Early Prediction of Sepsis Patients

Terrance Thomas

X18184928

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1 - Area: Sepsis, Intensive Care Unit, Deep Learning, Data Mining, Predictive Modelling, Medical Computing.

2 - Questions

- To what extent Data Science can be used to predict Sepsis?
- To what extent the Sepsis prediction accuracy be improved?

3 - Value

New Diseases are coming up in the modern world and it has become very important to tackle them using emerging technologies. In today's world, Data Science is used in almost every field. The use is different as per the field. Data Science and Analytic is used in medical field to provide better care and prevent disease. The aim is to optimize all areas of care continuum. It is used to gain insights and support decision making backed by the large collection of medical data present.

Sepsis is a life-threatening condition caused by body's response to a condition. Body releases chemicals to fight with the condition, during this period sepsis occurs triggering changes that can damage multiple organs. An estimated 49 million people were affected by sepsis in 2017 and 1 out every 5 results in mortality. Early treatment of Sepsis improves chance of survival. Sepsis has the third highest mortality rate as the symptoms are very common like fever, low body temperature etc and is not detected in early stages. On average the sepsis treatment can cost 22,000 dollars.

Millions of dollars are being spent on medical industry to reduce the mortality and early prediction of diseases. Using Data Mining and Deep Learning methods, sepsis detection can be done which will not only save thousands of dollars but also reduce the mortality rate especially in children.

4 - Justification

In 2013, over 23 billion US dollars have spent in hospitals Intensive Care Unit (ICU). In the research, the authors (Li, et al., 2019) proposes an end to end neural model which integrate concurrently analyses other organ system and reflect the patient condition in a timely manner. The proposed model gives an F1 score of 94.72 percentage compared to the

traditional and Neural Model. It is suggested that a better method can be used to improve the accuracy than the proposed model.

The authors (Tekin, et al., 2019) developed a Smart Heart Disease Prediction System which used k-nearest neighbours (KNN) and Naive Bayesian classification. 13 factors were taken into consideration for the prediction. KNN algorithm gave an accuracy of 94.53 percentage while Naive Bayesian gave a score of 93.75 percentage. However, the data set used for the research was comparatively very small.

Large amount of data is obtained from a single patient in the ICU which makes it impossible to interpret, thus models are created. Logistic Regression was used on the data set. The researchers (E, et al., 2019) suggest evaluating using different algorithms on the dataset.

The researchers (Yu, et al., 2019) uses Reinforcement Learning (RL) for sepsis treatment. Deep inverse RL with mini tree (DIRL-MT) method is proposed. Future work states that more comprehensive evaluation should be done so that the importance of different features is analysed and used accordingly.

The data to be used for the research is open data and publicly available and it doesn't violate the principles of data ethics (Ownership, Transaction Transparency, Consent, Privacy, Currency and Openness).

5 – References

E, J. et al., 2019 . *One-Year Mortality Prediction in ICU Patients with Diagnosis of Sepsis Driven by Population Similarities.* Athens, Greece, IEEE 19th International Conference on Bioinformatics and Bioengineering (BIBE).

Li, Q. et al., 2019. *Data-driven Discovery of a Sepsis Patients Severity Prediction in the ICU via Pre-training BiLSTM Networks.* San Diego, CA, USA, IEEE International Conference on Bioinformatics and Biomedicine (BIBM).

Tekin, A., Ulas, M. & Uzun, F., 2019. *Analysis of the Neonatal Sepsis Data Set with Data Mining Methods.* Ankara, Turkey, 1st International Informatics and Software Engineering Conference (UBMYK).

Yu, C., Ren, G. & Liu, J., 2019 . *Deep Inverse Reinforcement Learning for Sepsis Treatment.* Xi'an, China, IEEE International Conference on Healthcare Informatics (ICHI).