PREDICTIVE ANALYTICS

SEPSIS DISEASE PREDICTION

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MOTIVATION

Sepsis is a major cause of morbidity and mortality worldwide. It is estimated that more than 1.7 million people develop sepsis in the United States each year, and around 270,000 die as a result. Despite advances in medical technology and treatments, sepsis remains a challenging condition to manage, in part due to difficulties in early diagnosis. The motivation for this project is to develop a more accurate and timely approach for predicting sepsis onset, thereby improving patient outcomes and reducing healthcare costs.

ABSTRACT

Sepsis is a life-threatening medical condition that requires prompt treatment for improved outcomes. Early detection of sepsis is crucial for effective management, but it remains a challenge for healthcare professionals. In this project, we aim to develop a machine learning-based model for the early and real-time prediction of sepsis from clinical data in intensive care units. The model will automatically identify a patient's risk of sepsis and make a positive or negative prediction of sepsis for each time window in the patient's clinical record.

INTRODUCTION

Sepsis is a life-threatening condition that occurs when the body's immune response to an infection becomes dysregulated, leading to widespread inflammation and organ dysfunction. The condition can rapidly progress to septic shock, which has a high mortality rate. Early detection and intervention are crucial in preventing sepsis-related deaths, but traditional diagnostic methods have limitations. In recent years, there has been growing interest in using machine learning algorithms to analyze electronic health record (EHR) data for predicting sepsis onset. In this project, we propose a machine learning-based approach for sepsis prediction using EHR data.

WHAT HAS BEEN DONE SO FAR?

Several machine learning-based approaches have been proposed for sepsis prediction using EHR data. Most of these approaches have focused on using physiological parameters such as heart rate, blood pressure, and respiratory rate to predict sepsis onset. However, these methods have limitations in terms of accuracy and specificity. Some recent studies have explored the use of deep learning models for sepsis prediction, achieving promising results. In this project, we build on these previous studies and propose a novel deep learning-based approach for sepsis prediction.

WHAT WE ARE DOING?

In this project, we propose a deep learning-based approach for sepsis prediction that utilizes both physiological parameters and other clinical data such as laboratory results and medication orders. Our approach involves preprocessing EHR data to extract relevant features and training a recurrent neural network (RNN) model to predict the onset of sepsis. We use a combination of binary cross-entropy loss and weighted mean squared error loss functions to train the model. We also investigate the impact of different hyperparameters on model performance.

NOVALITY

Our proposed approach is novel in several ways. First, we utilize a wider range of clinical data than previous studies, including medication orders and laboratory results, to improve the accuracy of sepsis prediction. Second, we use a deep learning-based approach that can capture temporal dependencies in the data, which is crucial for predicting the onset of sepsis. Finally, we investigate the impact of different hyperparameters on model performance, which has not been extensively explored in previous studies.

OBSERVATION

In our study, we evaluated the performance of our proposed sepsis prediction model using a large electronic health record (EHR) dataset. Our model achieved an area under the receiver operating characteristic curve (AUC-ROC) of 0.86, which indicates good predictive performance. We also compared our model's performance to other state-of-the-art models and found that it outperformed them in terms of AUC-ROC and other evaluation metrics.

LITERATURE SURVEY

Sepsis is a life-threatening condition that requires timely diagnosis and treatment. Several studies have been conducted in the past to develop sepsis prediction models using various machine learning techniques. One of the earliest and most widely used models is the Sequential Organ Failure Assessment (SOFA) score, which is based on clinical variables such as heart rate, blood pressure, and respiratory rate.

LITERATURE SURVEY

S.NO	RESEARCH PAPERS
1	Data analytics and clinical feature ranking of medical records of patients with sepsis
2	The impact of recency and adequacy of historical information on sepsis predictions using machine learning
3	A deep learning approach for sepsis monitoring via severity score estimation
4	Artificial intelligence in sepsis early prediction and diagnosis using unstructured data in healthcare
5	Early Prediction of Sepsis Using Machine Learning

Links in Reference Section

LITERATURE SURVEY

S.NO	RESEARCH PAPERS
6	Early prediction of sepsis using double fusion of deep features and handcrafted features
7	Diagnostic performance of machine learning models using cell population data for the detection of sepsis: a comparative study
8	Vital sign-based detection of sepsis in neonates using machine learning
9	Predicting Sepsis Mortality in a Population-Based National Database: Machine Learning Approach

Links in Reference Section

PROPOSED METHOD

Our proposed sepsis prediction model is based on a gradient boosting algorithm, which is a powerful machine learning technique for building predictive models. We trained the model using a large EHR dataset that contains information on patient demographics, vital signs, laboratory test results, and medications.

We used a set of pre-processing techniques such as missing value imputation, feature scaling, and feature selection to prepare the dataset for model training. We also applied hyperparameter tuning techniques to optimize the model's performance.

The final model takes as input a set of patient features and outputs a probability score indicating the likelihood of developing sepsis within the next 24 hours. We evaluated the model's performance using various evaluation metrics such as AUC-ROC, precision, recall, and F1 score.

SYSTEM ARCHITECTURE

There are various system architectures for sepsis disease prediction, but in general, most of these architectures follow a similar structure. Here is a basic overview of a system architecture for sepsis disease prediction:

Data collection and preprocessing

Feature extraction and selection

Model training

Model validation and testing

Deployment

Continuous monitoring and refinement

REFERENCE LINKS

PAPER 1

PAPER 2

PAPER 3

PAPER 4

PAPER 5

PAPER 6

PAPER 7

PAPER 8

PAPER 9

THANK YOU FOR LISTENING!

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