Using deep learning to predict emergency room visits

April 25 2018, by Dr. Qin Yong

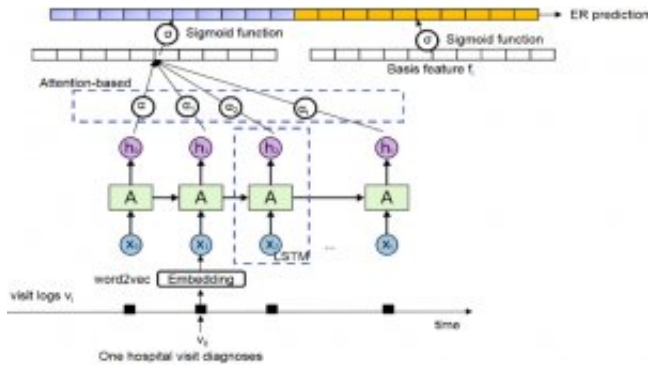

Figure 1. Proposed Model. Credit: IBM

At IBM Research, we are exploring new solutions for a range of health care challenges. One such challenge is emergency room (ER) overcrowding, which can lead to long wait times for treatment. Overcrowding results in part from people visiting the ER for non-emergency conditions rather than relying on primary physicians. Patients who use the ER for non-emergency situations are more likely to return to the ER multiple times (Poole et al. 2016), further contributing to overcrowding. Identifying those patients who are likely to return to the ER may enable hospitals to intervene to ensure access to necessary care outside the ER and potentially alleviate overcrowding.

A neural network model

My team at IBM Research-China took on this challenge. We developed a novel neural network model to predict how many times a person will visit the ER based on information from his or her electronic health records (EHRs). The model is based on a typical recurrent neural network, but unlike traditional machine learning methods, it exhibits dynamic temporal behavior based on EHR information and has a complex structure to better model the correlation between ER visits and other patient data (Figure 1). We used the model to make precise predictions of whether and how many times a person will visit the ER and found that it outperformed other common techniques. For example, precision of our model was 6.59 percent greater than a typical logistic regression model in predicting whether a person will visit the ER and >90 percent greater in predicting number of ER visits compared with linear regression model. Our model also had approximately 2 percent greater precision than the popular XGboost model in predicting number of ER visits.

By better predicting how many times a person will visit the ER, we hope that this model might enable hospitals to establish, prioritize, and target interventions to ensure that patients have access to the care they require outside an ER setting.

Sharing our work

These results along with five other papers from the IBM Research team in China have been accepted by Medical Informatics Europe 2018, a premier medical informatics conference taking place this week in Gothenberg, Sweden. The other papers involve analysis of real-world evidence on treatment-subgroup interactions, detection of anomalies in the utilization of medical supplies, use of deep learning and other machine learning technologies to answer questions from patients, and prediction of in-hospital major adverse cardiac events using a generalized linear model. Details of all six accepted papers are listed

below. Our collaborators on these projects represent top hospitals (Fuwai Hospital and Anzhen Hospitals) and top pharmaceutical companies (Pfizer). By working with the best partners with the best data on the most challenging real-world problems, we can generate world-class research results in China.

More information: Fine-Tuning Neural Patient Question Retrieval Model with Generative Adversarial Networks. www.ncbi.nlm.nih.gov/pubmed/29678055

Clinical Similarity Based Framework for Hospital Medical Supplies Utilization Anomaly Detection: A Case Study DOI: 10.3233/978-1-61499-852-5-31

Using Machine Learning Approaches for Emergency Room Visit Prediction Based on Electronic Health Record Data. DOI: 10.3233/978-1-61499-852-5-111

Using Model-Based Recursive Partitioning for Treatment-Subgroup Interactions Detection in Real-World Data: A Myocardial Infarction Case Study. *Stud Health Technol Inform*. www.ncbi.nlm.nih.gov/pubmed/29678026

Provided by IBM