Abstract View

AN UNBIASED AUTOMATED APPROACH TO SINGLE CHANNEL SLEEP SCORING

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The blind manual scoring of sleep through a single electroencephalogram (EEG) channel, without access to overt behaviors as characterized by electromyogram (EMG) or electrooculogram (EOG) data, is both unreliable and time consuming. Moreover, features used by nonlinear classifiers to score sleep EEG are either not explicit or, when they are, tend to reflect a human bias which is in turn imposed on the data analysis.
To resolve this issue, we have developed a reliable and unsupervised sleep scoring algorithm which clusters single channel EEG data into sleep stages following a detailed exploration of the parameter space. For any chosen set of parameters, statistical confidence in the stage separation is established with one-way multivariate ANOVAs at the cluster level and is further refined by multitaper and independent component analyses of canonical spectra for each cluster. Based on this analysis, the algorithm computes the hypnogram, stage density, average episode length and number, cycle time, inter REM interval and stage transitions per hour and per recording.
In the Zebra Finch, Taeniopygia guttata, the algorithm was successful in detecting the REM, SWS and Intermediate stages as well as their ultradian distributions. For each animal, the algorithm's performance was reliable across independently scored channels and was equivalent to manual scoring of the EEG supplemented with visual inspection of overt behaviors such as eye, head and body movements.
This method awaits further testing in different species and might provide a basis for comparative sleep EEG analysis.

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