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Model-based analysis of functional connectivity during associative learning in schizophrenia

Bányai, M.[1,2]; Diwadkar, V.[3]; Érdi, P.[1,2*]

1: KFKI Research Institute for Particle and Nuclear Physics of the Hungarian Academy of Sciences, Budapest, Hungary
2: Center for Complex Systems Studies, Kalamazoo College, Kalamazoo, USA
3: Wayne State University, Detroit, USA

Schizophrenia is often regarded as a set of symptoms caused by impairments in the connectivity of the information processing macro-networks of the brain. To investigate this hypothesis, an fMRI study involving an associative learning task was conducted with schizophrenia patients and controls. A set of generative models of the BOLD signal generation were defined to describe the interaction of five brain regions (Primary Visual Cortex, Superior Parietal and Inferior Temporal Cortex, Hippocampus and Dorsal Prefrontal Cortex) and the experimental conditions. The models were fitted to the data using Bayesian model inversion. The comparison of different model connectivity structures lead to the finding that in schizophrenia, the information processing functional network is fundamentally different relative to healthy controls. Parameter-level analysis also pointed out that there are significant impairments in the prefrontal control of hippocampal memory formation in patients. By the comparison of the posterior model probability distributions of the healthy subjects with low performance and patients, we showed that the methodological framework is able to differentiate between illness and natural slow learning by capturing the differences of the underlying functional network.