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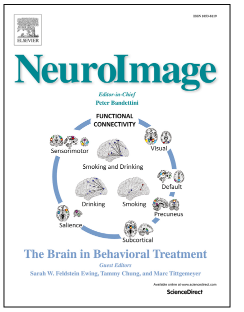

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Estimating Dynamic Brain Functional Networks Using Multi-subject fMRI Data

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Abstract: A common assumption in the study of brain functional connectivity is that the brain network is stationary. However it is increasingly recognized that the brain organization is prone to variations across the scanning session, fueling the need for dynamic connectivity approaches. One of the main challenges in developing such approaches is that the frequency and change points for the brain organization are unknown, with these changes potentially occurring frequently during the scanning session. In order to provide greater power to detect rapid connectivity changes, we propose a fully automated two-stage approach which pools information across multiple subjects to estimate change points in functional connectivity, and subsequently estimates the brain networks within each state phase lying between consecutive change points. The number and positioning of the change points are unknown and learned from the data in the first stage, by modeling a time-dependent connectivity metric under a fused lasso approach. In the second stage, the brain functional network for each state phase is inferred via sparse inverse covariance matrices. We compare the performance of the method with existing dynamic connectivity approaches via extensive simulation studies, and apply the proposed approach to a saccade block task fMRI data.

Keywords: *Brain functional connectivity; change point models; dynamic networks; fused lasso; graphical models; precision matrix estimation.*

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