements of medical images

The area “Image Selection” 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

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using “Browse” button and view the image by using “View” button.



Fig. 2. Area “Image Selection”

The user can choose some functions such as region of interest (ROI), contour of the selected objects and (or) complement of image. With the last function the dark areas of the image become lighter and light areas become darker. They are not obligatory for image statistic and analysis, but they can give more visual information for the investigations.

The area “Image Statistic and Analyses” is shown on Fig. 3. The user can select different statistic shape properties from the medical object such as bounding box, standard deviation, perimeter, area, orientation, computing of partial histogram and the centroid. For more precisely investigation can be selected also the type of the center of mass of the selected ROI. The computed histogram is presented in graphical mode.

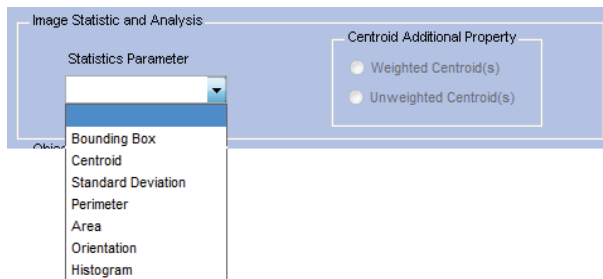


Fig. 3. Area “Image Statistic and Analysis”

The next area “Object Analysis” is shown on Fig.4. It can be used by computing a distance between two or more objects in the image. In this case are used fast algorithms to compute the true Euclidean or (and) Quasi- Euclidean distance transform. They can be selected respectively from the Checkboxes.



Fig. 4. Area “Object Analysis”

The obtained results can be saved on HDD in image files in ‘jpg’ format by selecting the check- box “Save Results” in area “Handle Results”. They can be used by more detailed statistic processing and analyzing.

After choosing all input information the procedure of processing begins, when the user clicks on button “Process Image”. Then the final result is shown – original image, and the obtained result-images. When button “Close” is pressed the program can be closed. Message about a mistake “Invalid

Image Path” or a warning message such as “Please specify the Image Path” can be obtained by simulation.

III. TASKS CARRIED OUT FROM THE MAIN PROGRAM

The basic algorithm that works behind is shown in Fig.5.

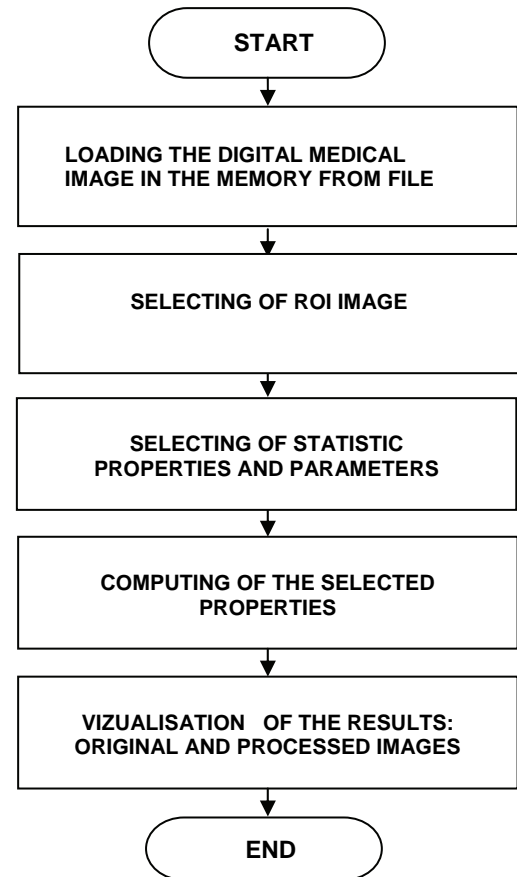


Fig. 5. Block diagram of the basic algorithm

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.

Some results from simulation, which illustrate the working of the program, are presented in the next figures below.

In Fig.6 is shown the original MRI image of size 512x256 pixels with brain tumor.

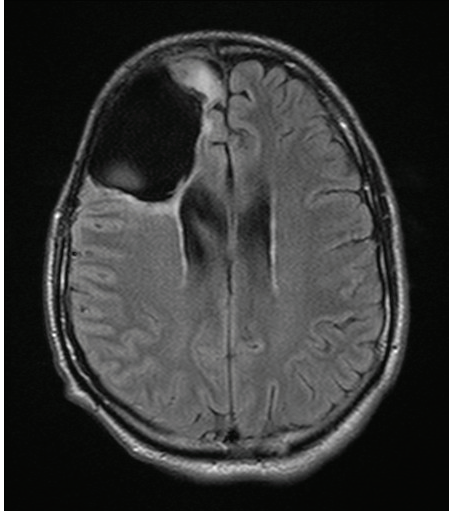


Fig. 6. Original MRI image

In Fig.7 are presented selected ROI image of size 120x100 pixels and its modification, made by complement of the original ROI image.

