

Blood Volume Pulse Extraction for Non-Contact Photoplethysmography Measurement from Facial Images

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Abstract : According to WHO estimation, 38 out of 56 million (68%) global deaths in 2012, were due to noncommunicable diseases (NCDs). To avert NCD, one of the solutions is early detection of diseases. In order to do that, we developed 'U-Healthcare Mirror', which is able to measure vital sign such as heart rate (HR) and respiration rate without any physical contact and consciousness. To measure HR in the mirror, we utilized digital camera. The camera records red, green, and blue (RGB) discoloration from user's facial image sequences. We extracted blood volume pulse (BVP) from the RGB discoloration because the discoloration of the facial skin is accordance with BVP. We used blind source separation (BSS) to extract BVP from the RGB discoloration and adaptive filters for removing noises. We utilized singular value decomposition (SVD) method to implement the BSS and the adaptive filters. HR was estimated from the obtained BVP. We did experiment for HR measurement by using our method and previous method that used independent component analysis (ICA) method. We compared both of them with HR measurement from commercial oximeter. The experiment was conducted under various distance between 30~110 cm and light intensity between 5~2000 lux. For each condition, we did measurement 7 times. The estimated HR showed 2.25 bpm of mean error and 0.73 of pearson correlation coefficient. The accuracy has improved compared to previous work. The optimal distance between the mirror and user for HR measurement was 50 cm with medium light intensity, around 550 lux.

Keywords : blood volume pulse, heart rate, photoplethysmography, independent component analysis

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