Evaluating the Potential of Decision Tree Machine Learning Algorithm for Analyzing Animal Sleep Stages

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Abstract

Objective: With the development of technology, hardware and algorithms can be used in many research fields to assist researchers. Current commercial computers, like notebooks and desktops, can perform basic machine learning algorithms; meanwhile, open-source tools, like Python and scikit-learn, are also available to everyone from the internet. This study aims to share the use of the scikit-learn tool to build a sleep stage autoscoring under the Python development environment.

Methods: In this study, we built a machine learning script with the scikit-learn tool in the Python development environment. We evaluate the potential of the Decision Tree, a supervised learning algorithm for classification, in scoring animal sleep stages. Two datasets are recruited for the evaluation: one set is with relatively fewer recording artifacts and the other is with relatively more artifacts. Both datasets contain 3600 epochs of stages analyzed by an experienced analyst. The testing size of the algorithm is 20%. The accuracy and precision of both datasets will be used to evaluate the Decision Tree algorithm in animal sleep stage analysis.

Results: In our pilot study, we evaluated the accuracy and precision of the Decision Tree algorithm under two datasets with different artifact levels. The accuracy and precision are around 0.82 and 0.80, respectively, with fewer artifacts; the accuracy and precision are around 0.68 and 0.59, respectively, with more artifacts. These results demonstrated that the Decision Tree algorithm exhibited higher accuracy and precision when feeding with high-quality electrophysiological data for sleep stage analysis.

Conclusion: Our pilot study suggests that the Decision Tree algorithm may be a potential candidate for animal sleep stage analysis. However, technical challenges in using the Decision Tree as a sleep stages analysis should be conquered.