Early Prediction of Cardiac Arrest Using Neural Networks

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PURDUE UNIVERSITY | The Data Mine

Introduction

The healthcare industry has demonstrated remarkable technological advances over the last decade. However, despite these gains, the incidence of in-hospital cardiac arrest (IHCA) continues to increase. Annually, more than 290,000 patients suffer from an IHCA, with only approximately 26% surviving to discharge. Research demonstrates that 18% - 66% of IHCA are preventable.

Vital signs are objective clinical measures of a patient's health. Especially key is the complicated interaction between these vital signs prior to cardiac arrest. Research has demonstrated that machine learning models, such as an artificial neural network, can discern patterns within vital signs to accurately predict IHCA.

Purpose

This research aims to develop an artificial neural network that can predict IHCA using age, gender, race, and vital signs.

Study Population

- Data gathered from the Medical Information Mart for Intensive Care Emergency Department (MIMIC-IV ED) dataset
- 448,972 adult Emergency Department admissions

Methods

Data Preparation

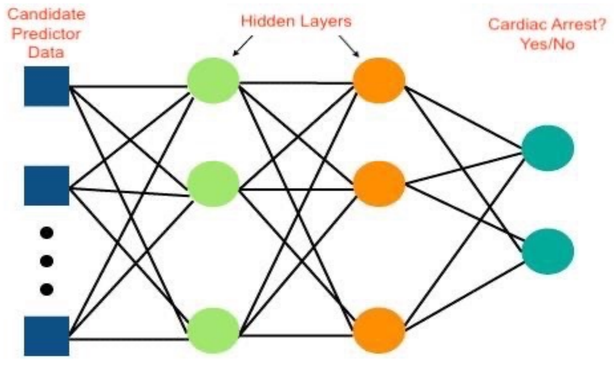
- Obtaining candidate predictor and ICD code information for each patient from the dataset
- Excluding outliers and creating a consistent labeling system for racial categories based on NIH definitions
- Taking the data and concatenating it into a NumPy array that can be interpreted by our model

Model Development

- Hybrid multilayer perceptron (MLP) and long–short–term memory (LSTM)
- Stratified K-fold splitting with separate validation and testing splits

Performance Analysis

A comparison between the neural network model (MLP-LSTM) and logistic regression will be reported. Models will be evaluated based on precision performance based on the area under the receiver operating characteristic curve (AUROC).



Results

Results to be determined with analysis.

Implications

- Potential to reduce morbidity and mortality
- Improve the early recognition of IHCA
- Implementation of model into portable, low-cost, and easy-to-use bedside device

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