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| Deep Learning-based automated assessment of reduced left ventricular ejection fraction by echocardiography  **Grigorios Kalliatakis**1#\*, **Georgios Manikis**1 and **Kostas Marias**1  1Computational BioMedicine Laboratory, Institute of Computer Science, Foundation for Research and Technology (FORTH), Heraklion, Crete, 70013, Greece  2Affiliation 2  # Presenting author: Grigorios Kalliatakis, email: gkalliatak@ics.forth.gr  \* Corresponding author: Grigorios Kalliatakis, email: gkalliatak@ics.forth.gr |

abstract

Deep learning is an emerging approach for analysing images but has not yet been widely applied to echocardiography. This work aims for comprehensive computer-assisted echocardiographic interpretation by investigating whether computers can correlate raw imaging data with reduced left ventricular ejection fraction (LVEF), an important prognostic indicator of cardiovascular outcomes [1]. We treat the problem of diagnosing patients with reduced LVEF as a binary image classification task. We utilize the CAMUS publicly available dataset of echocardiograms [2] to train deep learning models. The two classes are balanced with 50.20% of the data representing individuals with EF>45% and 49.8% representing patients with reduced EF ≤ 45%. We implemented an image-only model as a ResNet-18 architecture with global max pooling. The training dataset was augmented with random flips and rotations of our images, while the dropout regularization was applied, and all parameters were trained with the Adam optimizer. To obtain a risk assessment from an entire echo study, we returned the maximum risk assessed among both two-chamber and four-chamber views, for both end systolic and end diastolic frames. The model was trained to diagnose the pathological risk of a specific echo study from any view of the heart. Each image was treated independently at training time, but we took the maximum among images to assess the examination-level performance of the model at test time. We chose the configuration that achieved the highest AUC on the validation set. ResNet18 with a multilayer perceptron (MLP) showed the highest AUC of 0.64. The improvement of augmentations over the standard dataset is significant at the examination-level assessment for both MLP and linear architectures. For most settings, an AUC performance well above 0.60 was achieved, indicating that the proposed DL models can correlate raw imaging data with a marker of LV dysfunction. These results support our hypothesis that once data collection is completed for CARDIOCARE [3], deep learning-based models should have the capacity to predict myocardial alterations induced by cardiotoxicity.

**REFERENCES**

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