Department of Statistics and Computer Science

UMR 6625 CNRS

Internship position in Agrocampus Ouest, Rennes, France

Topic: Statistical testing for event-related potentials data. Validation of a testing strategy, implementation of an R package.

Keywords: EEG data, ERP data, factor modeling, functional data, functional ANOVA

Context

Event-related potentials (ERPs) are recordings of electrical activity along the scalp time-locked to perceptual, motor and cognitive events. Such high-throughput instrumental data provide high temporal resolution to chart the time course of mental processes. With the routine collection of massive amounts of data from ERP studies, researchers must face the challenge of signal detection, which shall guarantee a low false positive error rate while maintaining sufficient power. How to achieve this objective for ERP data exhibiting arbitrarily strong temporal dependence is the focus of the present paper.

In the 'Rare and Weak' (RW) paradigm introduced by Donoho and Jin (2004), the former authors demonstrate that a detection method called Higher Criticism Thresholding, which is based on a distance between the empirical probability distribution function of the p-values and the uniform null distribution, achieves the theoretically optimal decision limits. As reported in Causeur et al. (2012), the pronounced auto-correlation observed in ERP data can however induce a long-range regularity for the test statistics, resulting in spuriously low p-values outside of the support of the signal, which in turn can affect the control of type-I error rate of signal detection procedures.

As in Perthame et al. (2015) and Sheu et al. (2016), the objective of the internship position is to develop an alternative approach of decorrelated signal detection based on a flexible factor model for time-dependence.

Department of Statistics and Computer Science

The research team (5 faculties) in statistics in Agrocampus (Rennes) is part of the Statistics team (about 40 fellows) of the Rennes Research Unit in Mathematics (Irmar, Institut de recherche mathématique de Rennes, UMR CNRS 6625). Statistical research in Agrocampus is especially dedicated to high-dimensional statistical learning and genomic data analysis.

For more information, www.agrocampus-ouest.fr and www.irmar.univ-rennes1.fr

Details

Duration: 4 to 6 months (start: March, 1st, 2016)

Application deadline (CV + motivation letter): February, 25th, 2016

Location: Agrocampus, 65 rue de St-Brieuc, CS84215, 35042 Rennes cedex

Salary : 550 €/month

Skills: Experience in R and particular interest in applied statistics

Contact: David Causeur,

  Email: david.causeur@agrocampus-ouest.fr

  Url: http://math.agrocampus-ouest.fr/infoglueDeliverLive/membres/david.causeur

Bibliography

Causeur, D., Chu, M.C., Hsieh, S. and Sheu, C.F. (2012) A factor-adjusted multiple testing procedure for ERP data analysis. Behavior Research Methods, vol. 44, pp. 635-643.

Donoho, D and Jin, J. (2004) Higher criticism for detecting sparse heterogeneous mixtures. The Annals of Statistics, vol. 32, no. 3, pp. 962-994.

Perthame, E., Friguet, C. and Causeur, D. (2015) Stability of feature selection in classification issues for high-dimensional correlated data. Statistics and computing, DOI 10.1007/s11222-015-9569-2, pp. 1-14.

Sheu, C.F, Perthame, E., Lee, Y.S. and Causeur, D. (2016) Accounting for time dependence in large-scale multiple testing of event-related potential data. Annals of Applied Statistics. 10(1), 219-245.