Mathematical Sciences

Spring 2020

Colloquium Series

Candidate for Data Science Faculty Position

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New York University

Monday, February 17, 2020
Bell Hall 143
3pm

(Note the unusual day)

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Multiple Testing of Complex Two-Way Classified Hypotheses with an Application to an EEG Experiment

Abstract

Electroencephalography (EEG) is extensively used to study brain activity due to its low cost and non-invasive technology. Such data, however, have a complex spatio-temporal structure, understanding the dynamics of which is key to improving our understanding of the functioning of the human brain. Several ideas of multiple hypotheses testing procedures have been put forward in the literature to analyze neuro-imaging data. However, they are unable to fully utilize the valuable information locked in the complex two-way (spatial and temporal) classification structure of the data. In this article, we propose a generalized multiple testing procedure, which is a weighted version of the well-known Benjamini-Hochberg (BH) procedure. The rigorous weighing scheme used by our method, enables it to encode structural information from simultaneous two-way classification as well as hierarchical partitioning of hypotheses into groups, with provisions to accommodate overlapping groups. The method is proven to control the False Discovery Rate (FDR) when the p-values involved are Positively Regression Dependent on the Subset (PRDS) of null p-values and is shown to be more powerful than existing comparable multiple testing procedures. The corresponding data-adaptive version of the method controls FDR under the assumption that the p-values involved are independent and is more powerful than existing data-adaptive multiple testing procedures. We apply this procedure to an EEG dataset to analyze the impact of alcoholism on the human brain.