Offer #2023-06144

Post-Doctoral Research Visit F/M Dimension reduction for the estimation of extreme risk measures

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

About the research centre or Inria department

Grenoble Rhône-Alpes Research Center groups together a few less than 800 people in 35 research teams and 9 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

Context

Team Statify, LJK & Inria Grenoble Rhone-Alpes;**team leader**: Florence Forbes.

Research topics: extreme-value analysis, dimension reduction, Bayesian statistics.

Advisor:
Stéphane Girard, Statify, Inria Grenoble, Rhone-Alpes, France,Stephane.Girard@inria.fr
Webpage: http://mistis.inrialpes.fr/people/girard/

Location: Inria Grenoble Rhone-Alpes, 38330 Montbonnot, France.

Assignment

Extreme value theory is a branch of probability and statistics dealing specifically with the behaviour of a probability distribution in its tails. More precisely, it focuses on the asymptotic behaviour of the largest, or lowest, observations in a collection of random observations from the same distribution. In extreme value statistics, the main problems are typically the estimation of the extreme value index and extreme quantiles associated to a random variable of interest Y with unknown underlying distribution. The extreme value index drives the behaviour of the distribution of Y in its right tail. We refer to [1,2] for a general account on extreme value statistics.

From a risk analysis perspective, the estimation of an extreme quantile of Y, generally referred to as a Value at Risk (VaR), has been extensively studied. When a covariate X, representing valuable information on Y, is recorded alongside Y, the associated VaR may depend on X and is interpreted as a conditional extreme quantile. In this framework, and without any further information on the structure in the pair (X,Y), the estimation of the conditional extreme quantile is generally based on a combination of nonparametric smoothing techniques with extreme value statistics (see [3]).

When the dimension of X is large compared to the sample size, estimating the conditional distribution of Y given X becomes difficult. Indeed, high dimensionality raises important problems in the analysis of extreme values. On the one hand, extreme conditional quantiles and classical estimators become inefficient. On the other hand, the quality of the estimate is further degraded in extreme value analysis, as the number of observations in the distribution tails is low. Therefore, dimensionality reduction in the conditional extreme framework is a key issue. However, the combination of these two main lines of work is rather unexplored in the statistical literature. A first attempt has been proposed in [4] with the adaptation of the PLS method to the extreme framework.

The goal of this postdoc work is to contribute to the development of Bayesian methods for the estimation of extreme risk measures in high dimensional settings. We propose to investigate how introducing prior information in the Extreme-PLS model [4] can improve the estimation of extreme risk measures on the challenging situation of small sample size and high dimension. The method will be applied to the insurance in the agricultural sector, whose yields and prices are directly exposed to

climatic and financial risks and depend on a large number of external factors. The analysis will be conducted on a survey of French farmer's income belonging to the Farm Accountancy Data Network (FADN), in collaboration with Geoffroy Enjolras (CERAG, UGA).

References:

[1] P. Embrechts, C. Kluppelberg & T. Mikosch. (1997).
Modelling extremal events, Springer.

[2] L. de Haan & A. Ferreira. (2006).
Extreme Value Theory: An Introduction, Springer-Verlag, New York.

[3] A. Daouia, L. Gardes & S. Girard. (2013).
On kernel smoothing for extremal quantile regression, Bernoulli, 19, 2557--2589.

[4] Bousebata, M., Enjolras, G., & Girard, S. (2022). Extreme Partial Least-Squares,https://hal.inria.fr/hal-03165399

Main activities

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Skills

Conditions for applicants:

We look for candidates strongly motivated by challenging statistical research with application to real world data. The applicant should have a solid background in mathematics, and more specifically in probability and statistics. He/she will also ideally have experience in either extreme value analysis, dimension reduction methods or Bayesian statistics. The applicant will have significant experience in programming with either C/C++, Matlab, Python or R.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking and flexible organization of working hoursrofessional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Remuneration

Gross salary: 2746 Euros per month

General Information

- **Theme/Domain :** Optimization, machine learning and statistical methods
  Statistics (Big data) (BAP E)
- **Town/city :** Montbonnot
- **Inria Center :** Centre Inria de l'Université Grenoble Alpes
- **Starting date :** 2023-09-01
- **Duration of contract :** 1 year
- **Deadline to apply :** 2023-07-31

Contacts

- **Inria Team :** STATIFY
- **Recruiter :**
  Girard Stephane / stephane.girard@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

Instruction to apply

Applicants should hold a PhD in Systems and Control or Applied Mathematics.

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.