Abstract

This research introduces the new approach of the 3D active contour model to evaluate the velocity vectors of the lung motion and learning the inhomogeneous motion pattern from each lung lobe to generate the predictive model. The non-rigid registration model by using its biophysical model is applied. The velocity vectors between EI and EE models are evaluated by the corresponding points on the parametric surface model of the EE model to the EI model. The external energy from the EI models is the external force that pushes the 3D parametric surface reaching the boundary. The external forces such as balloon force and Gradient Vector Flow (GVF) were adjusted adaptively based on the Z_{ratio} which calculated from the ratio of the maximum value of EI to EE model in Z axis. Next, the feature representation is studied and evaluated based on the lung structure which is separated into 5 lobes. The hierarchical classification is applied to screen the lung diseases into normal, obstructive lung, and restrictive lung by using the stepwise regression and Artificial Neural Network techniques. Lastly, the inhomogeneous motion pattern of lungs integrated with the medical based knowledge can be used to analyze the lung diseases: firstly, by differentiating normal and inhomogeneous motion pattern, secondly by separating restrictive and obstructive lung diseases and thirdly basing on the cause and location of the disease which is the function of the immune and lymphatic system.

Keywords: *3D Active Contour Model, non-rigid registration, inhomogeneous motion pattern, velocity vector map, hierarchical classification*