Multi-Motion Compensation for Computed Tomography

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Technology description

Unmet Need

During computed tomography (CT) or cone-beam CT, scans can be affected due to patient motion that causes significant artifacts that diminish image quality. This is functionally the case because of slow image acquisition speed, causing artifacts in the image due to patient’ s difficulty in following commands and remaining still. Furthermore, motion patterns occurring in brain imaging are even more challenging due to more rapid, aperiodic, and of larger amplitude. Currently, there is an “auto-focus” motion compensation method where the patient motion is iteratively estimated so the image is reconstructed to its maximum capability. However, there is a problem when encountering a critical care imaging offers even larger amplitude and rapid displacement, which challenges this autofocus optimization method. In addition, there is a need to optimize and improve reconstruction methods so that they are able to consider multiple fields of views. This allows for movement to not be as destructive to image quality.

Technology Overview

The inventors have proposed a new autofocus method, called “Multi-Motion,” that accounts for multiple regions and objects undergoing different motion patterns. This means it can take into account a patient’ s head rolling within a head cradle or even a lower part of the leg moving separate speeds than the upper portion of the leg. This methodology uses novel-preconditioning to begin motion estimates, improving the efficiency of the Multi-Motion algorithm. This novel innovation doesn’ t require the motion-free 3D image as an input for 3D-2D registration as the current method does. By using an uncompensated 3D image reconstruction that actually generates 2 or more sub-regions, this method can model complex deformable motion. This algorithm doesn’ t require any trackers, fiducials, or prior scans for estimation. The novel two-pronged methodology of including a preconditioning stage and modifying reconstruction methods to accommodate multiple fields of motion not only improves on the accuracy but also the efficiency of prior art.

Institution

Johns Hopkins University

Inventors

Joseph Stayman
Research Associate Faculty
Biomedical Engineering SOM
Wojciech Zbijewski
Sr. Research Data Analyst
Biomedical Engineering SOM
Jeffrey Siewerdsen
Professor
Biomedical Engineering SOM