

International Conference on

Big Data Analytics and Data Mining

November 25-26, 2019 | Frankfurt, Germany

Medical data mining in functional neuroimaging

Radu Mutihac

University of Bucharest, Romania

Imaging Neuroscience is aiming to reveal functional changes in brain activity and structural changes in neuroanatomy. Biomedical time series, particularly functional brain imaging data, are rich sources of information about physiological processes, but they are often contaminated with artifacts and noise, and typically recorded as mixtures of unknown combinations of sources summing up differently in time and/or space. In many cases, even the nature of sources is an open question. Finally, yet importantly, some hypotheses on the working brain are necessary. The interest in functional brain studies lays in the electrical activity of firing neurons, which cannot entirely be inferred by analysing the vascular process because the hemodynamic lag varies in a complex fashion from tissue to tissue, and no theory on the relationship between the electrical and hemodynamic processes is available.

Most of imaging Neuroscience relies on confirmatory data analysis (CDA) like inferential hypothesis-led analysis, which makes use of spatially extended processes (e.g., statistical parametric mapping – SPM). Yet spatiotemporal characteristics of brain activity are frequently unknown and variable, which preclude their evaluation by confirmatory

methods only. Revealing unanticipated or missed patterns of activation, data mining (DM) and exploratory data analysis (EDA) allow to improve or even to change the original hypotheses. In contrast to CDA, exploratory methods entail no reference to prior knowledge of the structure in data and provide models whose characteristics are determined by the statistical properties of data only and no statistical model is required on performing inferences. However, some differences still exist: while DM searches for consistent patterns and predictability, EDA looks for systematic relationships between variables.

In imaging Neuroscience, the dynamic interplay between hypothesis generation and hypothesis testing, a Hegelian synthesis of EDA and CDA, has the best chance of dealing successfully with the increasingly complex experiments, or the emerging broad range of theoretical and clinical studies. As such, confirmatory and exploratory analyses appear more complementary rather than competitive. The presentation aims to advocate in favour of such duality approach based on most recent advances in Medical Imaging and the Human Connectome Project.

e: mutihac@gmail.com

*Notes:*