Collimator/Image Reconstruction Molecular Breast Imaging

Published date: Oct. 17, 2018

Technology description

Researchers at UC San Diego have developeda compressive sensing absorber (CSA) for Molecular Breast Imaging (MBI) and Breast Specific Gamma Imaging (BSGI) that will greatly increase scanner efficiency, decrease image acquisition time and allow for ultra-low-dose, high-resolution 2D and 3D molecular breast imaging. The invention uses a novel collimator containing a random pattern of attenuation that allows for detection of many more photons, thus greatly increasing sensitivity, and a compressive sensing reconstruction algorithm which, in combination with the hardware, allows for 3D imaging with a stationary camera head - no moving parts. The invention has a working prototype that has demonstrated the feasibility of image acquisition and reconstruction of a phantom using CSA on MBI gamma camera. The CSA is envisioned as a replacement for the inefficient parallel hole collimator (PHC) on current MBI and BSGI systems.
MBI and BSGI utilize γ-cameras in a mammographic configuration to provide functional images of the breast. Several studies have confirmed that MBI has a high sensitivity for the detection of small breast lesions, independent of tumor type. A large clinical trial compared MBI with screening mammography in over 1000 women with mammographically dense breast tissue and increased risk of breast cancer and showed that MBI detected two to three times more cancers than mammography. Despite these favorable results, BSGI and MBI have not been widely accepted for breast cancer screening due to greatereffective radiation dose compared with mammography. Another disadvantage of MBI is long imaging time, causing discomfort to the patient. Furthermore, while digital breast tomosynthesis (DBT) produces 3D images, resulting in improved cancer detection over mammography, current clinical MBI and BSGI systems produce only 2D images. These disadvantages are due to the use of parallel hole collimator (PHC) with MBI and BSGI, which is inefficient, allowing only gamma rays traveling perpendicular to the detector to be recorded. Furthermore, PHA cannot produce a 3D image with a stationary detector and results in a loss of image resolution with increasing distance between the tumor and the gamma detector.

Advantages

Greatly increased sensitivity and 3D Molecular Breast Imaging with a novel collimator hardware and image reconstruction algorithm compared to current commercial systems that are 2D, have low

sensitivity requiring high radiation dose and do not use image reconstruction. Novel collimator containing a random pattern of attenuation allows for detection of many more photons, greatly increasing sensitivity. Compressive sensing reconstruction algorithm in combination with hardware allows for 3D imaging with a stationary camera head - no moving parts.

Institution

University of California, San Diego