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Spatiotemporal dynamics of Brain connectivity in Neurological Disorders Explored by resting-state fMRI

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Dementia describes a group of symptoms affecting thinking and social abilities severely enough to interfere with daily human behavior. It is related with at least two brain functions: memory loss and impaired judgment or language and the inability to perform some common activities. Brain's energy is largely consumed at rest during spontaneous neuronal activity (~20%), while task-related increases in metabolism energy are minor (<5%). About 50% of people above the age of 85 experience cognitive impairments or dementia. Investigating the relationship between brain structure and function is a central issue in neuroscience research. Spontaneous low-frequency fluctuations in BOLD rsfMRI signals are temporally coherent among brain areas that are structurally connected and functionally related. Several cognitive functions such as learning and memory depend on normal communication between the hippocampus and prefrontal cortex. There is evidence that disruption to communication channels in these two areas of the brain contribute to symptoms in psychiatric disorders. Connectivity studies using neuroimaging data have increased the understanding of the organization of large-scale structural and functional brain networks. It has been shown that nonlinear analyses employing concepts such as entropy, fractality and predictability provide significant diagnostic and prognostic information in a number of pathologies. The contribution aims to identify specific changes in the resting-state networks univocally related to certain forms of dementia and/or dementia phases. The goal is to review and evaluate the most current approaches for early detection and classification of cognitive impairments and dementia, particularly among syndromes with relatively similar behavioral effects, on the basis of alterations in brain connectivity explored by the real-time fMRI during rest.

Biography

Radu Mutihac, Head of Medical Physics Section, works in Neuroscience, Signal Processing, Microelectronics and Artificial Intelligence. As postdoc/research associate/visiting professor/full professor he run his research at the University of Bucharest, the International Centre for Theoretical Physics (Italy), Ecole Polytechnique (France), Institut Henri Poincare (France), KU Leuven (Belgium). Data mining and exploratory analysis of neuroimaging time series were addressed during two Fulbright Grants in Neuroscience (Yale University and University of New Mexico). His research in fused biomedical imaging modalities was carried out at the Johns Hopkins University, National Institutes of Health and Walter Reed Army Institute of Research, MD, USA.

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