PhysioNet/CinC Challenge:

A Novel Combination of Survival Analysis and Deep Learning for Early detection of Sepsis

Soufiane Chami, Bijay Guragain, Bradley Hoffmann, Shubha Majumder,

Naima Kaabouche, Kouhyar Tavakolian

University of North Dakota

Objective: Sepsis is a severe medical condition caused by body's extreme response to an infection causing tissue damage, organ failure and even death. It is a global health concern whose early diagnosis is most. Our objective is to develop a machine learning model to predict sepsis at least 6 hours before clinical recognition.

Method: Early detection is a typical application of Survival Analysis (SA); it has been used in medicine and early detection of catastrophic events. However, SA despite being able to fit perfectly and handle the censored nature of data to estimate Time-To-Event (TTE) problems, it still remains a statistical modelling approach and not able to keep up with the advanced approaches of deep learning. Likewise, the fundamental idea of deep learning architectures still does not take into consideration the censorship aspect of the data as needed for TTE problems. As a result, deep learning itself would not be able to provide high performance on such problems. In this paper, a combination of survival analysis and deep learning is proposed for early detection of patients with potential sepsis using the data provided for PhysioNet Challenge 2019. In our model, we assume that TTE variable follows Weibull distribution governed by two parameters: alpha and beta. The idea is to estimate the TTE distribution instead of directly estimating the TTE variable.

Results: Based on our first iterations, we achieved the overall 80% AUC cross-validated score and 70% from the utility function assessed by PhysioNet. Our model is subject to be improved and changed to gain more consistent results. These are the preliminary results and further areas of improvement have been identified.

Significance: Sepsis can be predicted at least 6 hours in advance using only vital signs and demographic features.

Keywords: sepsis, early prediction, LSTM, survival analysis, Weibull distribution.