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Wavelength Selection for Portable Noninvasive Blood Component Measurement System Based on Spectral Difference Coefficient and Dynamic Spectrum

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ABSTRACT

Noninvasive blood component analysis by spectroscopy has been a hotspot in biomedical engineering in recent years. Dynamic spectrum provides an excellent idea for noninvasive blood component measurement, but studies have been limited to the application of broadband light sources and high-resolution spectroscopy instruments. In order to remove redundant information, a more effective wavelength selection method has been presented in this paper. In contrast to many common wavelength selection methods, this method is based on sensing mechanism which has a clear mechanism and can effectively avoid the noise from acquisition system. The spectral difference coefficient was theoretically proved to have a guiding significance for wavelength selection. After theoretical analysis, the multi-band spectral difference coefficient-wavelength selection method combining with the dynamic spectrum was proposed. An experimental analysis based on clinical trial data from 200 volunteers has been conducted to illustrate the effectiveness of this method. The extreme learning machine was used to develop the calibration models between the dynamic spectrum data and hemoglobin concentration. The experiment result shows that the prediction precision of hemoglobin concentration using multi-band spectral difference coefficient-wavelength selection method is higher compared with other methods.

Keywords: Dynamic spectrum; Noninvasive spectrum; Spectral difference coefficient; Wavelength selection