# A Hypotensive Episode Predictor for Intensive Care Based on Heart Rate and Blood Pressure Time Series

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In the intensive care unit (ICU), prompt therapeutic intervention to hypotensive episodes (HEs) is critical in order to avoid end-organ damage. In the stressful context of busy ICUs, advance alerts that can prospectively identify patients at increased risk of developing an HE in the next few hours would be of considerable value. Following this rationale, the objective of this study was to develop an automated, artificial neural network HE predictor for binary classification (normotensive vs. hypotensive) based on heart rate and blood pressure time series. Training and test data were compiled from 1,357 adult ICU stay records in the MIMIC II database. As many examples as possible were compiled from each record, provided that their time series quality was satisfactory. The gap between prediction time and the onset of the 30-minute target window was varied from 1 to 4 hours. A 30-minute observation window preceding the prediction time provided input information to the predictor. Various features were extracted from heart rate, mean arterial blood pressure, and pulse pressure time series. Feature space dimensionality was reduced via principal component analysis (PCA). While individual gap sizes were evaluated independently, weighted posterior probabilities based on different gap sizes were also investigated. The results showed that prediction performance degraded as gap size increased, and that the weighted voting scheme induced negligible performance improvement. Low PPVs were attributable to the overwhelming imbalance between the two groups. Overall prediction performance was promising with 1 hour gap, and the best mean area under ROC curve was 0.934. The nature of the data compilation and cross-validation promises similar prediction performance in a real-time clinical trial.