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Conference Abstract

YI 2.1 Pulse Wave Velocity Estimation from the Radial Pulse Waveform using Gaussian Process Regression: A Machine Learning Based Study

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ABSTRACT

Objective and Motivation: Pulse wave velocity (PWV) is known to be associated with vascular ageing, a risk factor for cardiovascular disease (CVD) [1]. The European gold standard measurement of PWV requires an experienced operator to measure pulse waveforms at multiple sites, sometimes together with an electrocardiogram [2,3]. This study aims to estimate PWV from the radial pulse waveform using machine learning.

Methods: Radial pulse waveforms and carotid-femoral PWVs were acquired in 3,082 unselected twins (https://twinsuk.ac.uk). 14 fiducial points on each pulse waveform were extracted using an in-house algorithm [4]. LASSO regression and principal component analysis (PCA) were used to identify the key features (timing and magnitude of the fiducial points) associated with PWV and exclude outliers. Finally, Gaussian process regression was used to estimate the PWV based on those key features only.

Results: Results show that PWV can be estimated from the radial pulse waveform only with an overall root mean squared error (RMSE) of 1.82 m/s (Figure A). Most of the measured PWV values were within the 95% confidence interval range of the estimated PWV. The difference between measured and estimated PWV values increased with the increasing PWV. PWV estimation on a subgroup of twins with a healthy range of blood pressure and PWV values [5] was achieved with a RMSE of 1.38 m/s (Figure B).

Conclusion: In this proof-of-concept study we have shown the possibility of estimating PWV from the radial pulse waveform using machine learning. This approach could make CVD detection more accessible to the wider population.

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