

2019 Physionet Challenge

Sub Project II










2019

2019 Physionet Challenge Summary

- At my previous company VUNO Inc., I decided to join 2019 Physionet Challenge.
- The main issue of 2019 Physionet Challenge was to predict sepsis disease early, our team wanted to test our algorithm building ability.
- In this challenge, 5 vital signs and 34 lab data obtained from 2 hospitals were provided, and it was important to effectively provide an alarm a few hours before sepsis occurred.
- Here, our team proposed various methods including feature engineering, regularization technique, and train data sampling methods, which can boost the performance of the model. Especially, we developed missing imputation method.
- Even though the utility score of was not great (Rank:23), our advanced model in Hackerton 2019 Singapore ranked 5th.
- We thought that we verified our algorithm in a way because this challenge data was real-world and the heterogeneous data.

Challenge Open Access

Early Prediction of Sepsis from Clinical Data: The PhysioNet/Computing in Cardiology Challenge 2019

Matthew Reyna , Chris Josef , Russell Jeter , Supreeth Shashikumar , Benjamin Moody , M. Brandon Westover , Ashish Sharma , Shamim Nemati , Gari D. Clifford 

Published: Aug. 5, 2019. Version: 1.0.0

Community forum for the 2019 PhysioNet/CinC Challenge (Nov. 5, 2019, 12:51 p.m.)

If you have any questions or comments regarding this challenge, please post it directly in our [Community Discussion Forum](#). This will increase transparency (benefiting all the competitors) and ensure that all the challenge organizers see your question.

Official paper describing the 2019 PhysioNet Challenge (Nov. 4, 2019, 4:45 p.m.)

The official paper describing the 2019 PhysioNet Challenge will appear in [Critical Care Medicine](#).

[► More news](#)

- **Contribution**

- Development an early sepsis prediction model

- **Development**

- Python, Tensorflow 1, 2

- **Issues**

- There are many issues, but here we focused to fill out missing imputation in the data

- **Achievement**

- Ranked 5th in the 2019 Physionet Hackerton Challenge Singapore
- Published into 2019 CinC Conference and Critical Care Medicine (IF:7.447)

