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Multivariate biosignal acquisition to assess the potential of remote photoplethysmography

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Introduction

Recently, non-contact plethysmography (rPPG, remote PPG) has attracted wide attention. By using cameras, rPPG acquires information on the hemodynamic activity from surface-near vessels. Besides the possibility of a contact-free measurement its non-reactive nature and its explanatory power render the rPPG an interesting field.
However, as structured experiments are very complex the state of research still must be denoted as experimental. Aiming at a deep characterization of the rPPG and its potential, we implemented a measurement setup which allows a synchronous recording of high-resolution rPPGs and conventional biosignals. This contribution summarizes the state of the art concerning the rPPG and gives an extensive insight into the measurement setup which was built up.

Methods

The measurement setup allows for facial rPPG recordings from different measurement perspectives. The rPPG is recorded by RGB cameras at sampling frequencies of up to 250 Hz (10 bit per channel, 160x80 pixels). Moreover, the measurement setup includes an infrared camera and various biosignals (ECG, conventional PPGs, respiration). The synchronisation between the measurement devices is accomplished by an analogous triggering mechanism. Data handling on the measurement PC is achieved by custom C++ software optimized for high throughput.

Results

Concerning technical aspects, the setup has shown to synchronize accurately and to be able to handle the huge amounts of incoming data (at least 0,85 GB/min are produced by each RGB camera). Regarding to the signals' content, mean heart rates (HR) are easily deducible at rest. By incorporating real-time motion tracking HR calculations have been successful even during smooth intermitting movements.

Conclusion

The measurement setup allows a deep characterisation of the rPPG and its potential use. Our system thus constitutes the basis for studies beyond the mean HR, e.g. the extraction of single heart beats, the assessment of the microcirculation and the analysis of blood flow velocity and blood distribution.