Program:

13:00 – 13:35 Anouk Van de Vel :: Clinical signs and consequences of motor seizures

13:35 – 14:10 Pieter Buteneers, PhD :: Epileptic Seizure Detection: the Reservoir Computing Approach

14:10 – 14:35 Milica Milosevic :: Detection of motor seizures in epileptic children

14:35 – 14:50 coffee break

14:50 – 15:15 Carolina Varon :: Detection of epileptic seizures based on cardiorespiratory coupling

15:15 – 15:40 Thomas De Cooman :: Online seizure detection using ECG in adult TLE patients

Speaker: Anouk Van de Vel (UZA, Antwerp)

Clinical signs and consequences of motor seizures

Seizures may result in a sudden alteration of sensation, motor activity or behavior, psyche, vocalizations or autonomic signs. Often different signs coincide, in which case the seizure type is determined by the predominant manifestation. To classify motor seizures, we take into account the semiology of the movement, the involved limb(s) and the evolution over time. ‘Simple’ movements seem unnatural and include myoclonic, clonic, tonic, versive and tonic-clonic seizures as well as spasms. ‘Complex’ movements imitate natural movements such as cycling (hypermotor seizure), smacking (automotor seizure) or laughing (gelastic seizure). Establishing the seizure type together with the duration and frequency of occurrence is important to assign an epilepsy syndrome to the patient, which together with etiology helps to determine treatment regimen and prognosis. Seizure manifestations could also help in identifying the epileptic zone in the brain, thereby assisting epilepsy surgery. And finally, seizure classification allows estimation of the risk for SUDEP (Sudden Unexpected Death). When determining what automatic seizure detection should focus on, we should keep in mind the seizure consequences, and that these not only depend on the type, but also on the intensity (possible injuries), circumstances (no supervision at night, dangerous situations during the day), duration (possible evolution to status epilepticus) and severity (brain damage, autonomic dysregulation, suffocation).

Speaker: Pieter Buteneers (UGent, Reservoir Lab, Gent)

Epileptic Seizure Detection: the Reservoir Computing Approach

Since epileptic seizures can occur at any given time, they are a burden on caregivers and parents of epilepsy patients. A reliable seizure alert system could soften this burden by notifying them when a seizure occurs so that they can give the patients their much needed care. A lot of research has already gone into seizure detection algorithms and it has been repeatedly shown that a patient specific approach is key to get the reliability required. However patient specific seizure detectors are often very costly to develop.
This talk elaborates on the seizure detection algorithms developed at Reservoir Lab at Gent University on EEG based seizure detectors and the future developments for an algorithm that can be installed on a smartwatch. Our main achievement lies in an algorithm that can transform a cheap but less reliable general seizure detector that works for all patients to a patient specific system with no additional cost.

Speaker: Milica Milosevic (KU Leuven, ESAT-STADIUS)
Detection of motor seizures in epileptic children
Accelerometry showed to be an inexpensive but effective means for long-term (home) monitoring of epileptic patients. Long-term assessment of seizure frequency should allow more accurate diagnosis, validation of changes made in therapy. Moreover, alarm system on the onset of the seizure would enable fast reactions and proper treatment. We present machine learning approach to construct patient-independent classifiers which detect the onset of a motor manifestation of an epileptic seizure through the analysis of limb acceleration. This problem is challenging because motor seizure are rare events which should be distinguished from innumerable normal movements, often with overlapping characteristics; inter- and intra-patient variability regarding clinical manifestations which depend not only on the seizure type, but on the strength of the patient, position before and during seizure, etc. The key steps in resolving this problem involve modeling of the problem into an appropriate machine learning framework and identifying relevant features to separate motor seizures from all other movements.

Speaker: Carolina Varon (KU Leuven, ESAT-STADIUS)
Detection of epileptic seizures based on cardiorespiratory coupling
Epileptic seizures are typically related to autonomic dysfunction. During seizures, the cardiac and respiratory mechanisms are deeply affected. This effect of epilepsy can also occur a few seconds before the seizure onset in the EEG. In addition, the interaction between respiration and heart rate is also expected to be affected. This study aims to determine whether the cardiorespiratory interactions change during seizures, and if these changes can be used to detect the onset of epileptic seizures. With this in mind, a methodology based on phase rectified signal averaging (PRSA) has been recently developed, and it will be presented during this talk.

Speaker: Thomas De Cooman (KU Leuven, ESAT-STADIUS)
Online seizure detection using ECG in adult TLE patients
In most cases, EEG signals are used in order to detect epileptic seizures with a reasonable performance. Acquisition of EEG is however very uncomfortable for the patient and is not possible for long-time monitoring. Therefore, usage of other biomedical signals for seizure detection has become more of interest during the last decade. The electrocardiogram (ECG) is one of the most often used biomedical signals and is easy to obtain in most circumstances. Previous studies showed that the heart rate can be influenced strongly during a seizure, making it an interesting signal choice for online seizure detection. In temporal lobe epilepsy patients, these heart rate changes are typically larger and more frequent than in the other epilepsy types. Therefore, an online patient-independent seizure detection system for adult patients with temporal lobe epilepsy using only ECG is proposed in this presentation.