IED clustering

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Between seizures, irritative network generates frequent brief synchronous activity, which manifests on the EEG as interictal epileptiform discharges (IEDs). Recent insights into the mechanism of IEDs at the microscopic level have demonstrated a high variance in the recruitment of neuronal populations generating IEDs and a high variability in the trajectories through which IEDs propagate across the brain. These phenomena represent one of the major constraints for precise characterization of network organization and for the utilization of IEDs during presurgical evaluations. We have developed a new approach to dissect human neocortical irritative networks and quantify their properties. We have demonstrated that irritative network has modular nature and it is composed of multiple independent sub-regions, each with specific IED propagation trajectories and differing in the extent of IED activity generated. The global activity of the irritative network is determined by long-term and circadian fluctuations in sub-region spatiotemporal properties. Also, the most active sub-region co-localizes with the seizure onset zone in 12/14 cases. This study demonstrates that principles of recruitment variability and propagation are conserved at the macroscopic level and that they determine irritative network properties in humans. Functional stratification of the irritative network increases the diagnostic yield of intracranial investigations with the potential to improve the outcomes of surgical treatment of neocortical epilepsy.

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Janca, R., Krsek, P., Jezdik, P., Cmejla, R., Tomasek, M., Komarek, V., et al. (2018). The Sub-Regional Functional Organization of Neocortical Irritative Epileptic Networks in Pediatric Epilepsy. Front. Neurol. 9, 184. doi:10.3389/fneur.2018.00184.

Application download:

https://isarg.fel.cvut.cz/downloads/ied-clustering/

Installation:

1) Download and run MATLAB Runtime Installer from official webpage in version 9.5. https://www.mathworks.com/products/compiler/matlab-runtime.html
2) Download application “IED clustering” and unzip to custom folder https://isarg.fel.cvut.cz/wp-content/uploads/IEDC_AppMATLAB.zip
3) Run the application **IEDC.exe**

iEEG data loading:

1) Select the MAT-file containing the iEEG data records (sample available **iEEG.mat**) https://isarg.fel.cvut.cz/downloads/ied-clustering/

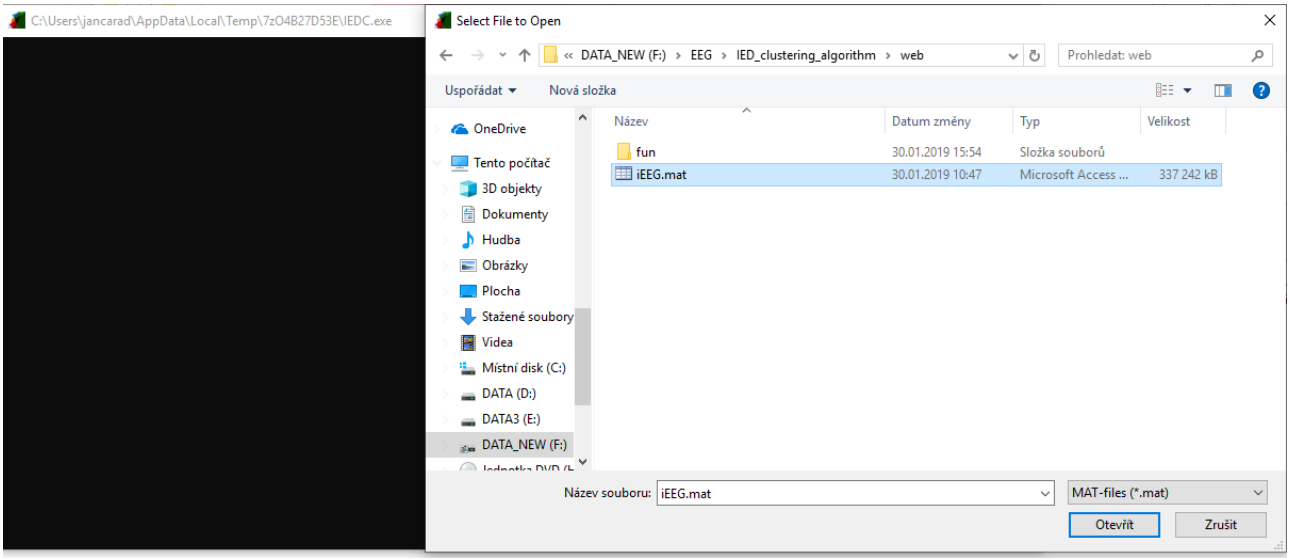
   mat-file requirements structure:

