PIPELINE USED FOR SEGMENTATION OF ORGANS IN THE HUMAN BODY USING MEDICAL IMAGING INTERACTION TOOLKIT (MITK)

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Introduction

The Medical Imaging Interaction Toolkit (MITK) aims to make it easier to create clinically useful image-based software. To check and, if necessary, rectify results from (semi-)automatic algorithms, clinically applicable software for image-guided treatments and image analysis necessitates a high level of interaction. The reconstruction of three-dimensional images from a series of two-dimensional medical image is critical in understanding the anatomy of the human body. Magnetic resonance imaging (MRI), computed tomography (CT), positron emission tomography (PET), and other 3D imaging modalities are used to generate these 2D medical images. This research evaluates a few tools for reconstructing a 3D image from a set of 2D images [1]. The following evaluation criteria were taken into account for this paper's comparison study: neuroimaging, 2D and 3D viewing capabilities, and technical assistance from the tool's creators. This paper's major goal is to demonstrate how medical images are labeled in order to facilitate testing and training of neural networks.

Background

MITK was created as an internal tool for developing dependable software for the medical imaging industry, it was made public and released in 2005. The toolkit development process has led to regular releases of the software and various applications as open-source software. Additionally, the branch-based workflow allowed a rising number of contributors from different backgrounds and degrees of experience to generally maintain a high software quality [2]. MITK is a free and adaptable open-source software project for the creation of medical image processing applications. It can be used as an application framework or C++ toolkit for program development. It was developed as a common framework for Ph.D. students in the German Cancer Research Center's Division of Medical and Biological Informatics (MBI). Its goal is to provide high-interaction support for the development of cutting-edge medical imaging software. [3]. The software's high level of integration of Image processing and analysis (ITK) and Visualization (VTK), enhanced with data management, advanced visualization, and interaction functionality in a single framework, which is supported by a wide range of researchers and developers, will be beneficial to research institutes, doctors, and businesses alike. This has aided in the ease of diagnosis by allowing medical images from many patients who have been diagnosed to be referred to for testing and training utilizing Artificial Neural Networks (ANN)to identify regions of interest. MITK, however, can also be utilized as a framework to create tasks, programs, writing modules, and plugins.

Methodology

Consequently, the following therapeutically relevant tasks must be completed by a software system created for the development of research software for a clinical context. Data management, image analysis, Support for diagnosis and treatment planning, Support for interventions and management of treatment [4]. The MITK workbench collects DICOM (Digital Imaging and Communications in Medicine) which is a typical format that aids medical specialists to view, store, and share medical images. The use of these application looks at current techniques for building 3D objects out of slices of 2D medical images in the DICOM format which are derived from medical measurement tools including magnetic resonance imaging (MRI), X-ray computed tomography (X-ray CT), and others. There are numerous modalities that can be used to reconstruct medical images and build models. There are further categories within medical imaging, with the following being the most common: The spiral tomography technology, computed axial tomography (CAT) scan, commonly known as X-ray computed tomography (CT), creates a 2D representation of the structures in a section of the body. A stream of X-rays passes through the object from various angles before spinning around it and being detected by sensitive radiation detectors in a CT scan. A computer analyzes the information after that and uses mathematical concepts to build a detailed image of the structure and its contents. A random transformation is used to reconstruct these sets of images so that they could be projected as a single image. Along with magnetic resonance imaging (MRI) and computed tomography (PET-CT), PET, sometimes referred to as positron emission tomography, is used (PET-MRI). Body cross-section tomographic images are frequently produced using MRI. The MITK workbench provides an axial, sagittal, and coronal view of the bodily organ in both 2D and

3D format. The Regions of interest (ROI) can be annotated, pixels adjusted and saved as a mask, nifti, or dicom format using the segmentation tools and user interface provided by the software.

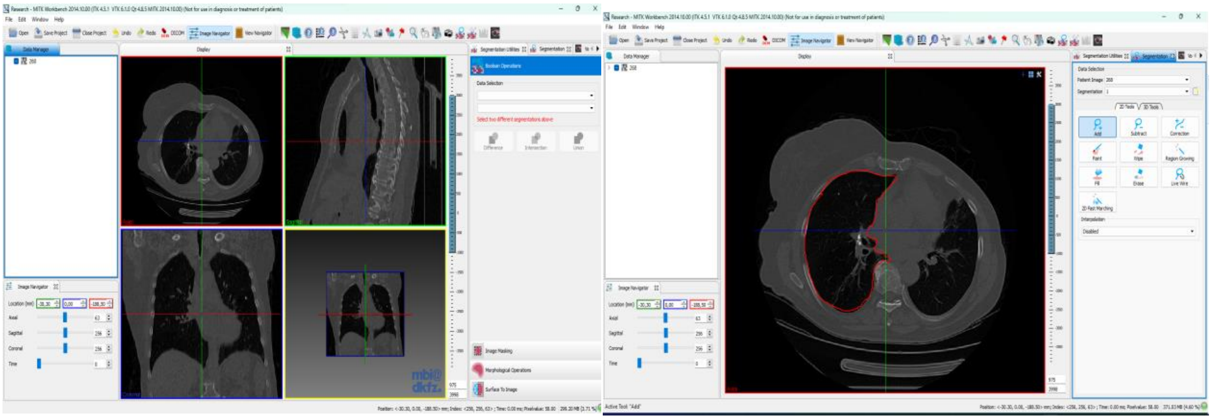

Fig 1. The MITK workbench shows the input image and selection of region of interest

Result

The annotations derived from the ROI are saved as masks and categorized into train and test images which are now fed to an ANN and this constructs algorithms that can learn and make data driven predictions or decisions through building a mathematical model from the input data. The decision of the sizes and strategies for data set division in training, test and validation sets is dependent on the problem and data available.

Conclusion

Only when medical imaging algorithms are used in a clinical setting can their worth be determined. This necessitates data visualization and interactivity. MITK provides a versatile platform with a high degree of modularization, interoperability and is well suited to meet the challenging tasks of todays and tomorrows clinically motivated research. It also provides optional support for tool tracking, image-guided therapy as well as various external packages. This has made the segmentation process of human organs easy and a breakthrough for doctors and researchers.

References

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