2019 Physionet Challenge Background & Our Insight

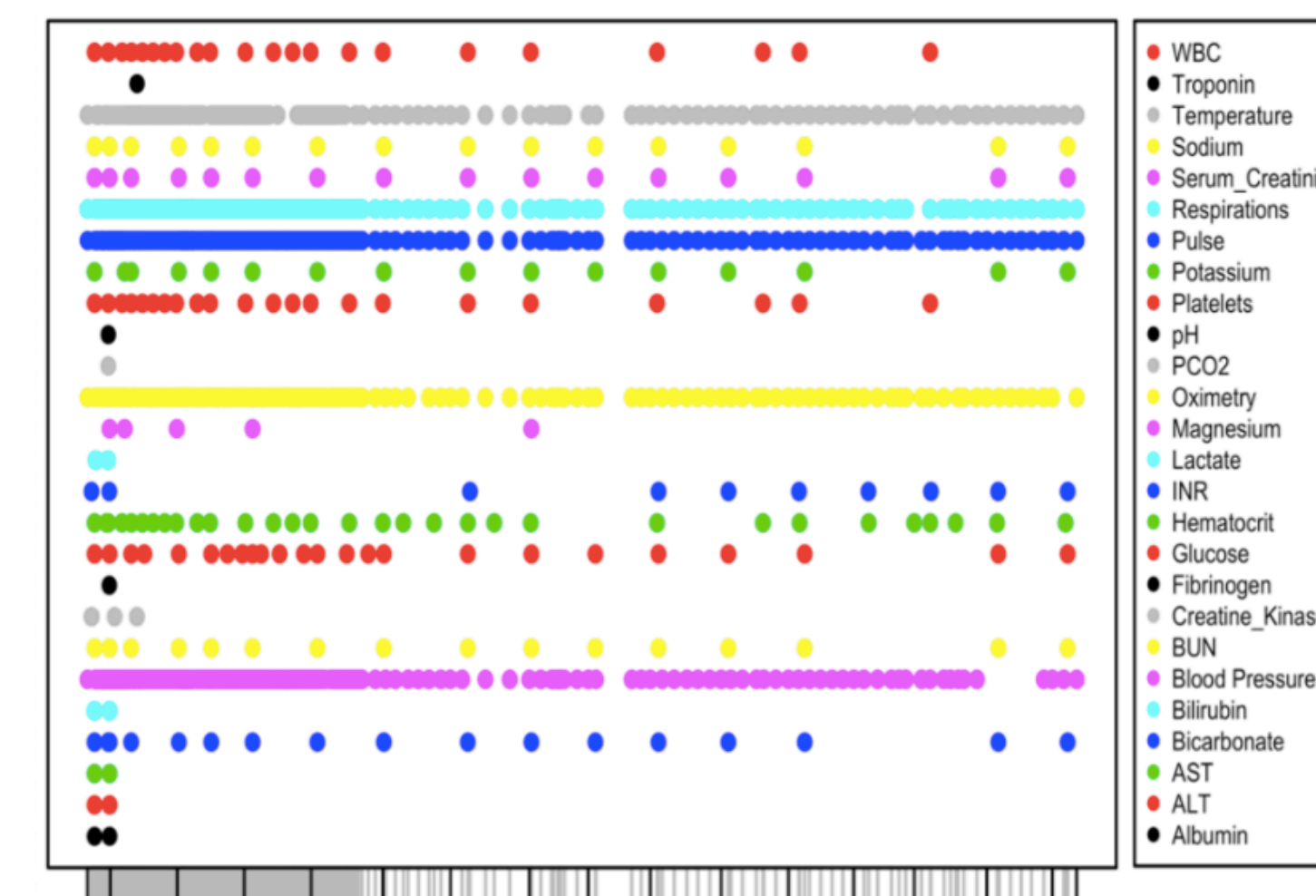
Input & Output definition

- Input: Discrete time-series data (5 vital signs & lab data)
- Output: Sepsis disease early prediction

