Novel Imaging Technique Combines Optical and MR Imaging Systems To Obtain High Resolution Optical Images

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OTHER INFORMATION

KEYWORDS

Medical imaging, Optical imaging, Small animal imaging, MRI, MR systems, Photo-acoustic, Tomography, PAT, Diffuse Optical Tomography, DOT, PMI, Catheter, Magnetic Resonance Thermometry, Photo-magnetic imaging

CATEGORIZED AS

- **Biotechnology**
  - Health
  - Other
- **Engineering**
  - Engineering
  - Other
- **Imaging**

BRIEF DESCRIPTION

Researchers at the University of California, Irvine have developed a novel high resolution imaging technique, referred to as Photo-Magnetic Imaging (PMI), that combines the abilities of optical and magnetic resonance (MR) imaging systems. Images are created with PMI by heating tissue with a light (e.g. laser) and measuring the resulting temperature change with MR Thermometry. This change in temperature can then be related to a tissue's absorption, scattering, and metabolic properties. PMI addresses the limitations of current optical imaging techniques by providing a repeatable, non-contact, high resolution optical image with increased quantitative accuracy. This technique can be used for a wide-range of applications including but not limited to imaging of small animals for research purposes. This technique may also be used in imaging the tissue and organs of a patient.

FULL DESCRIPTION

A variety of small animal imaging systems allows longitudinal imaging of cancer mouse models and thus the monitoring of natural or perturbed evolution of the processes in vivo in such mouse models. Meanwhile, optical imaging in absorption, fluorescence and bioluminescence mode has opened a new era in whole body small animal imaging. However, the main limitation has been the low resolution and quantitative accuracy of the images due to the highly scattering nature of tissue.

To address this problem, PMI images are captured using the unique contrast of optical imaging, but with the higher resolution achieved from MR imaging. Specifically, the PMI method is an approach for measuring the optical absorption properties of tissue in the near-infrared region of the electromagnetic spectrum. In this technique, tissue is heated with a laser and the MR system is used to measure the resulting temperature change, a value proportional to the tissue's absorption coefficient. Absorption data can then be used to estimate the tissue's metabolic properties and then be used to produce an image. Instead of working independently, the MR and optical imaging modalities work in harmony to offer images that cannot be obtained by either one alone.

SUGGESTED USES

Currently, the technology is being developed for small animal imaging in scientific research. This technology may be used to differentiate benign and malignant tumors for such research purposes. However, the PMI technique may also be developed for use in the imaging the following tissue and organs in patients such as the breast, prostate, ovary, skin, brain, head and neck and extremities such as arm and legs. In addition this technique may be used in catheter based applications.

It has also been suggested that the PMI system could be utilized as an add-on to the currently available MR systems. By utilizing the two techniques in sequence, the combination would provide unique structural and functional MR information along with the high resolution optical images of PMI.

ADVANTAGES

The advantages of this new technique are:

a. Increased Accuracy;

b. Increased Spatial Resolution;

c. No Tissue Contact Required;

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,078,587	07/14/2015	2011-357

TESTING

Phantom testing has been completed.

RELATED CASES

2011-357-0

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