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NewbornCare RTD 2013

FNSNF

Camera-Based Respiration Monitoring

csem

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Introduction

Nowadays, the **monitoring** of babies in **neonatal intensive care** units is based on wired sensors measuring parameters such as **respiratory rate (RR)** and **heart rate (HR)**. However, the placement of **electrodes** causes a **high discomfort** (due to the **delicate skin** of neonatal babies) and often leads to **false alarms** (**detaching** sensors).

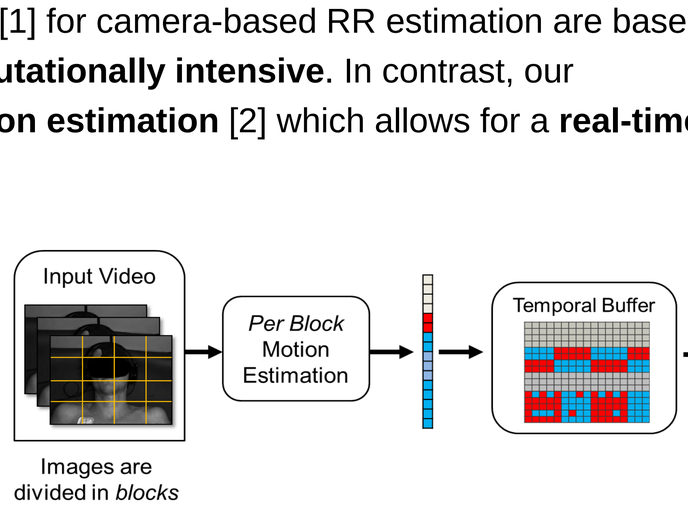
In the scope of the *NewbornCare* project we aim at getting rid of wired sensors by **estimating** both **RR** and **HR** in a **contactless** fashion via a simple **video camera**. In the current work we present the preliminary results for a real-time capable RR monitor. In the long term, this solution is expected to reduce false alarms and increase the comfort of patients and care staff.

Methods

Many of the **previously reported approaches** [1] for camera-based RR estimation are based on optical flow computation and are thus **computationally intensive**. In contrast, our approach uses a **simple** projection-based **motion estimation** [2] which allows for a **real-time implementation**.

Two different algorithms are used to estimate the RR from subtle thorax movements:

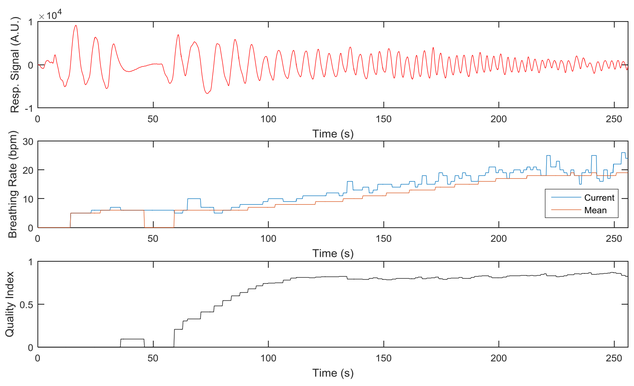
(A) Frequency domain-based algorithm
(B) Time domain-based algorithm



Dataset used:

- 4-minute recordings from **9 adult volunteers**
- in **artificial light/darkness** using **RGB-/NIR-camera**

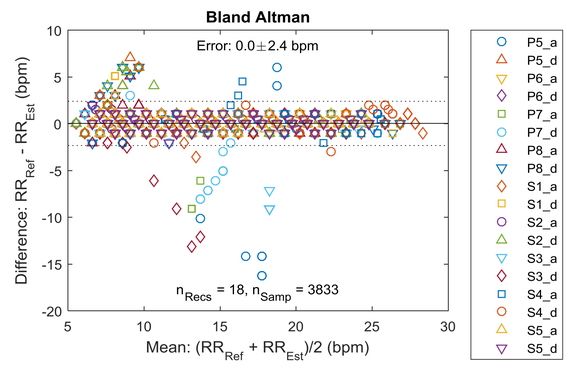
Results and Discussion

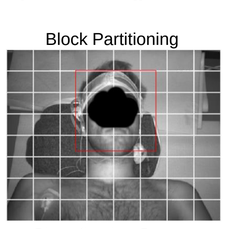


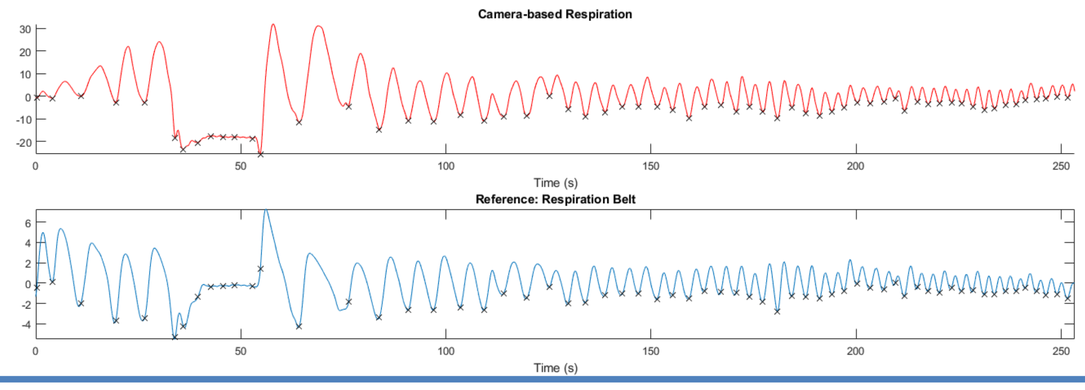
- The frequency domain-based approach shows a lower bias and error than the time-domain based approach
- The time domain-based approach shows a higher delay but provides the ability for single breath detections

(A) Frequency domain-based

- Error: 0.0 ± 2.4 bpm
- Delay: approx. 10s
- Real-time capable

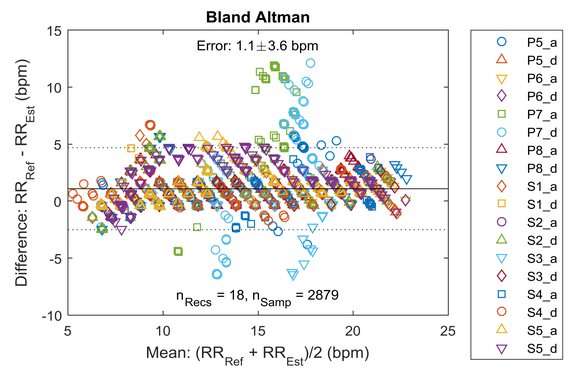






(B) Time domain-based

- Error: 1.1 ± 3.6 bpm
- Delay: approx. 35s
- Single breath detection
- Implemented and running in real-time



Conlusion

In the current work we present two algorithms which allow for a **continuous** and **contactless monitoring** on **respiratory rate (RR)** via a video **camera** in **real time**. **Future work** necessitates the **improvement** of the algorithms to **suppress non-respiratory movement** or **detect** long **apnea sequences**. This should be followed by the evaluation of the algorithm performance on an extended database and in particular on neonatal data.

References: [1] Janssen, R et al. *Physiological measurement* 37.1 (2015). [2] Bartula, M et al. *IEEE EMBC 2013*, (2013)

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