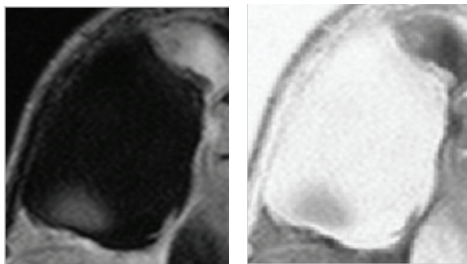


Fig. 7. Selected original ROI image and its modification

In the next figures are presented the results obtained by computing of some statistic properties of the investigated objects. In Fig. 8 are displayed exterior object boundaries (colored inside).



Fig. 8. Exterior object boundaries in ROI image

In Fig. 9 is shown the computed histogram of the selected ROI image.

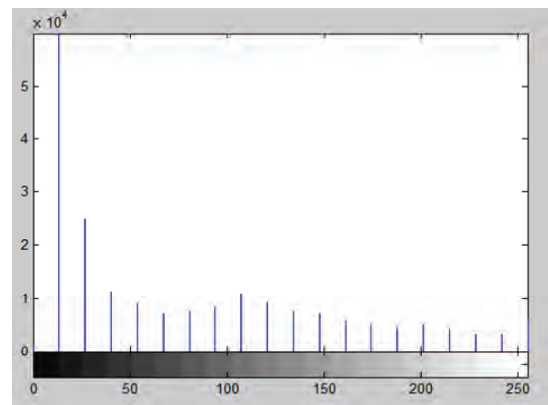


Fig. 9. The histogram of selected ROI image

Fig. 10 illustrates the axes and the orientation of the corresponding ellipses of some objects and weighted centroids in the investigated region in order to obtain information of their position detection.

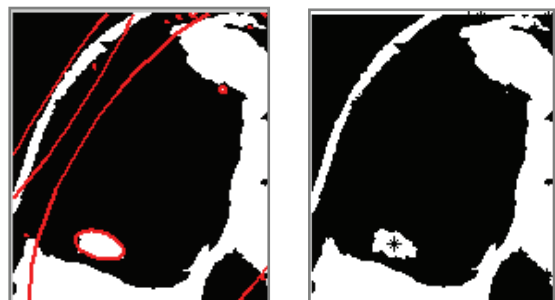


Fig. 10. Orientation of the corresponding ellipses and centroids of some objects

In Fig. 11 are shown 4 selected points (P1, P2, P3 and P4) from the investigated objects and the graphic of the computed Euclidean distance.

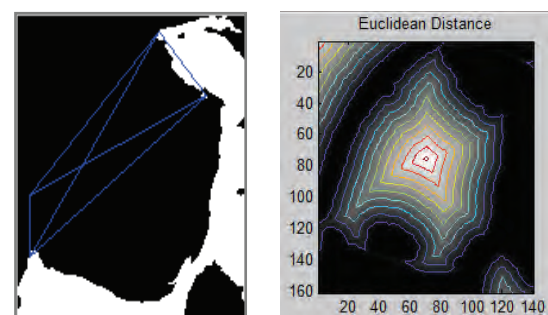


Fig. 11. Selected points and graphic of their Euclidean distances

In Table 1 are presented the Euclidean distances between the selected points, which are calculated by the program.

TABLE I
EUCLIDEAN DISTANCES BETWEEN THE SELECTED POINTS

Points	P1	P2	P3	P4
P1	0	33	143.67	138.05
P2	33	0	117.52	120.30
P3	143.67	117.52	0	44.69
P4	138.05	120.30	44.69	0

IV. CONCLUSION

In this paper is presented a GUI for measurement of set of statistic properties, which can be used by analyses of medical image objects. It uses MATLAB defined function and works in MATLAB 7.12 environment. The processing can be used to analyze objects as organs and tumors by using of shape measurement and pixel measurement 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. Some results can be used for future application in 3D visualization.

REFERENCES

- [1] M. Smith, A. Docef, "Transforms in telemedicine applications", Kluwer Academic Publishers, 1999.
- [2] H. Mallot, Datenanalyse mit Matlab: Mathematische Grundlagen, Eberhard Universität Tübingen, 2011
- [3] W. Pratt, "Digital Image Processing", John Wiley & Sons Inc., 2001.
- [4] MATLAB User's Guide. Accessed at: www.mathwork.com