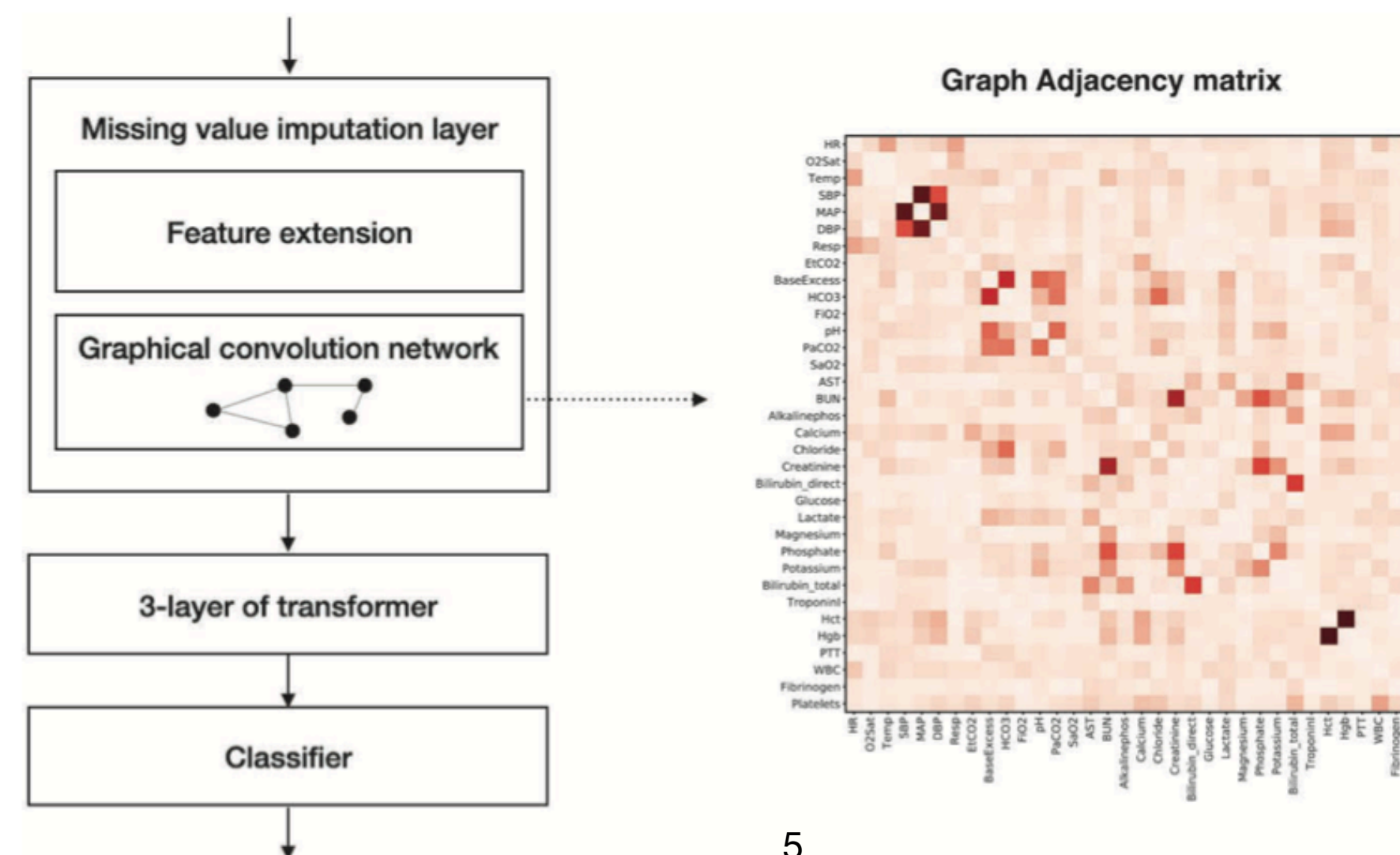
Our Approach Insight

- We hypothesized that **EMR variables** are correlated with one another, so considering feature relationships between data would be important for missing imputation, and long-range temporal relationships between input variables should be considered for model design.
- From this perspective, a two-layer graph convolutional network was designed to impute values when absent in EMR data.

- filling out missing values



- 1. Assuming feature relationships between data using graph CNN (GCN)
 - Covariance matrix (A) from training data set was obtained, then multiplying input data
 - Giving restricted search spaces which consider feature relationships
- 2. Long-range temporal relationships between input variables should be considered
 - We transformed dataset to an hourly setting, combined GCN with transformer models



$$z_i = \tanh(W_i z_i A) + z_i, i = 1, 2$$

2019 Physionet Challenge Conclusion



- We provided a novel feature relationship design for sepsis early prediction, which considers feature relationships between data to impute missing data and long-range temporal relationships.
- Based on Physionet Challenge 2019, our proposed method can accurately and early predict the onset of sepsis, which ranked 5th in the 2019 Physionet Hackerton Challenge Singapore.
 - Based on these results, we published our paper into 2019 CinC Conference and Critical Care Medicine (IF:7.447).
- The proposed method can be a practical early warning system in the environment of real hospitals.

Improving the Performance of a Neural Network for Early Prediction of Sepsis

ByeongTak Lee, KyungJae Cho, Oyeon Kwon and Yeha Lee

VUNO, Seoul, South Korea

Abstract

Early prediction of sepsis is a clinically important, yet remains challenging. As machine learning develops, there have been many approaches for prediction of sepsis using neural network-based models. In this work, We propose various methods including feature engineering, regular-

early prediction of sepsis. After exploring various techniques for improving the neural network, we suggest following three methods in this study:

- *Input imputation and transformation*
- *Regularization via auxiliary loss*
- *Manipulation of training data distribution*

CinC Conference

1 citations (on 2022.11.14), 3rd author

Graph Convolutional Networks-Based Noisy Data Imputation in Electronic Health Record

Byeong Tak Lee, MS¹; O-Yeon Kwon, MS¹; Hyunho Park, MD¹; Kyung-Jae Cho, MS¹; Joon-Myoung Kwon, MD²; Yeha Lee, PhD¹

Objectives: A deep learning-based early warning system is proposed to predict sepsis prior to its onset.
Design: A novel algorithm was devised to detect sepsis 6 hours prior to its onset based on electronic medical records.
Setting: Retrospective cohorts from three separate hospitals are used in this study. Sepsis onset was defined based on Sepsis-3. Algorithms are evaluated based on the score function used in the

affecting up to 6% of all hospital admissions and causing more than 15% in-hospital mortality (2, 3). Almost 30 million patients experience sepsis, and 6 million patients worldwide die annually (4). If sepsis can be detected early on, patients can be treated properly, and the mortality rate could be greatly reduced (5). Many attempts in developing early sepsis warning systems (6–8), however, cannot yet handle noise levels pre-

Critical Care Medicine, IF:7.447

7 citations (on 2022.11.14), co-first author