Extraction of functional dynamic networks describing patient's epileptic seizures

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Intracranial EEG studies using stereotactic EEG (SEEG) have shown that during seizures, epileptic activity spreads across several anatomical regions from the seizure onset zone towards remote brain areas. This appears like patient-specific time-varying networks that has to be extracted and characterised. Functional Connectivity (FC) analysis of SEEG signals recorded during seizures enables to describe the statistical relations between all pairs of recorded signals. However, extracting meaningful information from those large datasets is time-consuming and requires high expertise. In the present study [1], we propose a novel method named Brain-wide Time-varying Network Decomposition (BTND) to characterise the dynamic epileptogenic networks activated during seizures in individual patients recorded with SEEG electrodes. The method provides a number of pathological FC subgraphs with their temporal course of activation. The method can be applied to several seizures of the patient to extract reproducible subgraphs. To validate the extraction, we compare the activated subgraphs obtained by BTND to interpretation of SEEG signals recorded in 27 seizures from 9 different patients. We a found a good agreement about the activated subgraphs and the corresponding brain regions involved during the seizures and their activation dynamics.

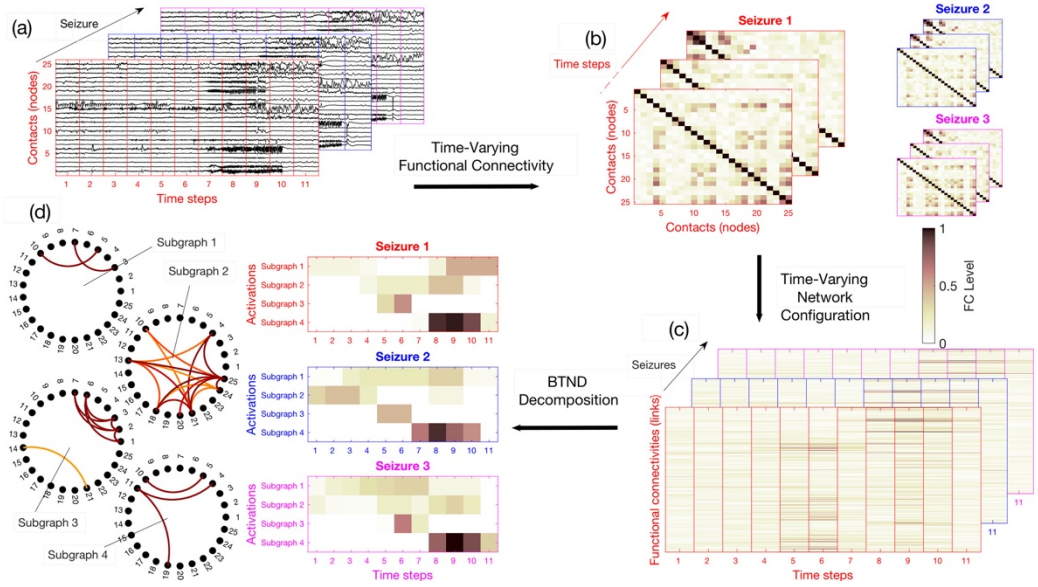

Figure 1: Overview of the joint decomposition strategy of seizures in dynamical graphs.

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References

[1] Gaëtan Frusque, Pierre Borgnat, Paulo Gonçalves, Julien Jung. Semi-automatic extraction of functional dynamic networks describing patient's epileptic seizures. *Frontiers in Neurology*, Frontiers, In press, pp.24. hal-02935666 (2020).