Method for Removing Breathing Motion Artifacts in CT

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SUMMARY

UCLA researchers have developed a novel scanning and analysis method to remove breathing motion artifacts in CT scans by integrating motion modeling to the image reconstruction process.

BACKGROUND

Modern CT scanners acquire images very quickly, moving the patient as the CT scanner rotates. This is termed helical scanning and is used for most CT scanning image acquisition. Breathing motion induces artifacts and blurring in the images that can degrade the diagnostic utility of the images.

Many times the patient is asked to hold their breath, but there are some circumstances when this is not possible or desired. Some patients are unable to hold their breath, whether due to lung disease or inability to understand or follow breath hold instructions. Besides, there are some imaging studies that are intended to measure or evaluate the patient under free breathing conditions, so holding their breath is undesirable.

In pulmonology and upper abdominal imaging, the existing state of the art is to make CT scanners faster. They have gotten to a practical limit. Cardiology does something similar to this invention, integrating motion modeling to the image reconstruction process. Cardiac imaging takes advantage of the regularity of the cardiac cycle. The breathing cycle can be very irregular, so these techniques do notwork when removing motion artifacts from lung or upper abdomen imaging.

INNOVATION

UCLA researchers have developed a novel method to produce CT images that have reduced or eliminated breathing motion artifacts. The invention simultaneously integrates a breathing surrogate, which can be an external noninvasive system such as a spirometer or abdominal belt, with the CT sinogram data, along with a breathing motion model to reduce or eliminate motion artifacts.

The motion model is either predetermined or iteratively developed during the image reconstruction process. The motion model ties the motion behavior of the patient's tissues, through the surrogate measurement, to time and subsequently to the individual sinogram components.

APPLICATIONS

The primary application for this invention is to provide breathing motion artifacts free CT scans of the thorax and upper abdomen for downstream diagnosis or treatment response monitoring.

ADVANTAGES

- Patients do not need to hold their breath during CT scans to get high quality images.
- The motion model will reduce or even eliminate breath motion artifacts in CT scans.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,734,839	08/22/2023	2017-099
European Patent Office	Published Application	EP 3768380 A1	01/27/2021	2017-099

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OTHER INFORMATION

KEYWORDS

breathing motion, artifacts, computed tomography (CT), image reconstruction, motion model

CATEGORIZED AS

- **Imaging**
  - Medical
- **Medical**
  - Devices
  - Imaging

RELATED CASES

2017-099-0

RELATED MATERIALS

▶ Low D A, White B M, Lee P P, et al. A novel CT acquisition and analysis technique for breathing motion modeling[J]. Physics in medicine and biology, 2013, 58(11): L31. http://iopscience.iop.org/article/10.1088/0031-9155/58/11/L31/meta

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