

Advances in EEG analysis for Detection of Interictal Epileptiform Discharges and their Roles in Deep Brain Stimulation for Seizure

Abstract:

The brain mesial, temporal or occipital interictal epileptiform discharges (IEDs) are often invisible in the scalp EEG (sEEG) signals. However, due to within-electrode temporal correlation and between-electrode spatial correlation, they still have their signatures in the sEEG. Therefore, it is expected to have some common spatial and temporal features among the IEDs. This requires development of an effective project algorithm to map the scalp observations into their underlying intracranial information which are often invisible in the sEEG. Hence, in this keynote we will see what the IEDs are and how they can be detected from over the scalp. To do that, we will explore in detail the use of DNN-based projection approaches, such as an asymmetric autoencoder, as well as those based on tensor factorisation including common-feature analysis techniques. Additionally, we will see how the uncertainty in labelling the IEDs, as a popular problem in medical data analytics, can be incorporated into the IED detection formulation.

The IED study is now being extended to the area of brain stimulation for the treatment of drug-resistant epilepsy which opens another arena for brain research. Here, we will look at some preliminary results of brain excitability assessment, localization of epileptic zone, and deep brain stimulation for seizure suppression.



Biography:

Saeid Sanei received his PhD in Biomedical Signal and Image Processing from Imperial College London in 1991. Since then, he has been working in National University of Singapore, King's College London, Cardiff University, University of Surrey, and currently in Nottingham Trent University (as a Professor of Signal Processing & Machine Learning) and Imperial College London (as an Academic Visitor). He is a Fellow of British Computer Society (FBCS) and a Senior Member of IEEE. Biosignal and Image Processing, Brain-Computer Interfacing (BCI), Assistive Technology, Bio-statistical Data Processing, Biomedical Systems Modelling, Body Sensor Networking, Speech, AI & Machine Learning, IoT for health monitoring are his main research areas. Prof Sanei published 5 books, a number of book chapters and edited books, and over 400 peer-reviewed publications. He has been an Associate Editor for the IEEE Signal Processing Magazine, IEEE Signal Processing Letters, and Journal of Computational Intelligence and Neuroscience. He organised and chaired a number of reputed conferences including the 44th IEEE International Conference in Acoustics, Speech, and Signal Processing (ICASSP 2019) in the UK.