ABSTRACTS

Dr. Ing. Kris Cuppens, Dept. Electrical Engineering, Division ESAT-STADIUS, and Thomas More Kempen, Division Mobilab

Integrating Video and Accelerometer Signals for Nocturnal Epileptic Seizure Detection

Epileptic seizure detection is traditionally done using video/electroencephalogram (EEG) monitoring, which is not applicable in a home situation. In recent years, attempts have been made to detect the seizures using other modalities. In this research we investigate if a combined usage of accelerometers attached to the limbs and video data would increase the performance compared to a single modality approach. Therefore, we used two existing approaches for seizure detection in accelerometers and video and combined them using a linear discriminant analysis (LDA) classifier in a late integration. We compared these results also with an early integration of the accelerometer and video features. The single modality results give a sensitivity and PPV for the accelerometers of 83.33% and 100.00% and for the video of 70.00% and 97.22%, respectively. The early integration does not seem to improve performance (sens 83.33% and PPV 96.00%) where the late integration gives a small increase in sensitivity (86.67%), but a decrease in PPV (97.50%).
References to the presentation:

Dr. Ir. Anca Croitor, Dept. Electrical Engineering, Division ESAT-STADIUS

Nosologic Imaging for brain tumour recognition

Magnetic Resonance Imaging (MRI) techniques have taken a leading role in the study of the human body and it is widely used in clinical diagnosis. Magnetic Resonance Spectroscopy (MRS) and MRS Imaging (MRSI) techniques can additionally provide valuable metabolic information as compared to MRI and are gaining more clinical interest. Brain tumors constitute a very important research area where Magnetic Resonance (MR) techniques are considered to identify the pathology, provide insight in the underlying pathology or monitor the effect of medication.

The analysis of MRS(I) data is a complex procedure and requires several (pre)processing steps. In this presentation we will show how to extract relevant metabolic information by MRSI quantification and how to further exploit this information for obtaining nosologic images which characterize the brain tissue type (cancer, healthy). For obtaining nosologic images, supervised or unsupervised classifiers may be considered. Moreover, the combined use of multimodal sources of information coming from MRSI and MRI in the classification of brain tumors is explored.

References to the presentation:


Multimodal Techniques for Cerebral Haemodynamics Monitoring in Preterm Infants

Due to recent advances in medical care, mortality of critically ill premature infants has decreased. However, they are still at risk of brain damage due to immaturity of the regulation mechanism that protects the brain. In addition, these mechanisms are interconnected and work simultaneously under different conditions. Therefore, there is a need for techniques that might be able to scan the status of this mechanism and warn for possible risky situations. In general, cerebral haemodynamics should be independent from variations from systemic variables such as blood pressure (MABP), oxygen saturation (SaO2), paCO2, heart rate (HR), and respiration rate among others. Multimodal techniques, such as canonical correlation analysis (CCA) and subspace projection, are able to look for the common dynamics between these variables and their impact on cerebral haemodynamosics. In this work, results from these methods applied to a set of signals acquired from a patient under ECMO procedure will be presented.

References to the presentation:

Simultaneous EEG-fMRI data acquisition for epileptic source localization and cognitive processes

Electroencephalography (EEG) provides a measure for the electrical activity of the brain with a very precise temporal resolution, but with a rather low spatial resolution. Functional magnetic resonance imaging (fMRI) on the other hand, can localize active brain regions with a millimeter precision, but without detailed time information. As such, EEG and fMRI are perfectly complementary, making them ideal candidates for combined measurements and analyses. Due to these advantageous properties, simultaneous EEG-fMRI has been widely and successfully applied both in cognitive studies and in clinical applications. However, the data acquisition, preprocessing and data analysis poses great challenges. This lecture will illustrate these challenges, discuss various alternative solutions using traditional signal processing techniques or advanced blind source separation techniques. Real-life applications from the field of cognitive psychology and neurology, namely epileptic source localization, will also be presented.