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Multi-Channel Convolutional Neural Network Models for Personalized Anti-Epileptic Drug Suggestion Using Medical History

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Epilepsy is characterized by abnormal brain activity that can lead to seizures and is mainly treated with anti-epileptic drugs (AEDs). However, selection of an effective AED for a patient is often challenging and is conducted in an *ad hoc* manner, because the available AEDs have a different mode of action and thus the drug response of a patient is quite different. In this study, we present a computational method using multi-channel convolutional neural network (CNN) models to suggest an effective AED from three respective AEDs (vigabatrin, prednisolone, and clobazam) based on a patient's medical history. To construct the three models for each of the AEDs, we generated an integrated embedding matrix by utilizing the medical histories of 1,330 patients. This embedding matrix consists of a word-embedding matrix for text-based information and a matrix for numerical and categorical data. Subsequently, three multi-channel CNN models were constructed to predict the efficacy of the three AEDs. When cross-validated, these models achieved high predictive performance with the areas under the receiver-operating curves (AUROCs) of 0.90, 0.80, and 0.92, respectively. When evaluated on a test dataset to assess the practical utility of the models, the models achieved high positive predictive values (PPVs) of 0.92, 0.97, and 0.91, along with accuracies of 0.98, 0.99, and 0.97 for the respective AED models. Our method for personalized AED suggestion has the potential to enhance the clinical decision-making process in selecting an effective AED for patients with epilepsy.