

Early Detection of Sepsis Using Electronic Health Record

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Abstract

Predict whether a patient has Sepsis Disease or not on the basis of his/her ICU data with help of a Deep neural network.sepsis is a life-threatening condition that occurs when the body's response to infection causes tissue damage, organ failure, or death. About 30 millions people develop sepsis and one-fifth of them die from the disease every year around the world. Detecting sepsis early and starting immediate treatment often save patients lives. The goal of this project is to early detect sepsis using physiological data. The inputs are patients' information, including vital signs, laboratory values and demographics.

Keywords: — *Early Detection of Sepsis, Machine Learning*

I.Introduction

The core aim of Sepsis Analysis and Prediction is to cure patients by early sepsis prediction through the use of our trained neural network model. It has been suggested by many doctors that the main reason why so many patients die due to sepsis infection is because the disease is discovered in the body when it has reached a severe stage. Between 2002 and 2012, the proportion of sepsis patients admitted to hospitals in the European ICU remained unchanged; however, the severity of the disease increased significantly [1]. The standardized sepsis-related mortality rate in China in 2015 was 67 deaths per 100,000, which was equivalent to more than 1 million deaths due to sepsis [2]. Hence in order to discover the disease in an early stage we have constructed a network that uses statistical reasoning and deep networks for predicting the sepsis positive patients. In order to achieve our goal we have created a dense neural network containing 45,561 trainable parameters in a total of 6 layers. Also the accuracy of the model significantly increases as the time of sepsis infection passes, but we are trying to give accurate results from the beginning.

II.EXPLORATORY DATA ANALYSIS (EDA)

The PhysioNet/Computing in Cardiology Challenge 2019 data consists of 40336 PSV files, 20336 in hospital A and 20000 in hospital[3]. Each PSV file refers to one patient's hourly recorded health condition data after entering the ICU. The hourly collected data on each patient consists of 41 variables, the first 40 variables include eight vital signs, such as heart rate, pulse oximetry, and temperature. The remaining 32 variable include 26 laboratory values (Measure of excess bicarbonate, Bicarbonate, Fraction of inspired oxygen, etc.), and six demographics (age, gender, ICU length-of-stay, etc.). The last variable is the sepsis label. The label is recorded hourly using 0 or 1, where 0 means no sepsis, and 1 means that sepsis is identified based on Sepsis-3 criteria [4].

III. LITERATURE SURVEY

[1]. Early Prediction of Sepsis aim of Sepsis Analysis and Prediction is to cure patients by early sepsis prediction through the use of our trained neural network model. It has been suggested by many doctors that the main reason why so many patients die due to sepsis infection is because the disease is discovered in the body when it has reached a severe stage. Hence in order to discover the disease in an early stage we have constructed a network that uses statistical reasoning and deep networks for predicting the sepsis positive patients.

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[3]. The PhysioNet/Computing in Cardiology Challenge 2019 data consists of 40336 PSV files, 20336 in hospital A and 20000 in hospital. Each PSV file refers to one patient's hourly recorded health condition data after entering the ICU.

[4]. In general, methods based on neural networks might be used not only for ECG but also for any other time-series. However, methods based on CNNs are not suitable for processing of signals with different signal lengths or nonuniform sampling rate. In this challenge [3], each data example might have a different number of observations with approximate sampling rate of one measurement per hour. For this reason, we choose to use neural networks with Long-Short-Term-Memory layers, which exhibit more suitable features for classification of time-series with non uniform sampling rates.

[5]. The architecture of LSTM allows for efficient propagation of gradients during the training phase, which helps to solve the vanishing gradients problem that is common in recurrent neural networks.

[6]. The experiment is conducted using Python programming language, the LSTM model is trained and evaluated with TensorFlow open-source library. Accuracy in terms of correct prediction about whether the patient has chances of getting sepsis for ICU patients was plotted for training as well as testing records.

IV. PROBLEM STATEMENT AND OBJECTIVE

1. Problem Statement

The goal of this Challenge is the early detection of sepsis using physiological data. For the purpose of the Challenge, defined sepsis according to the Sepsis-3 guidelines, i.e., a two-point change in the patient's Sequential Organ Failure Assessment (SOFA) score and clinical suspicion of infection (as defined by the ordering of blood cultures or IV antibiotics). The early prediction of sepsis is potentially life-saving, and challenging participants to predict sepsis 6 hours before the clinical prediction of sepsis. Conversely, the late prediction of sepsis is potentially life-threatening, and predicting sepsis in non-sepsis patients (or predicting sepsis very early in sepsis patients) consumes limited hospital resources. Develop a digital solution that uses artificial intelligence to detect patient deterioration before it's too late and trigger notifications to clinicians and care teams.

2. Objectives

The main objectives are:

- ☐ The main objective of the project is to predict whether a patient has Sepsis Disease or not on the basis of his/her ICU data with help of a Deep neural network.
- ☐ Predictor is made from 6 layer deep neural networks which has precision score of 95%. This project is to try to decrease the number of cases by discovering most of the cases in early stages so that they can be cured with ease.

V. PROPOSED SYSTEM

- To predict whether a patient has Sepsis Disease or not on the basis of his/her ICU data with help of a Deep neural network
- This project will try to decrease the number of cases by discovering most of the cases in early stages so that they can be cured with ease.
- For doctors as well as patient we made a web portal which takes registered patientID, automatically fetches parameters from database and passes to the model running in the backend.

