Detection of Heart Rate Turbulence in Photoplethysmographic Signals

Eduardo Gil*, Leif Sörnmo and Pablo Laguna

GTC
Aragón Institute of Engineering Research, IIS, University of Zaragoza, Zaragoza, Spain / CIBER de Bioingeniería, Biomateriales y Nanomedicina (CIBERBBN)

In this study, alterations in the cardiovascular system caused by ventricular premature beats (VPBs) are investigated by analyzing the photoplethysmographic (PPG) signal. A simple algorithm for PPG-based detection of VPBs is devised and evaluated, and then employed for the analysis of heart rate turbulence (HRT), here labelled pulse rate turbulence (PRT). The pulse transit time is also studied as it constitutes the main difference between HRT and PRT. The data sets included a total of 3872 VPBs and 13169 normal beats. The results showed that VPBs can be detected from the PPG signal with a sensitivity of 92.8%, a specificity of 99.8% and an accuracy of 99.3%, using six features and a simple linear classifier. The shape of PRT was found to resemble that of HRT, the latter type of turbulence resulting from ECG-based analysis, suggesting that PRT analysis can be used as a replacement for HRT analysis when the ECG is not available.