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## Functional Neuroimaging Data Mining

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. The interest in functional brain studies lays in the electrical activity of firing neurons, which cannot entirely be inferred by analyzing the vascular process because the hemodynamic lag varies in a complex way 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 provides models whose characteristics are determined by the statistical properties of data only and no statistical model is required on the inferences to perform. However, some differences exist: while DM searches for consistent patterns and predictability, EDA looks for systematic relationships between variables. The contribution : 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.

### Biography

Radu Mutihac is a Head of Medical Physics Section, works in Neuroscience, Signal Processing, Microelectronics and Artificial Intelligence. As a Post-doc/Research Associate/Visiting Professor/Full Professor, he does his research at University of Bucharest, International Centre for Theoretical Physics (Italy), Ecole Polytechnique (France), Institute Henri Poincare (France) and KU Leuven (Belgium). His research in "Fused biomedical imaging modalities" was carried out at Johns Hopkins University, National Institutes of Health and Walter Reed Army Institute of Research, USA. He is a member of ISMRM, ESMRMB, OHBM, Romanian US Alumni Association, and Fellow of Signal Processing and Neural Networks Society IEEE. He has published over 100 scientific papers, 12 monographs and contributed with chapters in other 10 text books. He contributed to more than 150 scientific meetings with posters and oral presentations, seminars, invited and plenary lectures, as well as acting as Organizer, Chairman, and Keynote Speaker.

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