Abstract Title: A non-invasive algorithm for predicting cardiac output using a Convolutional Neural Network

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Abstract Content: Cardiac output (CO) (or stroke volume (SV)) have been estimated based on pulmonary arterial catheters or arterial pressure waveforms (ABP). However, both methods require invasiveness, which may lead to severe complications. In this study, we propose a non-invasive deep learning model for SV prediction. Electrocardiogram (ECG), plethysmography (PPG), mean blood pressure (MBP), pulse pressure (PP), and demographic information were used as input variables. The input waveforms were preprocessed with bandpass filters, and outliers of MBP and PP were excluded. The output variable was the SV from commercially available ABP-based CO device (e.g., EV1000, Edwards Lifesciences, USA). The model was designed as a squeeze-and-excitation-ResNet based model to learn appropriate feature extraction from the 20-second segments of waveforms and other inputs. The model with ECG, PPG, and demographic information showed mean absolute error (MAE) of SV by 12.1ml/beat, limits of agreement (LOA) of SV by 37.4%. When we add MBP and PP as inputs of the model, performance was increased as MAE by 10.0 ml/beat, LOA by 30.9 % (Figure 1). The LOA of the model is close to 30%, which can be an alternative to the existing APCO [1].

Images:

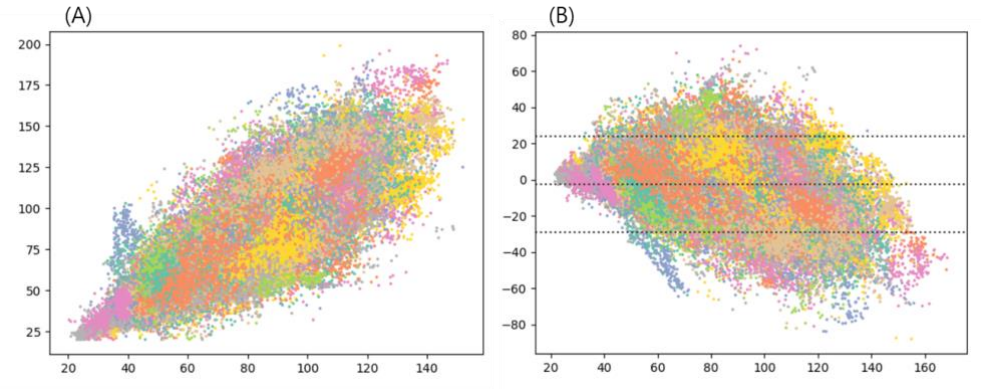

Figure 1. (A) Scatter plot and (B) bland-altman plot between SV from commercially available CO device (x-axis) and predicted SV of our model (y-axis).

References:

[1] Odor PM, Bampoe S, Cecconi M. Cardiac Output Monitoring: Validation Studies-how Results Should be Presented. Curr Anesthesiol Rep. 2017;7(4):410-415. doi:10.1007/s40140-017-0239-0