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Assessment of Left Ventricular Function in Cardiac MSCT Imaging by a 4D Hierarchical Surface-Volume Matching Process

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Abstract

Multislice computed tomography (MSCT) scanners offer new perspectives for cardiac kinetics evaluation with 4D dynamic sequences of high contrast and spatiotemporal resolutions. A new method is proposed for cardiac motion extraction in multislice CT. Based on a 4D hierarchical surface-volume matching process, it provides the detection of the heart left cavities along the acquired sequence and the estimation of their 3D surface velocity fields. A Markov random field model is defined to find, according to topological descriptors, the best correspondences between a 3D mesh describing the left endocardium at one time and the 3D acquired volume at the following time. The global optimization of the correspondences is realized with a multiresolution process. Results obtained on simulated and real data show the capabilities to extract clinically relevant global and local motion parameters and highlight new perspectives in cardiac computed tomography imaging.