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Pulse arrival time and ballistocardiogram application to blood pressure variability estimation

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Abstract: This work presents a system which estimates blood pressure variability (BPV) via pulse arrival time (PAT) using two distinct methods. Three heart rate estimates are acquired from beat-to-beat time interval extraction of electrocardiogram (ECG), finger photoplethysmogram (PPG), and ballistocardiogram (BCG). Using both ECG and BCG as reference signals, PAT is computed. Since PAT variability (PATV) is correlated to blood pressure variability, the system obtains an estimation of both heart rate variability (HRV) and BPV, parameters which carry vast information to characterize physiological and pathological states. Since BCG has not been studied yet as an alternative to ECG in PAT calculations, this study focus on the correlation of these two PATV estimates.

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I. Introduction

Used in different contexts, several bibliographic references consider heart rate variability both as a diagnostic and outcome estimator of neurological conditions due to the alterations induced by cardiac pathologies in the cardiovascular control mechanisms [1]–[4]. Not only the beat-to-beat HRV is important, but also BPV is a parameter that provides important evidences regarding autonomic cardiovascular regulation [4]. Besides, both of them carry prognostic indications in respect to cardiovascular risks [1], [3], thus requiring truthful measurement of these parameters to avoid misdiagnosis. In recent years, HRV and BPV have been increasingly studied in order to search correspondences between them and the existence of maladies associated with sympathetic and parasympathetic branches of the autonomic nervous system [2], [5], [6].

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