New contributions in extreme value theory

The aim of this PhD is to make new contributions in extreme value theory, mainly in the following two directions:

1) Censored data, where only partial information on a random variable is available. This is typically the case in the insurance field where the settlement of the largest claims can take a long time, which implies that at the time of the valuation of a portfolio of insurance contracts, some claims will not be completely settled. In such cases, the exact total amount of claims is not available, but it is known that it will correspond at least to the amount paid at the time of the valuation. Extreme value theory in the presence of censoring has already been studied in the literature, see, e.g., Beirlant et al. (2007), Einmahl et al. (2008), Gomes & Neves (2011), Worms & Worms (2014) or more recently Bladt & Rodionov (2024) where an innovative approach based on the convergence of extreme Kaplan-Meier integrals was developed;

2) Time series, where it is necessary to jointly handle temporal dependence and extreme data. This constitutes a mathematical challenge to be grasped since, from a practical point of view, data are often collected over time. This is for instance the case within climate and environmental sciences (e.g., with temperature, rainfall, wind speed, ozone, pollution, …) where the usual assumption of independent observations is clearly violated. In such applications, it is usual to be faced with covariates, which needs also to be taken into account jointly with this temporal dependence.

Note that this PhD may be preceded by a Master 2 thesis over the period February - July 2025 (dates to be defined) allowing the candidates to familiarize themselves with the subject.

References:

Beirlant, J., Guillou, A., Dierckx, G. & Fils-Villetard, A. (2007). Estimation of the extreme value index and extreme quantiles under random censoring. Extremes, 10, 151-174.

Bladt, M. & Rodionov, I. (2024). Censored extreme value estimation, https://arxiv.org/pdf/2312.10499.

Einmahl, J.H.J., Fils-Villetard, A. & Guillou, A. (2008). Statistics of extremes under random censoring. Bernoulli, 14, 207-227.

Gomes, M.I. & Neves, M.M. (2011). Estimation of the extreme value index for randomly censored data. Biometrical Letters, 48, 1-22.

Worms, J. & Worms, R. (2014). New estimators of the extreme value index under random right censoring, for heavy-tailed distributions. Extremes, 17, 337-358.

Starting date: October 1st, 2025.

Application deadline: As early as possible until May 1, 2025.

Place of work: Institut de Recherche Mathématique Avancée, UMR 7501, Université de Strasbourg.

Skills: A solid background in statistics and probability, particularly in stochastic processes, is required as well as a taste for applications. A good knowledge of R and possibly a programming language is also crucial.

Instructions for applying: Applications must contain: CV + cover letter + grade transcripts (bachelor and master level). All these documents should be in pdf and addressed to Armelle Guillou (armelle.guillou@math.unistra.fr).