RESEARCH

Reduction of Alert Fatigue with Decision Analysis using Boosting Dynamics and Bayesian Methods

Gobind Singh[??][*][†], Boaz Avitall[??]
and Hui Lu[??]

[*]Correspondence: gsingh6@uic.edu
[??]Department of Bioengineering,
University of Illinois at Chicago,
808 S. Wood St., Chicago, US
Full list of author information is
available at the end of the article
[†]Equal contributor

Abstract

Background: The rate of Alert Fatigue is defined as the number of alerts ignored by clinical staff. Normally, alerts are generated, independent of context, by any number of devices or systems.

Objective: (1) To test our hypothesis that the dynamical weights of boosting associated with nearer to boundaries classification, relates to clinical points of interest, (2) to increase the number of alerts relating to care and management(3) to provide criteria for meaningful medical use relating to effect size, feature variability, and group differences.

Methods: Two data sets were obtained. Alert classification labels are defined using bayes credible intervals, association mapping, generative mixture, and expert priors using the roulette method. Prior distribution over the boosting weights dynamics, alert classification, is determined using kernel density estimator. Expert prior distribution for alert classification, are determined with a trained cardiologist using the roulette method. Boosting is calibrated over the two groups, ICU and at-home telehealth. Validation of prior estimates is determined through convergence of posteriors, between large ICU and small telehealth data-sets. The overlap between the joint posterior distriubtions of the hard vs easy points is what determines statistically significant difference. Power curve analysis of effect size is determined. Causal modeling of time of day, gender, and geography are also explored. A hierarchical model over top alert-type features is explored. A loss likelihood function for the prediction of care is defined as the sum over a probability distribution of the number of alerts, the distribution of time between alerst, using a weibull prior, and the predicted number of alerts not yet seen.

Keywords: boosting, empirical bayes methods, meaningful clinical use, alert fatigueboosting; bayesian methods; meaningful clinical use; alert fatigue

Introduction

Medical alerts have been shown to provide positive benefit: such as reduced blood sugar variability [?], and improved prescribing safety [?]. Currently, the extent of preventable medical error is estimated at 40,000 fatalities per year [?]. The need for improved medical alerts has been recognized in a recent Joint Commission and FDA statement. The percentage of alerts currently being ignored, or alert fatigue, is estimated at 70-80% [?]. The purpose of this study is to link model complexity with visual information for a clinically meaningful alert. Recently, we were involved with a telehealth, at-home monitoring study, which recorded patient vital sign readings, twice daily, for an approximate several month interval. A publicly available