Comparative Analysis between two Automatic Systems for Lungs Segmentation and Quantification from CT Images of Healthy Persons and Patients with COPD

John Hebert da Silva Felix¹, Paulo César Cortez², João Manuel R. S. Tavares², Victor Hugo Costa de Albuquerque¹,², Marcelo Alcântara Holanda³

¹ Federal University of Ceará / Teleinformatic Engineering Department, UFC, Fortaleza, Brazil
² Faculty of Engineering of University of Porto / Department of Mechanical Engineering and Industrial Management, Porto, Portugal
³ Federal University of Ceará / Image and Pulmonology Departments, UFC, Fortaleza, Brazil

Abstract

Computed Tomography (CT) of the thorax is the most accurate imaging modality for the diagnosis of the majority of lung and chest diseases. However, there are still some limitations in diagnosing and, in particular, quantifying some lung diseases, such as the emphysema, from CT images. Automatic segmentation and quantification of lungs from images can be improved by adequate image processing and analysis techniques. These techniques can, for example, enhance the visualization of the lungs and of the chest wall as well. In this paper, will be compared two computational systems, the SVEP (Computational Vision System for Detection and Quantification of the Pulmonary Emphysemas) and the OSIRIS system, to segment and quantify lungs from CT images. The SVEP system was developed by authors and is able to automatically segment and quantify the lungs of healthy volunteers and of patients with Chronic Obstructive Pulmonary Disease (COPD) in prone positions. Moreover, our SVEP system is able to accomplish successfully the automatic segmentation of lungs in CT images, and measure the area, volume and perimeters of each lung. On the other hand, the compared OSIRIS system is just able to manually segment each lung, being necessary to do a posterior manual segmentation adjust to obtain a satisfactory final result, and it performs only the determination of the lung area. Thus, our SVEP system, based on techniques of region growing and mathematical morphology, reveals more efficient than OSIRIS system to segment and to quantify lungs from CT images. In resume, with this paper, we can conclude that the proposed SVEP system offers to researchers, engineers, medical doctors and specialist and others of Medical Digital Image Processing field, one valid option for efficient and automatic segmentation and quantification of lungs from CT images.

Key words: Automatic segmentation and quantification, lungs measurement, image processing and analysis, medical imaging.