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Intervention Models in Functional Connectivity Identification Applied to fMRI

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Abstract

Recent advances in neuroimaging techniques have provided precise spatial localization of brain activation applied in several neuroscience subareas. The development of functional magnetic resonance imaging (fMRI), based on the BOLD signal, is one of the most popular techniques related to the detection of neuronal activation. However, understanding the interactions between several neuronal modules is also an important task, providing a better comprehension about brain dynamics. Nevertheless, most connectivity studies in fMRI are based on a simple correlation analysis, which is only an association measure and does not provide the direction of information flow between brain areas. Other proposed methods like structural equation modeling (SEM) seem to be attractive alternatives. However, this approach assumes prior information about the causality direction and stationarity conditions, which may not be satisfied in fMRI experiments. Generally, the fMRI experiments are related to an activation task; hence, the stimulus conditions should also be included in the model. In this paper, we suggest an intervention analysis, which includes stimulus condition, allowing a nonstationary modeling. Furthermore, an illustrative application to real fMRI dataset from a simple motor task is presented.