Offer #2025-09109

PhD Position F/M INFERENCE FOR EXTREME DATA IN A UNIVARIATE DEPENDENT SETTING

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

About the research centre or Inria department

The Inria center at Université Côte d'Azur includes 42 research teams and 9 support services. The center's staff (about 500 people) is made up of scientists of di?erent nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regional economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Context

This PhD position is part of the "Thèses Tandem" program, a joint initiative between the Université de Montpellier (France) and the Université de Sherbrooke (Canada).

Two complementary PhD projects are offered through this collaboration, each focusing on a different yet interconnected aspect of univariate extreme value modeling
under dependence. The selected candidates will benefit from shared supervision, close collaboration between the two universities, and regular research exchanges. The program includes funding for a work computer, travel to national and
international conferences, and several research stays at Université de Sherbrooke, in Québec, Canada.

The aim of this thesis project is to develop frequentist and Bayesian inference techniques for estimating the limit distribution of themaximum under dependency assumptions. Bayesian methods are particularly suited to situations where information is scarce oruncertain - which is typically the case in the analysis of extremes

Assignment

Univariate extreme value theory (EVT) states that the maximum of a sequence of independent, identically distributed random variables converges to a Generalized
Extreme Value (GEV) distribution. However, the assumption of independence is often unrealistic in real-world applications, where data are typically temporally or spatially correlated - e.g., wave heights, temperature records, pollution levels, or financial returns.
Pioneering work by Leadbetter (1974, 1983) relaxed the independence assumption by introducing asymptotic dependence conditions, allowing a form of “quasiindependence”
between extreme events. More recently, copula-based approaches have enabled the separate modeling of marginal behavior and dependence structure (Sklar, 1959), significantly advancing the field, especially in multivariate settings.
We refer to Nelsen (2006), Joe (2015), or Durante and Sempi (2015) for textbook introductions.
A different point-of-view was proposed by Herrmann, Hofert, and Nešlehová (2024), who established convergence conditions for the maximum in a dependent univariate setting using copulas. This generalizes the Fisher-Tippett-Gnedenko theorem to sequences of dependent variables.

Main activities

Supervision team : Gwladys Toulemonde (IMAG, Université de Montpellier and Inria LEMON) and Nicolas Meyer (IMAG, Université de Montpellier and Inria LEMON)
with Klaus Herrmann and Eric Marchand (Equipe de statistique, Université de Sherbrooke)

The aim of this thesis project is to develop frequentist and Bayesian inference techniques for estimating the limit distribution of the maximum under dependency assumptions. Bayesian methods are particularly suited to situations where information is scarce or uncertain - which is typically the case in the analysis of extremes, see Beirlant et al. (2004, Chapter 11) or Bousquet & Bernardara (2021, Chapter 11). By introducing flexible prior distributions on the parameters, we can obtain :
— credibility intervals (rather than simple confidence intervals),
— density prediction for extreme observations,
— better consideration of dependency structure, particularly in exchangeable models, such as those discussed in Herrmann, Hofert & Nešlehová (2024).

The thesis will thus aim to develop and study estimators and evaluate their performance

on simulated and real data, for example meteorological or financial data.

Skills

M2 or engineering degree in statistics.
Strong background in mathematics, particularly statistics and probability theory, proficiency in R and/or Python programming

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 (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Contribution to mutual insurance (subject to conditions)

Remuneration

Duration: 36 months
Location: Sophia Antipolis, France
Gross Salary per month: 2200€ (2025).

General Information

- **Theme/Domain :** Stochastic approaches
  Statistics (Big data) (BAP E)
- **Town/city :** Montpellier
- **Inria Center :** Centre Inria d'Université Côte d'Azur
- **Starting date :** 2025-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2025-08-31

Contacts

- **Inria Team :** LEMON
- **PhD Supervisor :**
  Toulemonde Gwladys / gwladys.toulemonde@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.

The keys to success

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Applications must be submitted online on the Inria website. Collecting applications by other channels is not guaranteed.

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.