Computational Intelligence and Neuroscience

Special Issue on

Fusion Methods for Biosignal Analysis: Theory and Applications

CALL FOR PAPERS

Recent advances in data acquisition and biosignal processing are paving the way to the optimal integration or fusion of complementary data modalities in a wide variety of clinical settings, including electrocardiography (ECG), electroencephalography (EEG), electrocorticography (ECoG), magnetic resonance imaging (MRI), functional MRI (fMRI), positron emission tomography (PET), and diffusion tensor imaging (DTI). Integration can be performed by exploiting the analyses sequentially or simultaneously, depending on issues related to synchronization, physical compatibilities, and standard clinical procedures. Fusion approaches aim at integrating analyses of data from different modalities, establishing synergic relationships for improved clinical hypothesis testing and medical diagnosis.

The heterogeneous nature of data sources from different clinical analyses and acquisition modalities presents big challenges such as (i) extraction of conspicuous features from raw data in different domains and mapping into a normalized work space; (ii) defining a processing model for stationary or nonstationary joint analysis of the biosignals; (iii) possible decoding procedure from the model parameters to spatial and/or time coordinates; (iv) decision methods for detection, classification, segmentation, and so forth; and (v) methods for levels of fusion (e.g., early and late fusion). The main objective of data fusion is to exploit complementary properties of several single-modality methods in order to improve each of them considered separately. In addition, fusion can enable or enhance the approximation to more complex structured results (e.g., hierarchical trees and topological networks).

This broad field of research has been named in different ways, for instance, sensor data fusion, decision fusion, multimodal fusion, heterogeneous sensor fusion, mixture of experts, classifier combiners, and multiway signal processing. A classic example is the simultaneous analysis of EEG and fMRI that pursues to take advantage of EEG high temporal resolution and fMRI high spatial resolution. Fused analysis can help to highlight and enhance singular portions of image frames and EEG traces in dynamic analyses for different applications such as epileptic seizure focus detection and localization and cognitive networks estimation. Another example is hybrid brain computer interfaces that consider the possibility of creating a communication channel between the brain and a computer by using combination of different biosignals.

It is important to emphasize that this special issue is open to works dealing with any kind of biomedical data. Furthermore, the fusion methods do not exclude the possibility to combine more information coming from the same biosignal, for example, EEG rhythms and ERPs or HR and HRV from ECG.

Potential topics include but are not limited to the following:

- Multimodal fusion: algorithms and clinical experiences
- Signal processing on graphs for fusion methods
- Hierarchical approaches (e.g., brain levels of activation: fusion at different cortex depths)
- Computational issues in fusion methods for real-time biosignal analysis
- Heterogeneous sensor fusion in big data context
- Tensor methods and constraint techniques for multiway signal processing
- Hybrid brain computer interfaces (multimodal BCI systems)

Authors can submit their manuscripts through the Manuscript Tracking System at http://mts.hindawi.com/submit/journals/cin/fmba/.

Lead Guest Editor
Addisson Salazar, Universitat Politècnica de València, Valencia, Spain
asalazar@dcom.upv.es

Guest Editors
Vicente Zarzoso, Université Côte d'Azur, Sophia Antipolis Cedex, France
zarzoso@i3s.unice.fr

Manuel R. Zurera, Universidad de Alcalá, Campus Universitario, Alcalá de Henares, Spain
manuel.rosa@uah.es

Luis Vergara, Universitat Politècnica de València, Valencia, Spain
lvergara@dcom.upv.es

Manuscript Due
Friday, 27 January 2017

First Round of Reviews
Friday, 21 April 2017

Publication Date
Friday, 16 June 2017