

Real-Time Heart Rate Monitoring Using Smartphone Camera Based on PPG Signal and CNN

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Abstract: *The continuous observation of heart rate is vital for assessing cardiovascular health and detecting early signs of medical conditions. Traditional heart rate monitoring devices, although accurate, are often costly and require physical contact with the body. To overcome these limitations, this paper presents a real-time and contactless heart rate monitoring system that utilizes a smartphone camera to capture fingertip videos. The system applies the photoplethysmography (PPG) principle to identify minute color variations in the skin that occur due to blood flow changes during each cardiac cycle. The recorded video frames are preprocessed to enhance signal clarity through filtering, normalization, and principal component analysis, after which a convolutional neural network (CNN) is employed to estimate heart rate values. Experimental results indicate that the proposed method achieves reliable performance with a mean absolute error of 7.01 beats per minute and an average error rate of 8.3% when compared with readings from a standard pulse oximeter. This approach demonstrates the feasibility of using everyday mobile devices for accurate, affordable, and real-time heart rate measurement, promoting convenient health monitoring without external sensors or medical-grade instruments.*

Keywords: Heart rate monitoring, photoplethysmography (PPG), convolutional neural network (CNN), smartphone camera, blood volume pulse (BVP), physiological signal processing, non-invasive measurement, deep learning, real-time estimation, health informatics

