UNIVERSITÄT ZU LÜBECK

TECHNISCHE HOCHSCHULE LÜBECK

Master thesis

Topic: Leveraging ECG Artifacts from Surface EMG Recordings for Monitoring Respiration on Embedded Systems

Summary:

Monitoring respiration is important in clinical and recreational settings to obtain information about the human body. Algorithms for ECG-derived respiration have been the subject of the scientific discourse for some time. They may be used to develop devices that can evaluate both cardiac and respiratory activity without the need to attach additional sensors to the patient besides the ECG electrodes.

In the present thesis, various algorithms for reconstructing a surrogate respiratory signal from cardiogenic artifacts that occur during surface EMG recordings are compared on clinical data. The results are used to develop a real-time online implementation in C++ on an ARM® microcontroller.

The best single method achieves a median correlation of 0.85 with tidal volume. Using a data fusion approach on the four best algorithms, a median correlation of 0.89 with tidal volume across all patients is achieved. In addition, effects observed in clinical data are described that indicate that a change in intrathoracic impedance may not be the main cause of respiration-induced ECG amplitude modulation.

The effects observed in the clinical data have substantial implications for other studies, such as those attempting to diagnose obstructive sleep apnea based on ECG-derived respiration. The results of this study suggest that this may not be possible with the respiration-induced amplitude modulation.

Author: Benedikt Stepanek
Supervisor: Prof. Dr. Philipp Rostalski
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