Title: Personalizing alarms for patient monitoring in hospital settings with artificial intelligence

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Abstract
Generating accurate vital sign alarms that notify the clinicians about changes in a patient's state is an essential function of patient monitoring in critical care. Currently, most of the alarms are irrelevant, meaning, they do not require an intervention from the clinicians. Frequent, mostly irrelevant alarms lead to a phenomenon often referred to as alarm fatigue. Alarm fatigue can delay reaction to clinically relevant alarms which compromises patient safety. The aim of this work is to explore how artificial intelligence could be used to alleviate alarm fatigue in critical care by reducing the number of irrelevant alarms.

In hospitals, alarms are generated when one of the measured parameters, e.g., heart rate, respiration rate, peripheral oxygen saturation or blood pressure, exceeds a predefined threshold. The alarm thresholds are initially set to default values which are not suitable for every patient, creating a lot of irrelevant alarms. Previous solutions for optimizing threshold alarms include adding time delays and using different limits for age groups. In this work, the goal is to optimize alarms using supervised machine learning (ML) algorithms that differentiate between relevant and irrelevant alarms.

The first part of the work includes a systematic literature review on computational solutions in alarm management. Secondly, ways to utilize open-access intensive care unit databases, like MIMIC-IV [1], is explored because training ML algorithms requires a large amount of data. Supervised ML also requires annotations, but the available databases rarely include information on alarm relevance. For this reason, an automatic ML-based annotator has been developed.

References
[1] Johnson, A., Bulgarelli, L., Pollard, T., Gow, B., Moody, B., Horng, S., Celi, L. A., & Mark, R. (2024). MIMIC-IV (version 3.1). *PhysioNet*. RRID:SCR_007345. https://doi.org/10.13026/kpb9-mt58