USER INTERACTION FOR MEDICAL IMAGE ANALYSIS

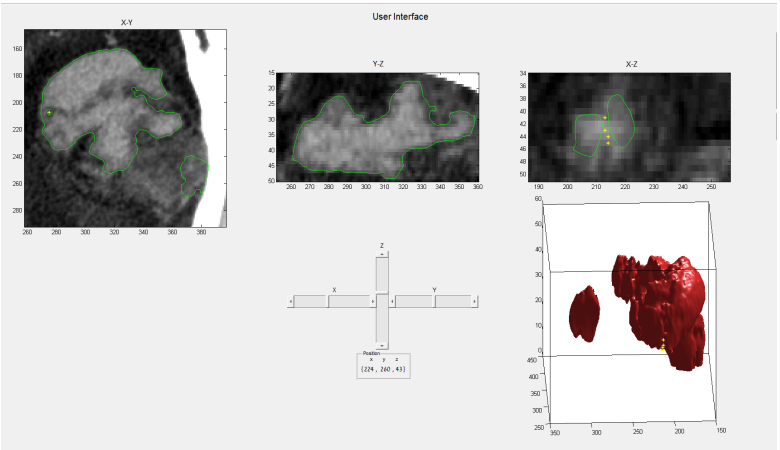
Background and Need

Technological advances in both software and hardware have enabled the development of anatomical and functional medical imaging modalities that allow clinicians and scientists to “look inside” the human body. Such imaging technologies provide a wealth of information that is critical to the understanding, modeling, diagnosis and treatment of diseases. Fundamental to medical imaging analysis is image segmentation, a field that is rigorously studied. Recent trends in this field focus on fully automatic segmentation frameworks, which are much faster than manual annotation, less biased and repeatable. In addition, they can easily process and analyze the large datasets of medical imaging, a task that is far beyond the abilities of human raters or imaging experts, who cannot compete with the computationally-driven capacity of the machine to perform modality fusion and three-dimensional (3D) visualization. Nevertheless, because the outcome of the image analysis process may have critical implications for the patient’s prospects for recuperation, that process must include consultation with an expert clinician.

Innovation and Development Stage

A novel probabilistic model for semi-automatic segmenting, in which the user interacts with the segmentation algorithm to provide spatial information, was developed.

The technique was exemplified on the segmentation of cerebral hemorrhages (CHs) in human brain CT scans. CH volume estimates provided by the segmentation may be critical to determining the therapeutic procedure, which may involve surgery and the intake of medicine. It is important to note that CHs have well-defined intensity ranges that are clearly expressed in Hounsfield units (CT numbers). Nevertheless, similar gray-level values, the result of calcification or CH proximity to the skull bone, may not be detected by a fully automatic segmentation process, and therefore, they may require the insight of a physician.



The application of our novel technique improved the accuracy of segmentation results with minimal user input for the segmentation.

Potential applications

The technology is applicable in computer aided diagnosis, therapy planning, and therapy assistance. A few examples are cerebral hemorrhages volume estimation, benign and cancerous tumor characterization, guidance in non-invasive or minimally invasive computerized treatments, such as cryoablation, focused ultrasound ablation, laser ablation and radiofrequency ablation.

Potential market

The global computer aided detection (CAD) software market is divided into sectors according to application area and type of imaging modality. Neurological, musculoskeletal and cardiovascular applications of CAD software have been developed for breast, lung, prostate, colorectal, liver, and bone cancers, among others. In terms of type of imaging modality, the market is also categorized into X-Ray imaging, computed tomography, ultrasound imaging, magnetic resonance imaging, nuclear medicine imaging, and others. The medical image analysis software market was estimated at about $1.7 billion in 2012, and that figure is projected to grow at a rate of 7.2% from 2012 to 2017, when it will be $2.4 billion.

Patent status

A provisional patent application was submitted.

The Team

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