Non - Invasive Cardiac Output Estimation Using Machine Learning - Driven Pulse Contour Analysis from PPG Signal

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Abstract

Cardiac output (CO) is a crucial indicator of cardiovascular function, traditionally measured with invasive techniques like thermodilution and pulse contour. These precise measures are technically challenging and non-continuous. The present work proposes a machine learning approach of non-invasive estimation of CO from photoplethysmogram (PPG) signals. The approach relies on low-pass filtering PPG signals and arterial pressure waveform reconstruction using a 1D Convolutional Neural Network (1D-CNN). Cardiac output is approximated from waveform features like systolic peaks and pulse pressure. The system also encompasses backflow detection and valve strength estimation to provide longer term physiological information. It was tested on the BIDMC dataset and demonstrates real-time usefulness, designed to improve patient safety and aid current hemodynamic monitoring.

Keywords

Cardiac output, photoplethysmogram (PPG), pulse contour analysis, non-invasive monitoring, arterial pressure waveform, machine learning, 1D convolutional neural network (1D-CNN), backflow detection, valve strength estimation, realtime biomedical signal processing.