PURDUE
OFFICE OF TECHNOLOGY COMMERCIALIZATION

Innovation Infosheet

Machine Learning Driven Contouring Technique for High-Frequency Four-Dimensional Cardiac Ultrasound

Track Code: 2021-GOER-69227

Categories:
- Biomedical Engineering
- Computer Technology

Keywords:
- Algorithm
- Biodynamic imaging
- Biomedical Engineering
- Biotechnology
- Cardiovascular Disease
- Computer Technology
- Diagnostic Imaging
- Heart Failure
- Machine Learning
- Medical Diagnostics
- Medical Imaging
- Neural Network
- Patient Care
- Ultrasound
- Ultrasound Imaging

Researchers at Purdue University have developed a new technique for contouring in high-frequency four-dimensional cardiac ultrasounds using machine learning. Cardiac diseases are on the rise, projected to affect over 8 million adults (age 18+) by the year 2030 and contribute to a 127% increase in total heart failure costs of up to $69.7 billion (USD) annually. Purdue researchers have created an algorithm for volumetric/4D ultrasounds for studying cardiac disease that allows for rapid contouring and quantification of regional left-ventricular motion. The computational approach can detect endo- and epi-cardial boundary positions automatically — with sensitivity in 90% of variations — unlike current technologies that require user intervention which can lead to inaccuracy. In testing with ultrasound data from 88 unique patients consisting of 40 images each, 12 distinct anchor points could be detected in 160,000 pixels per image. Normalized cardiac cycles were detected, allowing researchers to develop a deep neural network to train ultrasounds to identify abnormal cardiac patterns. This robust, user-friendly computational design can be implemented in biotechnology applications.

Advantages:
-Rapid Contouring
-Automatic Endo- and Epi-Cardial Boundary Detection
-Enhanced Diagnostic Imaging
-Improved Patient Care

Potential Applications:
-Cardiovascular Diagnostics
-Cardiac Disease Management
-Ultrasound Resolution

Technology Validation: A DNN has been developed to train ultrasound machines to recognize normal and abnormal cardiac cycle patterns as well as rapidly contour 12 key cardial regions and detect endo- and epi-cardial boundaries automatically with 90% accuracy.

Recent Publication:

"Machine Learning Driven Contouring and of High-Frequency Four-Dimensional Cardiac Ultrasound Data"
Journal of Applied Sciences
DOI: 10.3390/app11041690

People:

- Goergen, Craig Jonathan (Project leader)
- Damen, Frederick William
- Lin, Guang
- Newton, David Taylor

Intellectual Property:

Application Date: December 23, 2021
Type: Utility Patent
Country of Filing: United States
Patent Number: (None)
Issue Date: (None)

Application Date: January 25, 2021
Type: Provisional-Patent
Country of Filing: United States
Patent Number: (None)
Issue Date: (None)

Application Date: December 24, 2020
Type: Provisional-Patent
Country of Filing: United States
Patent Number: (None)
Issue Date: (None)

Contact OTC:

Purdue Office of Technology Commercialization
The Convergence Center
101 Foundry Drive, Suite 2500
West Lafayette, IN 47906

Phone: (765) 588-3475
Fax: (765) 463-3486
Email: otcip@prf.org