   d ... (time x channel) iEEG recordings

   fs ... sampling frequency

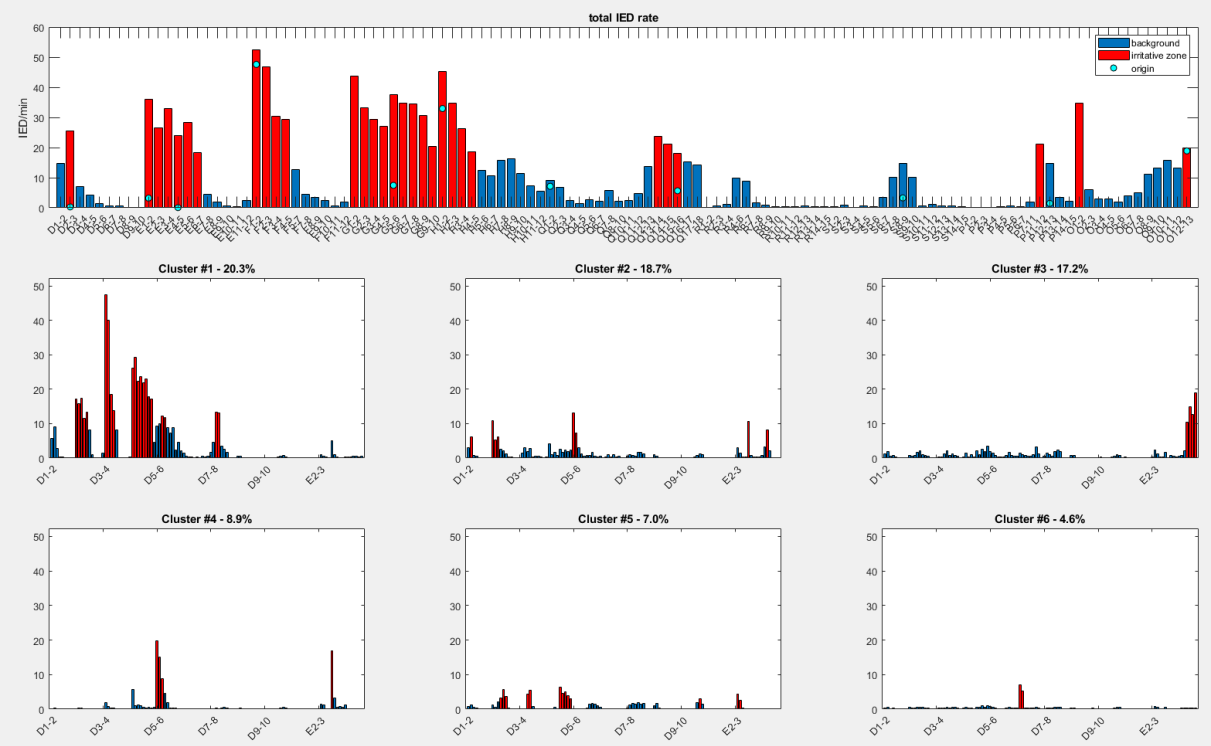
   labels ... cell vector with string labels of channels. The names have to be composed by letter+number. Application use bipolar recalculation from reference recording. The original iEEG data (i.e. A1, A2, A3 ... , B1, B2, B3) will be recalculated to (A1-2, A2-3, ... B1-2, B2–3).

   tabs ... (time x 1) contain the time of each sample in *datenum* MATLAB format.



Results:

The algorithm counts all interictal epileptiform discharges (IED) for all bipolar electrodes. The decomposition of total IED rate defines independent sub-regions - **clusters**, that are triggered by **origin**.



The results are summarised and export to application folder as table **result.csv**.