Real-time Adaptive Monitoring of Vital Signs for Clinical Alarm Preemption

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1. Objective
To enable prediction of clinical alerts via joint monitoring of multiple vital signs, while enabling timely adaptation of the model to particulars of a given patient.

2. Overview of the Vital Sign Monitoring System
Novelty of approach
• Unsupervised signal segmentation
• Tracking of multiple vital signs
• Models online-adaptable using patient-specific feedback signals
• Models incorporate effects of medication on state changes
• Models can incorporate expert feedback

3. Model
A = alarms observed when active
H = current state given previous states of multiple vitals
T = vector of administered meds

V = observed vital signs
S = signal state learned from vitals

4. Results
Alarm Prediction: 10 minutes in advance
Online adaptation of the model to patient data improves accuracy, as does inclusion of medication in the model.

5. Conclusions
• We prototyped a probabilistic model that predicts heart failure alarms from vital signs
• The system is able to learn the key parameters from data (state and temporal resolution)
• The system enables real time, incremental learning of more accurate personalized models

6. Future Work
• Identify anomalies
• Integrate expert feedback
• Incorporate prediction in wearable system

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