A Multi-Functional Interactive Image Processing Tool for Lung CT Images

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ABSTRACT

An important requirement for clinical diagnosis and treatment is a platform for medical image processing technique that is more flexible and accurate. An interactive image processing method that can be used as a Computer Aided Detection (CAD) tool for medical image processing is proposed in this paper. The tool is developed in MATLAB to read images of different formats like tif, jpg, DICOM etc. The tool is also capable of displaying information about the loaded image of the selected format, read and save images from and to workspace. In addition to this user can use functional tools like determining the value of pixel in the image, obtain histogram, horizontal and vertical profiles of selected lines of the image, color maps of CT window that include CT bone, CT spine, CT mediastinal, auto adjustment of global intensity and selective intensity, image smoothening, manual and auto thresholding. All the mentioned functions are integrated in Graphical User Interface which is user friendly.

Keywords: *Computed Tomography (CT), Computer Aided Detection (CAD), Diagnosis, Matrix Laboratory (MATLAB), Medical Image Processing*

INTRODUCTION

A subfield of computer science that studies algorithms for digital synthesis and manipulate visual information is Computer graphics. Computer graphics include computational techniques to perform visual and geometric content manipulation. It aims on the computational and mathematical foundations of image generation and processing (Draper & Beveridge, 2001, Mora B et al, 2009, & Peternier A et al, 2006). Image processing is a rapidly developing domain of computers. Improvements in digital imaging technology, processors, and mass storage device made the field grow. Digital image processing allows the expansion of image features of interest and mitigates details unrelated to a given application and then extract precious information. Image processing uses computer algorithms on digital images. It allows use of

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a wide range of algorithms to be applied on input image data, and avoids problems such as interference of noise and signal distortion during processing, (Gonzalez & Woods, 2008, Rodriguez et al., 2008).

CAD broadly refers to "the use of computer algorithms to aid the image interpretation process". Most CAD systems are about detection, which is why CAD can also stand for *computer aided detection.* CAD is now widely used as a general term, including computerized extraction of quantitative measurements from medical images. From the point of view of algorithm development this is natural, because detection and quantification use similar underlying techniques, and because they are both parts of the diagnostic process. In this paper a CAD tool for interactive image processing of medical image is proposed. It provides a platform for medical image processing techniques that are more accurate and flexible. MATLAB was used for processing of images using human data in different formats. In addition to this user can use functional tools like determining the value of pixel in the image, obtain histogram, horizontal and vertical profiles of selected lines of the image, color maps of CT window that include CT bone, CT spine, CT mediastinal, auto adjustment of global intensity and selective intensity, image smoothening, manual and auto thresholding. All the mentioned functions are integrated in a Graphical User Interface which is a user friendly image processing technique that could be of clinical use to assist for image analysis and diagnosis purpose.

LITERATURE REVIEW

Kunio Doi *et a,*1997 defined computer aided diagnosis as a diagnosis made by physician who takes into account the computer output as a second opinion to improve the diagnostic accuracy and the consistency of the radiologists image interpretation. In the article they had provided a brief overview of some of CAD schemes for detection and differential diagnosis of pulmonary nodules and interstitial opacities in chest radiography as well as clustered microcalcifications and masses in mammograms. Y. Kawata *et al*. (1997) presented a method to characterize small pulmonary nodules based on the morphology of the development of lung lesions in thin-section CT images. Computer assisted automatic diagnostic system for lung cancer that detects nodule candidates at an early stage from helical CT images of thorax was developed by K. Kanazawa *et al* (1998). The diagnostic system consists of analytical and diagnostic procedures. Laurence Monnier-Cholley *et al* (1998) evaluated the impact of computer aided diagnosis scheme on radiologists' interpretation of chest radiographs with interstitial opacities by performing as observer test using receiver operating characteristics (ROC) analysis. A computer-aided diagnostic scheme by using an artificial neural network to assist radiologists in the distinction of benign and malignant pulmonary nodules was developed by Katsimi Nakamura *et al* (2000). A patient specific model for automatically detecting lung nodules in CT images was proposed by Matthew S.Brown *et al.* (2001). Michael F. McNitt-Gray *et al* (2001) developed a method to determine whether malignant solitary pulmonary nodules (SPN) can be discriminated from benign lesions based on quantitative features derived from CT images. Given the potential applications to treatment and screening of patients, a computer vision system was developed by Jane P. Ko and Margrit Betke (2001) that not only detects pulmonary nodules at CT but also quantifies their volume and change over time. François Chabat *et al*. (2003) proposed an automated technique for differentiation between a variety of obstructive lung diseases on the basis of textural analysis of thin-section CT images. Junji Shiraishi *et al.* (2003) evaluated the radiologists' performance for determining a distinction between benign and malignant pulmonary nodules on chest radiographs without and with the use of computer aided diagnosis scheme. Ayman El-Baz *et al*. (2003) introduced two novel approaches for segmentation of the lung tissues from the surrounding structures in the chest cavity, and detection of the abnormalities in the lung tissues.

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