

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

**Deep learning tool that rapidly segments cardiac structures with 90% sensitivity for disease monitoring.**

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:

## **Technology ID**

2021-GOER-69227

## **Category**

Digital Health &  
Medtech/Medical Image  
Processing  
Digital Health & Medtech/AI in  
Medical Imaging

## **Authors**

Frederick Damen  
Craig Jonathan Goergen  
Guang Lin  
David Newton

## **Further information**

Patrick Finnerty  
[pwfinnerty@prf.org](mailto:pwfinnerty@prf.org)

## **View online**



- 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 cardiac 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

**TRL:** 3

**Intellectual Property:**

Provisional-Patent, 2020-12-24, United States

Provisional-Patent, 2021-01-25, United States

Utility Patent, 2021-12-23, United States

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