DEEP LEARNING TECHNIQUES FOR IN VIVO ELASTICITY IMAGING

Tech ID: 32216 / UC Case 2021-074-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20240005151	01/04/2024	2021-074

BRIEF DESCRIPTION

Imaging the material property distribution of solids has a broad range of applications in materials science, biomechanical engineering, and clinical diagnosis. For example, as various diseases progress, the elasticity of human cells, tissues, and organs can change significantly. If these changes in elasticity can be measured accurately over time, early detection and diagnosis of different disease states can be achieved.

Elasticity imaging is an emerging method to qualitatively image the elasticity distribution of an inhomogeneous body. A long-standing goal of this imaging is to provide alternative methods of clinical palpation (e.g. manual breast examination) for reliable tumor diagnosis. The displacement distribution of a body under externally applied forces (or displacements) can be acquired by a variety of imaging techniques such as ultrasound, magnetic resonance, and digital image correlation. A strain distribution, determined by the gradient of a displacement distribution, can be computed (or approximated) from measured displacements. If the strain and stress distributions of a body are both known, the elasticity distribution can be computed using the constitutive elasticity equations.

However, there is currently no technique that can measure the stress distribution of a body in vivo. Therefore, in elastography, the stress distribution of a body is commonly assumed to be uniform and a measured strain distribution can be interpreted as a relative elasticity distribution. This approach has the advantage of being easy to implement. The uniform stress assumption in this approach, however, is inaccurate for an inhomogeneous body. The stress field of a body can be distorted significantly near a hole, inclusion, or wherever the elasticity varies. Though strain-based elastography has been deployed on many commercial ultrasound diagnostic-imaging devices, the elasticity distribution predicted based on this method is prone to inaccuracies.

To address these inaccuracies, researchers at UC Berkeley have developed a de novo imaging method to learn the elasticity of solids from measured strains. Our approach involves using deep neural networks supervised by the theory of elasticity and does not require labeled data for the training process. Results show that the Berkeley method can learn the hidden elasticity of solids accurately and is robust when it comes to noisy and missing measurements.

SUGGESTED USES

Non-invasive elasticity characterization of materials for various applications.

ADVANTAGES

Accurate, in vivo elasticity imaging.

RELATED MATERIALS

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Imaging, Cancer Tumors, Elasticity, Elastography

CATEGORIZED AS

- **Agriculture & Animal Science**
  - Animal Science
- **Biotechnology**
  - Health
- **Computer**
  - Software
- **Environment**
  - Sensing
- **Engineering**
  - Engineering
- **Imaging**
  - Medical
  - Other
  - Software
- **Materials & Chemicals**
  - Biological
- **Medical**

» Diagnostics

» Disease: Cancer

» Disease: Women's Health

» Imaging

» Screening

» Software

» **Sensors & Instrumentation**

» Biosensors

» Medical

RELATED CASES

2021-074-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Sinusoidal Surface Serrations On A Bio-Inspired Propeller

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