VI. PROBLEMS IN THE EXISTING SYSTEM

- Most of the existing methods for sepsis diagnosis and early prediction only take advantage of structured data stored therefore early symptoms of sepsis are ambiguous and

difficult to recognize.

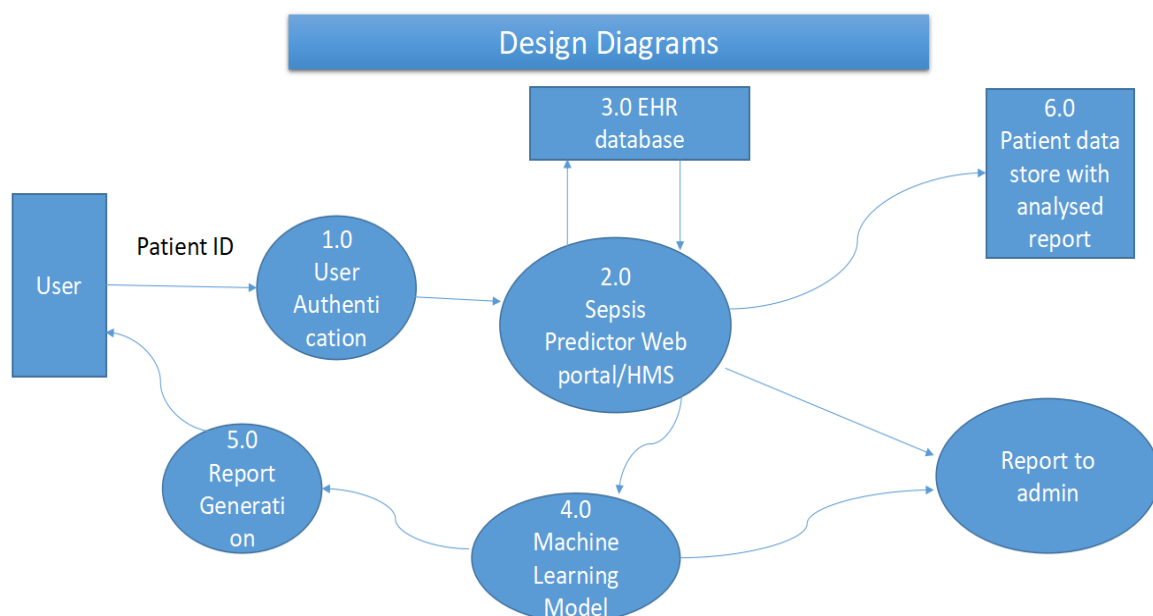
- Physicians also depend on unstructured data to review judgments and critical clinical information entered by other clinicians to gain a better understanding of a patient's condition or effects of their treatment.

VII. SOLUTION TO THE PROBLEM

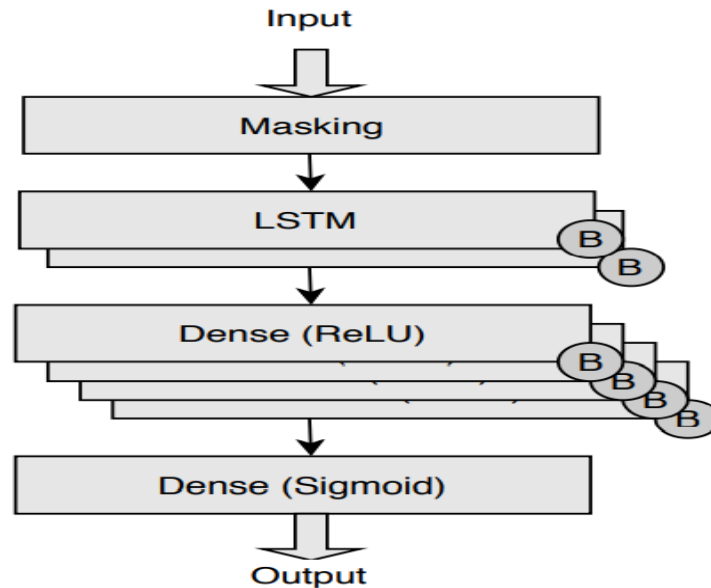
This problem can be solve during machine learning models to support hospitals in the administration of sepsis detection at the best time to reduce mortality of sepsis.

- To predict wheather a patient has sepsis Disease or not on the basis of his/her ICU data with the help of Deep neuaral network.
- This Project will try to decrease the number of cases by discovering most of the cases in early stages so that they can be cured with ease.
- This will support hospitals in the administration of spesis detection at the best time to reduce mortality of sepsis.
- For doctors as well as patient we made a web portal which takes registered patientID , automatically fetches parameters from database and passes to the model running in the backend.

VIII. ARCHITECTURE DIAGRAM



IX. MODEL DEVELOPMENT



X. CONCLUSION

Sepsis costs are even greater globally with the developing world at most risk. Altogether, sepsis is a major public health issue responsible for significant morbidity, mortality, and healthcare expenses. This newly established machine learning-based model has shown good predictive ability in sepsis patients. External validation studies are necessary to confirm the universality of our method in the population and treatment practice. Early detection and antibiotic treatment of sepsis are critical for improving sepsis outcomes, where each hour of delayed treatment has been associated with roughly an 4-8% increase in mortality so detecting sepsis early and starting immediate treatment often save patients lives.

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