Innovation in Emergency Care
Artificial Intelligence and Early Prediction of Cardiac Arrest

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Purpose

This research aims to develop an artificial intelligence (AI) model designed to outperform the conventional Modified Early Warning Score (MEWS) in predicting in-hospital cardiac arrest (IHCA). The integration of this emerging technology holds the potential to significantly enhance the decision-making capabilities of Physician Assistants (PAs) and other healthcare professionals within the Emergency Department (ED)

Introduction

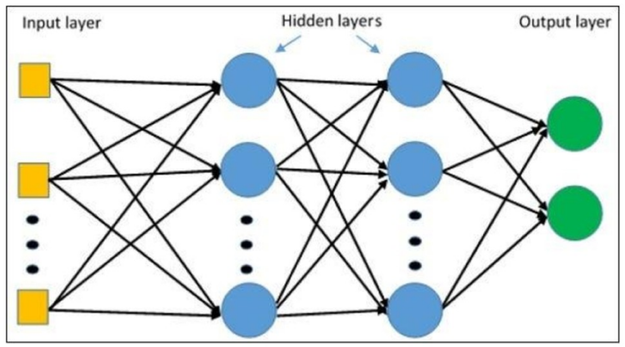
- Over 290,000 cases of IHCA in the U.S. annually
- 10% - 20% of all IHCA occur in the ED
- MEWS, a weighted track and trigger system developed in 1997, is commonly used today to detect clinical deterioration and IHCA
- Multilayer perceptron (MLP), a subset of artificial intelligence, offers the potential for more precise IHCA prediction
- Integrating AI models into the ED can enable early intervention and potentially reduce IHCA rates

Study Population

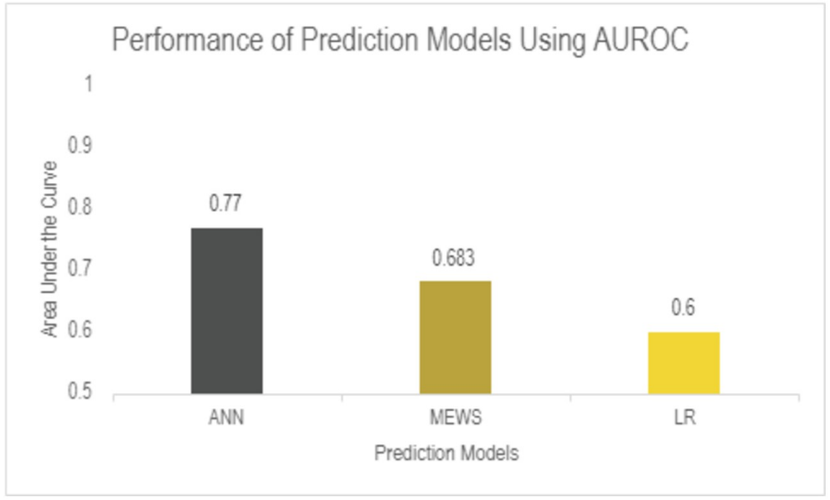
- Medical Information Mart for Intensive Care (MIMIC) IV-ED database
- 448,972 ED encounters at Beth Israel Deaconess Medical Center from 2011 to 2019
- All adult patients (≥ 18 yr old) were eligible for inclusion. Patients were excluded if they presented in active cardiac arrest and those with less than 10 data points
- Primary outcome: IHCA as defined by ICD-10 codes I46.2, I46.8 and I46.9

Methods

- Retrospective secondary analysis of MIMIC IV-ED database using a MLP artificial neural network (ANN) model
- The MLP model was trained using clinical features, including age, gender, and dynamic changes in vital signs prior to IHCA. Data divided into 70:30
- Model performance was evaluated with the area under the receiver operating characteristic curve (AUROC), sensitivity and specificity



Initial Results



Physician Assistant Application

The growing acuity of patients in the ED, coupled with the expanding responsibilities of PAs, emphasizes the critical need for an accurate method enabling PAs to recognize potential IHCA promptly. The MEWS had demonstrated limitations with low sensitivity and high false positive rates, making it less reliable when urgent clinical decisions must be made. This underscores the importance of implementing innovative solutions to enhance patient outcomes within this challenging healthcare setting.

Implications

This study endeavored to improve the accuracy of early cardiac arrest detection in the ED. Our MLP model can potentially improve IHCA prediction compared to the MEWS. This study highlights the potential for the early prediction of IHCA using AI. PAs can benefit from AI through improved decision-making, early detection and diagnosis, enhanced triage, and resource optimization.

References