A Novel Volumetric Deformable Registration Technique for Thoracic 4-D CT Images with Applications in Lung Radiation Therapy (12032)

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Technology description

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The main function of the respiratory system is gas exchange. Since many disease or injury conditions can cause biomechanical or material property changes that can alter lung function, there is great interest in measuring regional lung function and regional mechanical changes. While the mechanical changes associated with the change of the material properties originate at a regional level, they are largely asymptomatic and invisible to global measures of lung function until they have advanced significantly and have aggregated. Therefore it would be desirable to have objective methods with which to evaluate and follow the progression of disease based on measurement of regional mechanics. We have developed a novel approach for quantification of motion and mechanical strain in the lung from 4-D CT using a multi-scale optical flow deformable image registration method. The basic assumption in standard optical flow estimation is grey value constancy assumption which is not particularly applicable to lung motion estimation because of changes of voxel intensity (Hounsfield Unit) of lung during respiration. In this technology, we include gradient constancy, mass conservation, as well as spatio-temporal smoothness to more accurately model and estimate motion of the lung. This approach will give more information on regional lung function, assessment of disease severity and prognosis.

Markets Addressed

The University of Louisville is seeking a business partner interested in developing and commercializing a technique allowing the ability to track the motion of the lung using 4-D CT imaging to give more information on regional lung function, assessment of disease severity and inform better about prognosis.

This technology could be used in radiation therapy, lung cancer treatment, and treatment planning. It also could have medical applications for tracking moving organs because it has high special resolution and a smooth deformation map. There is also market potential for satellite and weather forecasting – for example tracking weather fronts.

Application area

Fields of Use Available: All

Advantages

This technology provides the possibility to enforce physical constraints (such as mass conservation) on the numerical solution.
It provides more accuracy and precision. It has shown to be an accurate model for lung motion.
Robust to noise and motion artifacts Useful for regional lung ventilation assessment.

Institution

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