Epileptic seizure detection exploiting structural information of the multichannel EEG

Background:
Epilepsy is a neurological disorder, affecting 0.5% of the worldwide population. The manifestation of this disease is the epileptic seizure, an abnormal, synchronous activity of the neurons in the brain. More than 20% of epilepsy patients are non-responsive to medication, hence their quality of life is seriously compromised. EEG monitoring is a useful technique for providing diagnostic information about the seizures. As the seizure spreads quickly through the brain, the early detection of the epileptic seizure is essential to gather information about the source brain region. Due to its fine temporal resolution the start of the seizure can be seen precisely on EEG.

An automatic seizure detection algorithm would reduce the workload of clinicians, supporting visual analysis of EEG. Moreover, such an algorithm is a key software for future ambulant home-monitoring systems for epilepsy patients.

Content:
The drawback of the existing seizure detection algorithms is the fact that they act on single channel data, however, the spatial distribution and evolution of the ictal pattern is a crucial characteristic of the seizure. Representing the EEG data in the form of a matrix (channels x time course), or a tensor (channels x time course x frequency or channels x time course x features) helps preserving and exploiting the inherent structural information of the multichannel EEG signal. Moreover, recent studies show that higher order representation of the data facilitates precise classification even for low number of provided training samples.

The goal of this thesis will be to explore possible data representations and suitable learning algorithms which can find the underlying structure in various seizure patterns. This project is performed in close collaboration with the epilepsy monitoring unit of the division of Neurology, UZ Leuven.

Number of Students: 1
Student profile:
Required skills: knowledge in machine learning theory, Matlab programming
Promoter:
Sabine Van Huffel (ESAT) Sabine.VanHuffel@esat.kuleuven.be
Wim Van Paesschen (Division of Neurology) Wim.VanPaesschen@uz.kuleuven.ac.be
Daily supervision:
Borbala Hunyadi (ESAT, room 2.50) Borbala.Hunyadi@esat.kuleuven.be
Work Location:
Departement of Electrical Engineering, division SCD-SISTA, Biomed group