ICU
MANAGEMENT & PRACTICE

## Supervised machine learning predicts CLABSI

Machine learning has proven to be useful for developing prediction models for outcomes in intensive care unit patients. A new study comparing machine learning techniques for predicting central line-associated bloodstream infection (CLABSI) shows supervised artificial intelligence can accurately predict CLABSI in patients admitted to the ICU. Early identification of patients at risk of developing CLABSI has implications for quality, cost, and outcome improvements.

"Comparing different machine learning algorithms across a range of related outcomes demonstrates advantages of certain algorithms over others. Specifically, gradient boosted trees allows for identifying the most important variables and can help guide further efforts to prevent infections," the study authors write. "Utilising the predictive models in this study has implications for outcome, quality, and cost improvements."

Incidence of CLABSI has proven difficult to predict and has been associated with increased mortality and poor ICU working environments. An estimated 30,100 CLABSIs occur in the United States each year.

Supervised machine learning (ML) involves the use of a training set of data to produce a function that can be used to predict a labelled outcome. Applications of supervised ML have shown to be highly-accurate for various predictions including outcomes in surgery and burn wound healing. Applying ML concepts to the ICU has also proven useful for discerning clinically relevant vital sign alarms and predicting clinical deterioration.

In this study, a team of researchers from the University of Miami Miller School of Medicine (Miami, FL) used illness severity scores and comorbidities provided to train artificial intelligence classifiers. These classifiers were highly accurate for predicting CLABSI and mortality.

For this research, investigators searched the Multiparameter Intelligent Monitoring in Intensive Care III (MIMIC-III) database for all ICU admissions. The variables included six different severities of illness scores calculated on the first day of ICU admission with their components and comorbidities. The outcomes of interest were in-hospital mortality, central line placement, and CLABSI. Predictive models were created for these outcomes using classifiers with different algorithms: logistic regression, gradient boosted trees, and deep learning.

There were 57,786 total hospital admissions and the mortality rate was 10.1%. There were 38.4% patients with a central line and the rate of CLABSI was 1.5%. The classifiers using deep learning performed with the highest AUC for mortality, $0.885 \pm 0.010$ ($p < 0.01$) and central line placement, $0.816 \pm 0.006$ ($p < 0.01$). The classifier using logistic regression for predicting CLABSI performed with an AUC of $0.722 \pm 0.048$ ($p < 0.01$).

The low values for sensitivity and specificity for the logistic regression classifier suggests that parameter optimisation could improve this classifier's performance.

According to the authors, "this study demonstrates the ability of using machine learning to easily design a predictive model for CLABSI using readily available patient variables. Incorporating such predictive models in ICU protocols has the potential to further reduce hospital acquired infections by early identification of patients at risk for these preventable complications."

Areas of further research include creating an adaptive algorithm that can be applied to patients as they progress through the ICU stay. The authors say such a model should be able to more precisely predict a CLABSI event before it occurs.

Source: Journal of Critical Care
Image Credit: Pixabay

Published on : Tue, 6 Mar 2018