DeepTAS Project

Sub Project I

2018-2019

DeepTAS Project : Part Lead Summary

- During DeepCAS project, I participated in another project, DeepTAS (Deep-learning-based Triage and Acuity Score).
- These works collaborated with Mediplex Hospital, and the main objective of this study was to develop and validate an artificial intelligence (AI) algorithm to predict the need for critical care of patients in EMS (Emergency Medical Services) accurately.
- In EMS, accurately predicting the need for critical care is important for the early identification of the vulnerability and high-risk of patients, and for deciding the most appropriate management during transfer.
    - This is because If the patient is expected to require critical care, the EMS technician must pass through the nearest low-level ED to a high-level ED.
- I contributed to predict the need for critical care in EMS. Here, I only utilized the patient's initial vital signs and other demographic information in EMS.
- I transformed those information into an embedding vector. I mainly implemented an entire framework and produced a stable performance, this work was done in Python and Tensorflow 1.
    - Feature tokenization such as quantization was applied to this.
    - After that, a simple deep learning network was used for this analysis
- Our algorithm showed superior performance than the conventional system (KTAS).
- It can be used later to help predict a patient's risk in EMS environment and decide to move to the most appropriate location.

DeepTAS Project : Part Lead
Summary

- **Contribution**
  - Develop the prediction model to understand the need for critical care of patients in EMS accurately.
- **Development**
  - Python, Tensorflow 1, 2
- **Issues**
  - Which information we should add
  - How we embed and tokenize given unstructured data
- **Achievement**
  - Successfully build EMS prediction model and publish a paper as a co-author

DeepTAS Project
Introduction

Input & Output definition

- Input: age, sex, chief complaint, symptom onset to arrival time, trauma, and initial vital signs; HR, SBP, DBP, RR, BT
- Output: Critical Care or Not

- Train data
  - 10+ million patients visited the emergency room nationwide for 3 years
- Test data
  - EMS run sheets from two EDs.

DeepTAS Project Contribution

- Feature tokenization was applied to the input
  - Discrete scale was transformed into pre-defined vectors.
    - For example, patient age =40 —> [0 0 1 0 0]
  - These transformed vectors were concatenated and utilized in the input of FC networks.
- A simple deep learning method was utilized
  - Feedforward networks (5 hidden layers, 89 nodes, and batch normalization]), and softmax classifier.
  - We applied a dropout rate of 0.5 at each layer for regularization and a rectified linear unit was used for the activation function.
  - The Adam optimizer was used to improve the efficiency of optimization, while the cross-entropy loss function was used to minimize the prediction loss based on supervised learning.

DeepTAS Project Conclusion

- This showed the possibility that the need for patient critical care can be measured in EMS, and feature tokenization for input embedding was the most important technical factor in this paper.

- Our AI algorithm accurately predicted the need for the critical care of patients which can provide online medical directions and prepare in-hospital management during EMS, and outperformed the conventional triage tools and early warning scores

ORIGINAL RESEARCH Open Access

Artificial intelligence algorithm to predict the need for critical care in prehospital emergency medical services

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Abstract

Background: In emergency medical services (EMSs), accurately predicting the severity of a patient's medical condition is important for the early identification of those who are vulnerable and at high-risk. In this study, we developed and validated an artificial intelligence (AI) algorithm based on deep learning to predict the need for critical care during EMS.

Methods: We conducted a retrospective observation cohort study. The algorithm was established using development data from the Korean national emergency department information system, which were collected during visits in real time from 151 emergency departments (EDs). We validated the algorithm using EMS run sheets from two EDs. The study subjects comprised adult patients who visited EDs. The endpoint was critical care, and we used age, sex, chief complaint, symptom onset to arrival time, trauma, and initial vital signs as the predicted variables.

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46 citations (on 2022.11.14), co-first author