World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:19, No:05, 2025

# Unsupervised Echocardiogram View Detection via Autoencoder-Based Representation Learning

**Authors :** Andrea Trevino Gavito, Diego Klabjan, Sanjiv Shah

**Abstract :** Echocardiograms serve as pivotal resources for clinicians in diagnosing cardiac conditions, offering non-invasive insights into a heart's structure and function. When echocardiographic studies are conducted, no standardized labeling of the acquired views is performed. Employing machine learning algorithms for automated echocardiogram view detection has emerged as a promising solution to enhance efficiency in echocardiogram use for diagnosis. However, existing approaches predominantly rely on supervised learning, necessitating labor-intensive expert labeling. In this paper, we introduce a fully unsupervised echocardiographic view detection framework that leverages convolutional autoencoders to obtain lower dimensional representations and the K-means algorithm for clustering them into view-related groups. Our approach focuses on discriminative patches from echocardiographic frames. Additionally, we propose a trainable inverse average layer to optimize the decoding of average operations. By integrating both public and proprietary datasets, we obtain a marked improvement in model performance when compared to utilizing a proprietary dataset alone. Our experiments show boosts of 15.5% in accuracy and 9.0% in the F-1 score for frame-based clustering, 25.9% in accuracy, and 19.8% in the F-1 score for view-based clustering. Our research highlights the potential of unsupervised learning methodologies and the utilization of open-sourced data in addressing the complexities of echocardiogram interpretation, paving the way for more accurate and efficient cardiac diagnoses.

**Keywords :** artificial intelligence, machine learning, unsupervised learning, self-supervised representation learning, echocardiography, echocardiographic view detection
**Conference Title :** ICDLMLUI 2025 : International Conference on Deep Learning and Machine Learning in Ultrasound Imaging
**Conference Location :** Amsterdam, Netherlands
**Conference Dates :** May 13-14, 2025