# An attention-based deep learning method for right ventricular quantification using 2D echocardiography: feasibility and accuracy

Polydoros Kampaktsis[1], Tuan A. Bohoran[2], Laura McLaughlin[1], Jay Leb S[3], Zhonghua Liu[4], Serafeim Moustakidis[5], Athanasios Siouras[5], Anvesha Singh[6], Rebecca Hahn[7], Gerry P. McCann[6], and Archontis Giannakidis[2]

[1]Columbia University Irving Medical Center
[2]Nottingham Trent University
[3]Columbia University Department of Radiology
[4]Columbia University Department of Biostatistics
[5]Panepistemio Thessalias Tmema Iatrikes
[6]University of Leicester Department of Cardiovascular Sciences
[7]Columbia University Division of Cardiology

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## Abstract

**Aim:** To test the feasibility and accuracy of a new attention-based deep learning (DL) method for right ventricular (RV) quantification using 2D echocardiography (2DE) with cardiac magnetic resonance imaging (CMR) as reference. **Methods and results:** We retrospectively analyzed images from 50 adult patients (median age 51, interquartile range 32-62 42% women) who had undergone CMR within 1 month of 2DE. RV planimetry of the myocardial border was performed in end-diastole (ED) and end-systole (ES) for 8 standardized 2DE RV views with calculation of areas. The DL model comprised a Feature Tokenizer module and a stack of Transformer layers. Age, gender and calculated areas were used as inputs, and the output was RV volume in ED/ES. The dataset was randomly split into training, validation and testing subsets (35, 5 and 10 patients respectively). Mean RVEDV, RVESV and RV ejection fraction (EF) were 163±70ml, 82±42ml and 51±8% respectively without differences among the subsets. The proposed method achieved good prediction of RV volumes ($R^2$=0.953, absolute percentage error [APE]=9.75±6.23%) and RVEF (APE=7.24±4.55%). Per CMR, there was 1 patient with RV dilatation and 3 with RV dysfunction in the testing dataset. The DL model detected RV dilatation in 1/1 case and RV dysfunction in 4/3 cases. **Conclusions:** An attention-based DL method for 2DE RV quantification showed feasibility and promising accuracy. The method requires validation in larger cohorts with wider range of RV size and function. Further research will focus on the reduction of the number of required 2DE to make the method clinically applicable.

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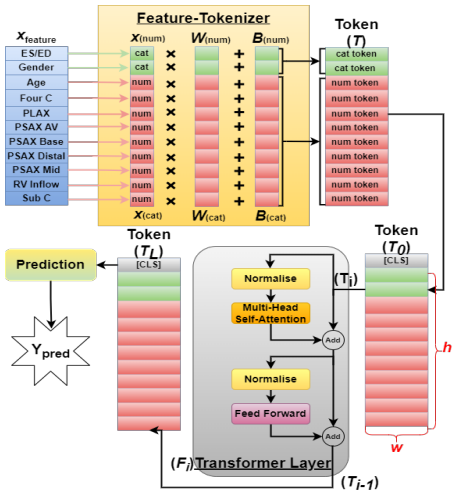
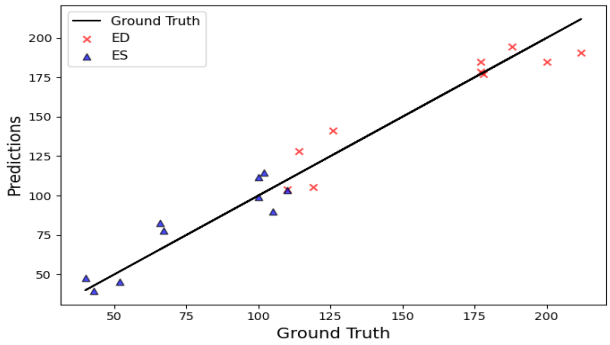
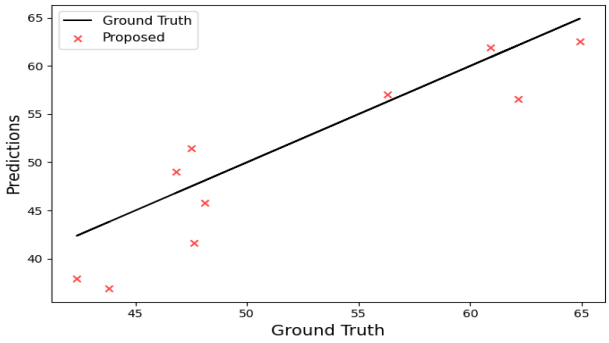


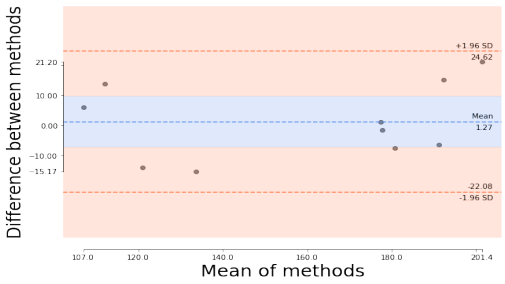
A. Predicted RV volumes vs. ground truth



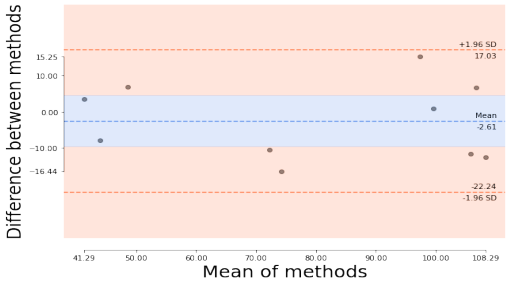

B. Predicted RVEF vs. ground truth



A. End-diastolic RV volume ($cm^3$)




B. End-systolic RV volume ($cm^3$)




C. RVEF (%)