Validation of a deep learning for the detection of absence seizures in single-lead EEG.

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Purpose: A wearable solution to better detect absence seizures could benefit people with such seizures, their caregivers and neurologists. Absence seizure frequency as reported by the people with epilepsy themselves or their caregivers are unreliable. Also, visualizing absence seizures e.g. for children in class could improve social interaction and acceptance. Critical for such a solution is an algorithm to automatically detect absence seizures.

Method: We have developed a deep learning convolutional neural network for the automatic detection of absence seizures. It consists of 4 convolutional layers, followed by two dense layers and a final logits layer. We use drop-out layers both in the convolutional and in the dense section to avoid over-fitting. We have validated the algorithm on a dataset of 10 subjects with absence epilepsy, containing 141h of EEG data and 273 seizures. From the EEG, we retained only the difference between Fp1 and Fz to simulate frontal single-lead wearable EEG. The outcome of the algorithm was compared to manual EEG annotations using a leave-one-out validation. We calculate sensitivity (% of seizures detected), positive predictive value (probability that a detected seizure is a true positive), and false alarm rate (false alarms per hour).

Results: The validation showed a sensitivity of 98.90%, a positive predictive value of 87.95% and a false alarm rate of 0.26 / h.

Conclusion: Absence seizure detection is possible on a single-lead frontal EEG using deep learning with high sensitivity and acceptable false alarm rates. In the future, we plan a validation study to compare results using clinical EEG with results using wearable EEG.