Evolution of EEG systems from high density to wearables: opportunities for expansion

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Abstract

With a history that started with recordings from two electrodes, EEG technology has evolved to a full coverage of the scalp with more than 300 electrodes, to only experience, in the last decades, a new trend of low electrode density in emerging consumer grade EEG systems. These new emerging EEG devices with low density electrodes are increasingly being used in research, opening new opportunities for large-scale data collection. However, due to the fast pace of consumer grade EEG, combined with the lack of a standardized framework to evaluate their performance, their accuracy and reliability in measuring EEG remains largely unknown. In this talk, I will present a historical perspective on the evolution of EEG technology and in that context, I will introduce a new methodology to assess the performance of EEG with low density electrodes, when applied to brain imaging. The performance will be compared with gold-standard high-density EEG (128, 231, 256 Ch). The methodology is conceived with the objective of selecting optimal electrode locations for a given paradigm, to design light EEG systems with minimum number of electrodes. The same methodology can be used for standardizing the performance testing of consumer grade EEG, thus increasing the replicability of validation studies. The tools developed based on this methodology can be easily adopted by researchers and commercial actors in the design process of new EEG systems and to increase the efficiency, interpretation, and the quality of validation studies of currently available devices. They can also serve as validation platform in the process of adoption of consumer grade EEG devices in research and clinical settings.

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