Medical Imaging Software that Improves Image Quality Without Exposing Patient to Longer X-Rays

Published date: May 14, 2019

Technology description

Algorithm Enables Precise Verification of Mobile Internal Organs and Tumors Using Image Reconstruction

This software reconstructs high quality Four-Dimensional Cone-Beam Computer Tomography (4D-CBCT) images using limited imaging projections and a standard free breathing CBCT scan. Roughly two–thirds of all cancer patients receive radiotherapy to target and, it is hoped, eliminate tumors. Radiotherapy treatment plans begin with locating the tumor using a CT scan. A 4D-CBCT is a medical device that records a sequence of CT images, formed at successive times, which illustrate moving portions of an object being imaged. Unfortunately, under normal operation, this device produces an unclear image set. The greatest challenge for medical imaging is producing a high-quality image with an insufficient amount of projection data. One solution is to increase the sample number of X-ray projections, but this increases the amount of time a patient spends in a CT scan and the patient’ s radiation exposure. Researchers at the University of Florida have developed software called common-mask guided image reconstruction (c-MGIR) that allows the reconstruction of high quality 4D-CBCT images with no more imaging projection than a clinically-used, standard free-breathing CBCT scan. This software has potential for online image-guided radiation therapy.

Technology

The software allows the image quality of 4-Dimensional Cone-Beam CT images to be significantly improved by using full projections, rather than only phase-resolved projections, for each single phase reconstruction. Full projections permit more information to be accommodated into the final, enhanced image. This software utilizes the medical imaging protocol called CBCT, which consists of sequencing an image with computed X-rays where the X-rays are divergent, forming a cone. The unknown cone volume of the X-ray was mathematically modeled to predict the next image through computer analysis and draw prediction lines called motion vectors and static vectors. The combination of phase-specific motion vectors and static vectors allows the software to reconstruct the next image in the X-ray sequence. The distinguishing aspect of this software is the common-mask, the matrix that

differentiates between the 3D elements that are moving from the stationary ones. Then the moving and static volumes are updated, and a higher quality image using 4D-CBCT is created.

Application area

Highly efficient medical imaging software that reconstructs high quality 4D-CBCT images using limited projection data and standard CT scanning technology.

Advantages

Provides faster, superior image quality, increasing the accuracy of diagnostic imaging
Requires no more projection data and imaging dose than a typical clinical 3D-CBCT scan, reducing the time required to collect image data and radiation exposure of a patient
Potentially useful in an online image guided radiation therapy (IGRT) environment

Institution

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