

Real-Time Predictive Analytics for Earlier Intervention of Hemodynamic Instability

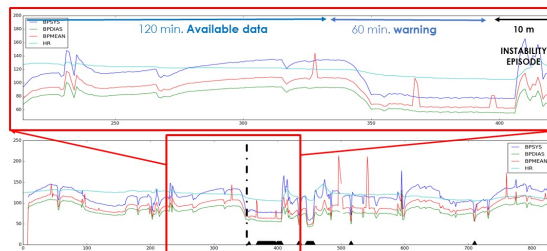
Background, Motivation, and Need

Hemodynamic instability is considered one of the most critical events that require effective and prompt intervention in the intensive care unit (ICU). It is one of the major reasons for ICU recidivism, which causes longer length of ICU stay. It is most commonly associated with an abnormal or unstable blood pressure (BP), especially hypotension, or more broadly associated with inadequate global or regional perfusion. Inadequate perfusion may result in damage of vital organs.

The unmet medical need is earlier prediction of physiologic deterioration of patients. This need could be met with an 'intelligent' patient monitoring software. Current patient care monitors are not capable of learning predictive models. They rely on experienced-based judgments from clinicians and nurses who are made aware of abnormal clinical trends only when a parameter exceeds a preset threshold. A widely recognized challenge is that pediatric patients with potentially life threatening injuries or infections often do not have obvious or typical signs suggesting that their injuries or illnesses are severe.

Contribution and Innovation

Using clinical data (demographics, vital signs, medications, etc.) of ICU patients in three different hospitals, we developed and evaluated machine learning algorithms that: 1) Extract multiple statistical features from multivariate time series of vital signs; 2) Select the most relevant features out of the set of extracted features; 3) Induce classification models for early and accurate prediction of instability episodes using the selected features; 4) Use temporal ensemble methods to aggregate predictions of multiple time-based learners.



Instability Episode Prediction

Product and Its Potential Market

A software system connected (locally or remotely) to a clinical information system and vital signs monitors in various intensive care settings such as: 1) Intensive Care Unit (ICU) at a hospital; 2) Emergency Room (ER) at a hospital; 3) Intensive Care Ambulance; 4) Intensive Care at Home service; 5) Military Intensive Care Unit. The patient monitoring market is expected to reach USD 27.71 Billion by the end of 2020, growing at a CAGR of around 5.8% from 2016 to 2021¹.

Project and Patent Status

The algorithms have already been designed, implemented, and tested. Currently, the algorithms are being evaluated retrospectively on the available clinical datasets and enhanced accordingly. Next, the developed algorithms should be encapsulated into an information system with a graphical user interface (GUI) to allow a prospective evaluation in a clinical setting. Several provisional patent applications will be submitted to protect this product. This is a joint project of Ben-Gurion University of the Negev, Beer-Sheva, Israel and Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA.

Leading Researcher

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¹ <https://www.mordorintelligence.com/industry-reports/global-patient-monitoring-market-industry>