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Editorial for the special issue on change-point detection

Titre: Éditorial du numéro spécial sur la détection de ruptures

Emilie Lebarbier[1] and Céline Lévy-Leduc[1]

The interest for the change-point detection issue has been motivated by its applications in several fields. Among them, we can quote genomics with the problem of detecting chromosomic aberrations which can be the cause of serious diseases; geodesy, where we are interested in the detection of abrupt changes which may be due to changes of devices or to short earthquakes; telecommunications, where change-point detection techniques can be used for detecting network attacks or network anomalies.

The change-point detection issue can be expressed as follows Let $y_1,\dots,y_n$ be some observations, from which we want to identify the regions in which the observations can be considered as "stationary" in a sense to be defined. The change-points correspond to the boundaries of these regions. More formally, the $(y_t)_{1\leq t\leq n}$ can be modeled as realizations of a sequence of n random variables $(Y_t)_{1\leq t\leq n}$ having a probability distribution depending on a parameter θ_t such as

$$Y_t \sim \mathscr{G}(\theta_t),$$

where θ_t is assumed to exhibit $K-1$ change-points $t_1,\dots,t_{K-1}$. This means that θ_t is assumed to be constant between two change-points and to change its value at each change-point position. Let $I_k = [t_{k-1}+1, t_k]$ be the interval on which θ_t is assumed to be constant and equal to θ_k, we then have that

$$Y_t \sim \mathscr{G}(\theta_k),\ t \in I_k.$$

The parameter θ_t can be the expectation, the variance or any other parameter characterizing the distribution of the Y_t's. It has to be noticed that the parameters of the probability distribution are not necessary all affected by change-points.

This special issue aims at giving an overview as large as possible of the different ways of considering the change-point detection issue in several contexts. Among the six articles of this special issue, five of them are co-authored by young researchers.

The problems that occur in the change-point detection field are the following proposing accurate estimators of the change-point positions from n observations $y_1,\dots,y_n$ (retrospective approach), proposing statistical tests to decide whether there is a change-point either with a retrospective or a sequential approach *i.e.* when the observations are available online.

[1] UMR MIA-Paris, AgroParisTech, INRA, Université Paris-Saclay, 75005, Paris, France.
E-mail: emilie.lebarbier@agroparistech.fr and E-mail: celine.levy-leduc@agroparistech.fr

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Sequential tests are proposed in the article of Van Long Do, Lionel Fillatre and Igor Nikiforov as well as in the one of William Kengne and in the one of Gabriela Ciuperca. A restrospective and nonparametric change-point test is proposed in the article of Alexandre Lung-Yut-Fong, Céline Lévy-Leduc and Olivier Cappé. The article of Julien Gazeaux, Emilie Lebarbier, Xavier Collilieux and Laurent Métivier proposes a retrospective method for estimating change-points. Finally, the article of Guillem Rigaill deals with the algorithmic issues which are associated with change-point detection and proposes a very fast algorithm for estimating the change-point positions.

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