TECHNOLOGY

Motion Artifact Suppression in 4D CT Reconstruction with Iterative Back Projection

OVERVIEW

Computational tomography (CT) is computer-aided reconstruction imaging of X-ray projection data and is commonly used for diagnostic purposes. Although image quality is essential for diagnostic accuracy, CT images are prone to artifacts because the image is reconstructed using multiple measurements and a single error in measurement will result in a faulty reconstructed image. 4 dimensional (4D) CT allow imaging of moving targets such as the lung or the heart by taking images in phases of the respiratory cycle and then reconstructing the image by combining projections taken in the same phase. However this limits the number of projections available for image reconstruction resulting in undersampling, causing blurring or the appearance of fine lines on the image, which can interfere with diagnostic accuracy. One of the methods to reduce undersampling is to reduce rotation speed of the CT gantry to increase the number of projections but this would mean a potential increase in patient motion artifacts due to the increased scan time. The common filtered back projection algorithms that are used for 4D CT imaging produce reconstructions that have a lot of motion-induced artifacts due to the moving components of the object being imaged. On the other hand, iterative techniques significantly reduce motion artifacts in reconstructed images but require high computational power and are time consuming.

The present invention is an algorithm that can reduce motion-induced artifacts in undersampled 4D CT imaging. This technique first creates a motion compensated image by suppressing the motion components of the composite image and then adds back the individual motion phases to depict motion and thereby produces a higher quality reconstructed image with reduced motion artifacts.

APPLICATIONS

Currently available reconstruction algorithms produce blurry images as a result of motion-induced artifacts that occur in undersampled projection data. The commonly used filter-back projection is good as long as the object being imaged in completely stationary, any noise will lead to motion artifacts. To reduce noise, radiation dose will have to be increased but this is undesirable from the patient's safety perspective. Iterative reconstruction produces better quality images but requires high computational power. Existing algorithms for iterative reconstruction such as SAFIRE and MBIR can reduce noise significantly but are time consuming and require high computational power hence are not applicable. The present invention is the only technique that reconstructs an image by extracting the motion components from the composite image and then adds it back to obtain a high-quality reconstructed image. It results in a better quality image than filtered back projection without requiring the computational power and processing time of the iterative reconstruction method. By increasing image quality without compromising speed, this technology will significantly improve diagnostic accuracy of 4D CT and 4D CBCT imaging. This technology can also be used in other imaging techniques that requires a reconstructed image of a moving object such as PET or SPECT.

The global medical imaging systems market was valued at $25 billion in 2013 and is projected to grow at a CAGR of 5.7% over the next four years. Amongst the various imaging technologies available, computed tomography holds a significant share. In the healthcare industry CT scans are used for a variety of conditions to provide detailed information of internal body structures. The global market for CT scanners has shown an upward trend in the last 30 years since its invention and continues to grow with the advent of newer CT technologies that improve the accuracy and speed of detection. 4D CT scanners are useful diagnostic tools for cardiovascular diseases and for cancer detection and are used to guide biopsy procedures and targeted radiotherapy. There is a need for technologies such as the one described here that can increase the quality of CT imaging of moving targets to improve diagnostic efficiency.

ADVANTAGES

Reduces motion-induced artifacts to produce high quality reconstructed images of moving objects

Does not require high computational power like currently available iterative methods

LICENSING POTENTIAL

UMB seeks to develop and commercialize via an exclusive or non-exclusive license agreement and/or sponsored research with a company active in the area.

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PATENT STATUS

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CATEGORIES

- Imaging devices
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