ERP: an *R* package for Event-Related Potentials data analysis

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Experiments involving recording event-related (brain) potentials (ERP) are now widely performed in psychological research to study the time courses of mental events. With the routine collection of massive amount of data from ERP studies, researchers must face the challenge of multiple comparison corrections: in shifting, simultaneously, through thousands or tens of thousands of tests, a balance must be struck between keeping a low false positive error rate while maintaining sufficient power for correct detection.

A number of False Discovery Rate (FDR) controlling procedures ([1]) have become standard tools to achieve the above objective in high-dimensional situations. It is, however, well known ([3]) that highly correlated data, such as ERPs with their strong temporal dependence, can severely affect the stability of simultaneous testing.

In ERP data analysis, before the widespread success of FDR controlling procedures, [5] had already proposed a procedure for identifying significant intervals assuming an auto-regressive dependence structure of order 1 among test statistics. This method exhibits desirable properties but suffers both from an inadequate time-dependence modelling and an uncontrolled proportions of false positives. An alternative approach to dealing with correlation in multiple testing is to account for the multivariate dependence by some flexible data reduction techniques involving latent variables (see [6, 4] or more recently [7]).

We propose a joint modeling of the signal and time-dependence in ERP data (see [2]) to improve the properties of multiple testing procedures, such as the Benjamini-Hochberg ([1]) procedure, the Guthrie-Buchwald method and the decorrelation approaches by [6] (SVA) and [7] (LEAPP). The talk will also introduce the *R* package **ERP**, which implements a variety of multiple testing functions including the aforementioned procedures.

References

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