Information Systems Design Considerations for Reducing Alarm Fatigue in ICU

TREO Talk Paper

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Abstract

Medical device alarms are a mechanism for notifying clinicians about deterioration patient conditions. However, alarm fatigue, which refers to the desensitization of clinicians to device alarms, is a major issue in hospitals and especially in intensive care facilities where a high number of medical devices are typically used to monitor critical patients (Ruskin & Hueske-Kraus, 2015). Alleviating alarm fatigue is an important problem since it can lead to lower response times and ultimately affect patient safety (Ruskin & Hueske-Kraus, 2015). A number of approaches have been proposed for alleviating the problem of alarm fatigue (Winters et al., 2018). Many of the potential solutions are in the domain of information systems and include the design of new algorithms, interfaces, and information routing policies. Given the low rate of accuracy in many types of device alarms, there is a significant scope to improve the accuracy using machine learning and data fusion techniques (Shrestha & Sarnikar, 2014). Another mechanism for alleviating alarm fatigue is role-based routing of alarms based on the nature of the alarm.

While new machine learning algorithms can potentially reduce false alarms in aggregate, machine learning algorithms are seldom 100% accurate and are likely to filter out true alarms as well. Moreover, the performance of alarms can vary significantly across different contexts. In order to assess the potential for implementing either the new algorithmic or the role-based routing approaches, it is first necessary to study the relative advantage (Yang, Kankanhalli, Ng, & Lim, 2013) of such systems impact varying performance of such algorithms and identify the threshold at which implementation of new machine learning based algorithms can be considered a viable option.

In this research, we use modeling approaches to study the workflow and cognitive processes involved in ICU management (Gupta & Sharda, 2013) and the impact of the performance of machine learning algorithms, alarm routing policies and staffing models on patient safety and identify minimum thresholds for machine learning performance and optimal routing policies for alarms under various staffing models to improve patient safety. The results of this research will help design information system solutions that include software (machine learning algorithms and performance thresholds), people (staffing models) and procedures (routing policies) for solving the alarm fatigue problem.

References


