A Novel & Robust Computer Vision-Based Algorithm for Heart Rate Estimation Using Cameras

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Heart rate estimation using cameras provides a cost-efficient, robust, and non-invasive heart rate detection methodology. Faces create subtle fluctuations in facial redness as a result of heart contractions sending waves of oxygenated blood to the face. Cameras are able to detect these changes and use them to calculate heart rate. Prior methods prove to be inaccurate when tested on databases that involve drastic head motions and changes in illumination. The purpose of this research is to develop a novel algorithm for heart rate estimation that performs efficiently regardless of these parameters. A facial feature-point tracking was used in order to maintain the facial structure despite head movements. Three raw RGB signals of facial skin were then extracted. Independent Component Analysis was then used over the three signals to extract a mutually independent blood volume pulse signal. Temporal filtering was performed over the BVP signal and a peak detection method was used to extract the highest confidence frequency at which there existed a heart rate signal. This methodology was tested on the open-source MAHNOB-HCI database for accuracy. The facial feature tracking method proved to be beneficial in extracting a more accurate heart rate regardless of head motions. However, the illumination removal method was not robust enough when tested on more diverse backgrounds. This research has proved the possibility of creating a robust algorithm that performs thoroughly regardless of head movements; thus developing an applicable technology. Heart rate estimation using cameras is one step in creating a globally accessible mobile healthcare model.

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