Secondary Peak Detection of PPG Signal for Continuous Cuffless Arterial Blood Pressure Measurement

The arterial blood pressure (ABP) is one of the most important physiological parameters for health monitoring. Most of the blood measurement devices in the market determine the ABP through the inflation and the deflation of a cuff controlled by a bladder. This method is very uncomfortable for most of the users and may even cause anxiety, which in turn can affect the blood pressure (BP) (white coat syndrome). This paper investigates a cuffless nonintrusive approach to estimate the BP. The main idea is to measure the pulse transit time (PTT), i.e., the delay between the R-peak of the electrocardiogram (ECG) signal and the following peak of the finger photoplethysmograph (PPG) signal. The main problem of this approach is that when the dicrotic notch of the PPG signal is unobservable, the position and the amplitude of the main peak of the PPG signal will be changed. As a result, the correlation between the BP and the PTT can be affected. To overcome this problem, three types of secondary peak detection methods are designed to reveal the secondary peak from the original PPG signal. Actual ECG, PPG, and the BP measurements extracted from the Multiparameter Intelligent Monitoring in Intensive Care II database that contains clinical signal data reflecting real measurements are used. The results verify that the proposed detection methods improve the correlation relationship between the BP and the PTT, and demonstrate that the adjusted PTT can be used as an indicator of the ABP by removing the dicrotic notch impact on the PPG signal.