

Abstract Submission No. : 2536

Use of Deep Learning to Predict Acute Kidney Injury after Intravenous Contrast Media Administration

Donghwan Yun, Semin Cho, Yong Chul Kim, Dong Ki Kim, Kook-Hwan Oh, Kown Wook Joo, Yon Su Kim, Seung Seok Han
Department of Internal Medicine-Nephrology, Seoul National University Hospital, Korea, Republic of

Objectives: Precise prediction of contrast media-induced acute kidney injury (CIAKI) is an important issue because of its relationship with worse outcomes. Herein, we examined whether a deep learning algorithm could predict the risk of intravenous CIAKI better than other machine learning and logistic regression models in patients undergoing computed tomography.

Methods: A total of 14,185 cases that underwent intravenous contrast media for computed tomography under the preventive and monitoring facility in Seoul National University Hospital were reviewed. CIAKI was defined as an increase in serum creatinine ≥ 0.3 mg/dl within 2 days and/or $\geq 50\%$ within 7 days. Using both time-varying and time-invariant features, machine learning models, such as the recurrent neural network (RNN), light gradient boosting machine, extreme boosting machine, random forest, decision tree, support vector machine, κ -nearest neighboring, and logistic regression, were developed using a training set, and their performance was compared using the area under the receiver operating characteristic curve (AUROC) in a test set.

Results: CIAKI developed in 261 cases (1.8%). The RNN model had the highest AUROC value of 0.755 (0.708-0.802) for predicting CIAKI, which was superior to those obtained from other machine learning models. Although CIAKI was defined as an increase in serum creatinine ≥ 0.5 mg/dl and/or $\geq 25\%$ within 3 days, the highest performance was achieved in the RNN model with an AUROC of 0.716 (0.664-0.768). In the feature ranking analysis, albumin level was the most highly contributing factor to RNN performance, followed by time-varying kidney function.

Conclusions: Application of a deep learning algorithm improves the predictability of intravenous CIAKI after computed tomography, representing a basis for future clinical alarming and preventive systems.

Figure 1. Schematic diagram of the recurrent neural network. C: concatenate; CIAKI: contrast-induced acute kidney injury; Cr: creatinine; Dense: dense layer; LSTM: long-short term memory layer; MLP: multilayer perceptron; eGFR: estimated glomerular filtration rate; RNN: recurrent neural network.

KSN 2021
FULLY VIRTUAL MEETING
September 02 (Thu) - 05 (Sun)

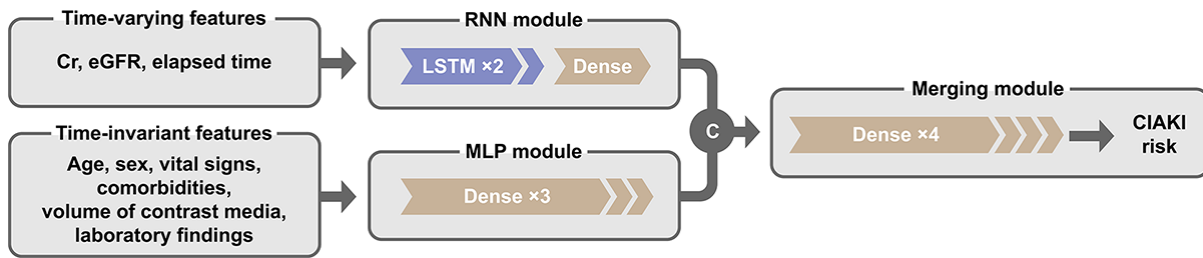


Figure 2. Area under the receiver operating characteristic (AUROC) curve for predicting intravenous contrast media-induced acute kidney injury in the machine learning models. DT: decision tree; KNN: k-nearest neighbor; LGM: light gradient boosting machine; LR: logistic regression; SVM: support vector machine; RF: random forest; RNN: recurrent neural network; XGB: extreme gradient boosting machine.

KSN 2021
FULLY VIRTUAL MEETING
September 02 (Thu) - 05 (Sun)

