Incorporation of Mathematical Constraints in Methods for Dose Reduction and Image Enhancement in Tomography

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SUMMARY

UCLA researchers have developed an algorithm that enables construction of 3D images from tomographic data through iterative methods with the incorporation of mathematical constraints. This methodology is an improvement over conventional techniques as it allows for radiation dose reduction and improved resolution.

BACKGROUND

Tomographic imaging techniques such as computed tomography (CT) and positron emission tomography (PET) are important diagnostic and interventional tools in medicine and other sciences. Typical tomography instrumentation contains a radiation source (i.e. X-rays, gamma rays, electrons, ions, or neutrons) and a detector that is rotated around an axis extending perpendicular from the plane in which the specimen is located.This apparatus enables a cross-sectional 2D or 3D image to be obtained of the internal structures of this object. A central problem in tomographic imaging is the danger of the radiation dose delivered to the patient or biological specimen. Furthermore, obtaining a high-quality image can be problematic because there are often incomplete sets of projection data as a result of mechanical limitations of the employed method. Thus, there is a need for a method that limits the exposure of the subject to potentially harmful radiation that is also accurate, reliable and computationally practical.

INNOVATION

Researchers at UCLA have identified a novel algorithm for creating 3D cross sectional images of an object by the data reconstruction of projections obtained through a tomographic technique. This algorithm improves upon the accuracy of a method using iterative refinement by these same researchers. The use of mathematical constraints in this new algorithm effectively drives the reconstructions to a less noisy state consistent with experimental predictions and physical constraints. The algorithm can be used with any tomographic imaging system that reconstructs an object from its projections. The methodology allows for either higher quality images to be obtained with conventional radiation doses or for reduction of radiation dose without loss of image quality when compared to conventional methods.

APPLICATIONS

- Tomographic imaging data reconstruction

ADVANTAGES

- Image enhancement due to higher spatial resolution, contrast, and signal to noise ratio
- Radiation dose and acquisition time reduction as a result of the fewer number of projections required
- Eliminates interpolative inaccuracies
- Permits parallel computing

STATE OF DEVELOPMENT

The invention has been shown experimentally to yield higher resolution images than produced by conventional reconstruction methods. In addition, dose reductions of 40% or more have been shown to be achievable in X-Ray, CT, and TEM studies.

PATENT STATUS

Country	Type	Number	Dated	Case

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OTHER INFORMATION

KEYWORDS

biomedical, computer software, diagnostic, imaging, process/procedure, algorithm, data reconstruction, tomography

CATEGORIZED AS

- **Imaging**
  - 3D/Immersive
  - Medical
  - Other
- **Medical**
  - Imaging

RELATED CASES

2008-836-0

United States Of America	Issued Patent	8,442,353	05/14/2013	2008-836

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Fast Implementation Of Equally-Sloped Tomography

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