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응급실 예진 단계 데이터를 활용한 중증 처치 추천 연합 학습 모델

Federated learning model for critical intervention recommendation using emergency room triage stage data

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Object

Triages system in the emergency department (ED) which discriminate severity and priority are based on patients' clinical symptoms and signs and do not predict the need for actual interventions in ED. The aim of this study is to develop a federated learning (FL) model for critical intervention recommendation that can be used as a novel tool for ED triage.

Methods

The FL model was developed using retrospective data from Samsung Medical Center (SMC) and Korea University Anam Hospital (KUMC) (212,679 and 108,966 ER visit patients per institution from 2017 to 2020). ED triage data, including initial vital signs and the lab tests within one year such as platelet, creatinine, bilirubin, and brain natriuretic peptide, which reflect baseline organ function, were used as input data. We developed three prediction models: Model 1 for a need of respiratory intervention (high flow nasal cannula or intubation), Model 2 for a need of cardiovascular support (central venous catheter insertion or use of vasopressors), and Model 3 is a poor clinical outcomes (cardiopulmonary resuscitation , intensive care unit admission or death). The local model was trained with a shallow neural network, and FL was trained with the fedavg algorithm.

Results

The AUROC of our FL models versus KUMC and SMC local model are as follows: 0.905 versus 0.91 and 0.9 in model 1, 0.885 versus 0.9 and 0.88 in model 2, 0.895 versus 0.92 and 0.87 in model 3.

The precision, recall and accuracy of our FL models are as follows: 0.18, 0.66 and 0.91 in model 1, 0.24, 0.6 and 0.88 in model 2, 0.175, 0.815 and 0.815 in model 3.



Conclusions

The development of the FL model without data transfer is feasible, and the performance was acceptable compared with two local models.

Reference

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* Keywords

Federated learning, critical intervention recommendation , Emergency room

