Assessment of Hemodynamic Parameters Based on Cardio-Electrical and -Mechanical Signals From Non-invasive Wearable Devices

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Heart failure poses a serious threat to patients' lives, and long-term monitoring of patients' hemodynamics can significantly improve treatment outcomes. However, existing equipment for monitoring hemodynamics is expensive. Recent studies have demonstrated the potential of seismocardiography (SCG) and electrocardiography (ECG) in heart failure treatment. Therefore, this study attempts to assess pulmonary artery pressure (PAP) and pulmonary capillary wedge pressure (PCWP) using the combined signals of SCG and ECG. The study proposes a prediction method for PAP and PCWP based on multi-scale feature fusion. Utilizing a multi-task learning framework, different scales of dilated convolutions are applied to extract features from SCG and ECG signals of a single heartbeat at different scales, which are then fused and encoded. Subsequently, global information embedded in the encoded data is used to adjust the weights of each part. Finally, the encoded signals are decoded to predict PAP and PCWP. Training, validation, and testing were conducted on data from 66 subjects. The accuracies of PAP and PCWP within a 20% error margin are 73.99% and 66.23%, respectively, with R2 values of 0.7294 and 0.7607. The experimental results indicate a strong correlation between PAP, PCWP, and SCG and ECG, providing a reference for tracking PAP and PCWP using wearable devices.