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Iterative Method for Lung Tumor Localization in 4D CT

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Abstract : In the last decade, there were immense advancements in the medical imaging modalities. These advancements can scan a whole volume of the lung organ in high resolution images within a short time. According to this performance, the physicians can clearly identify the complicated anatomical and pathological structures of lung. Therefore, these advancements give large opportunities for more advance of all types of lung cancer treatment available and will increase the survival rate. However, lung cancer is still one of the major causes of death with around 19% of all the cancer patients. Several factors may affect survival rate. One of the serious effects is the breathing process, which can affect the accuracy of diagnosis and lung tumor treatment plan. We have therefore developed a semi automated algorithm to localize the 3D lung tumor positions across all respiratory data during respiratory motion. The algorithm can be divided into two stages. First, a lung tumor segmentation for the first phase of the 4D computed tomography (CT). Lung tumor segmentation is performed using an active contours method. Then, localize the tumor 3D position across all next phases using a 12 degrees of freedom of an affine transformation. Two data set where used in this study, a compute simulate for 4D CT using extended cardiac-torso (XCAT) phantom and 4D CT clinical data sets. The result and error calculation is presented as root mean square error (RMSE). The average error in data sets is 0.94 mm ± 0.36. Finally, evaluation and quantitative comparison of the results with a state-of-the-art registration algorithm was introduced. The results obtained from the proposed localization algorithm show a promising result to localize alung tumor in 4D CT data.

Keywords : automated algorithm ,computed tomography, lung tumor, tumor localization
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