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Enhanced Extra Trees Classifier for Epileptic Seizure Prediction

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Abstract : For machine learning based epileptic seizure prediction, it is important for the model to be implemented in small implantable or wearable devices that can be used to monitor epilepsy patients; however, current state-of-the-art methods are complex and computationally intensive. We use Shapley Additive Explanation (SHAP) to find relevant intracranial electroencephalogram (iEEG) features and improve the computational efficiency of a state-of-the-art seizure prediction method based on the extra trees classifier while maintaining prediction performance. Results for a small contest dataset and a much larger dataset with continuous recordings of up to 3 years per patient from 15 patients yield better than chance prediction performance ($p < 0.004$). Moreover, while the performance of the SHAP-based model is comparable to that of the benchmark, the overall training and prediction time of the model has been reduced by a factor of 1.83. It can also be noted that the feature called zero crossing value is the best EEG feature for seizure prediction. These results suggest state-of-the-art seizure prediction performance can be achieved using efficient methods based on optimal feature selection.

Keywords : machine learning, seizure prediction, extra tree classifier, SHAP, epilepsy
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