Position description

1. Position identification

Title of post : Post-doc position

Type of contract : Fixed-term contract

Category (A,B or C) : A

Contract/project period : 24 months

Expected date of employment : starting between September 2026 and January 2027

Proportion of work : Full-time (35h per week)

Workplace : IRMA lab, University of Strasbourg

Desired level of education : PhD

Experience required :

Contact(s) for information on the position (identity, position, e-mail address) : Etienne Birmelé, Professor, birmele@unistra.fr

Ségolen Geaffray, Assistant Professor, geffray@math.unistra.fr

Date of publication : February 12, 2026

Closing date for the receipt of applications : May 15, 2026

2. Research project or operation

This postdoctoral position is part of the interdisciplinary HisToGraM project, funded by Inserm for the period 2025–2029. It brings together probabilists and statisticians from Strasbourg and Calais with an Inserm team of bioinformaticians and physicians from Hôpital Beaujon in the parisian area.

The aim of this project is to develop statistical tools for differential histology, enabling the comparison of tissue structures of an organ under different conditions.

From a mathematical point of view, the data can be represented as colored points in a plane, where each point symbolizes a cell, and its color indicates its type or morphology. Data from the same condition can be viewed as realizations of a marked point process, for instance log-gaussian Cox processes [WGJM16], with parameters depending on the condition. The challenge is to discriminate between different types of point processes and parameterizations, and to determine the most relevant statistics for this purpose. We are particularly interested in statistics derived from topological data analysis [dMDES24], pattern counting [RS14], or geometric extremes [BC20].

These studies require both theoretical and computational developments, especially in simulation-based inference. Real data from pancreatic cancer will be used to develop the method in a relevant way and to test its results in terms of interpretability and tissue classification potential.

3. Activities

> **Description of the research activities :**

The main mission of this postdoctoral position will be to develop the project's component related to simulation-based inference [DG84,CBL20], which allows for the consideration of realistic but theoretically intractable point processes. This methodology uses simulation to determine the empirical distributions of well-chosen statistics, enabling model selection, parameter estimation, or hypothesis testing. It has been successfully applied in ecology [Woo10], systems biology [TS10], and tumor growth modeling [JRTH17].

The recruited post-doc will primarily aim to develop this approach to:

- empirically evaluate the discriminative power of the indicators considered in the project;
- perform model selection and inference among marked point processes;
- construct tests for comparing two tissue populations.

They will also be invited to participate to the HisToGraM meetings and hence in the other aspects of the project.

The work carried out will be published in international peer-reviewed journals or conferences, and the code will be integrated into the R package developed as part of the project.

[BC20] G. Bonnet et N. Chenavier, The maximal degree in a Poisson-Delaunay graph, 2020.

[CBL20] K. Cranmer, J. Brehmer, and G. Louppe. The frontier of simulation-based inference, 2020.

[DG84] P. J. Diggle and R.J. Gratton. Monte carlo methods of inference for implicit statistical models, 1984.

[dMDES24] S. Cultrera di Montesano, O. Draganov, H. Edelsbrunner and M. Saghafian, Chromatic topological data analysis, arXiv : 2406.04102, 2024.

[JRTH17] N. Jagiella, D. Rickert, F.J. Theis, and J. Hasenauer. Parallelization and high-performance computing enables automated statistical inference of multi-scale models, 2017.

[RS14] P. Ribeiro and F. Silva, Discovering colored network motifs, 2014.

[TS10] T. Toni and M.P.H. Stumpf. Simulation-based model selection for dynamical systems in systems and population biology, 2010.

[WGJM16] R. Waagepetersen, Y. Guan, A. Jalilian and J. Mateu, Analysis of multispecies point patterns unsing multavariate log-gaussian Cox processes, 2016

[Woo10] S. N. Wood. Statistical inference for noisy nonlinear ecological dynamic systems, 2010.

4. Skills

> **Qualifications/knowledge** :

Applicants should have a PhD in Statistics. They may alternatively have a PhD in Mathematics or in a related field and show a strong motivation to transition into Statistics.

➢ **Operational skills/expertise :** Statistical inference, programing in R and Python

➢ **Personal qualities :** Ability to work independently and as part of a team

5. Environment and context of work

➢ **Presentation of the laboratory/unity :**

The Institut de Recherche Mathématique Avancée (IRMA) is a mathematics research laboratory under the joint supervision of the University of Strasbourg and the CNRS. It brings together approximately 130 people, organized into seven teams covering a broad spectrum from pure mathematics to applied mathematics.

The successful candidate will join the Statistics team at IRMA.

➢ **Hierarchical relationship :**

The successful candidate will depend hierarchically from the director of the lab, Charles Frances, under the direct supervision of Etienne Birmelé

➢ **Special conditions of practice : /**

To apply, please send your CV, cover letter, diploma, summary of your previous research (3-4 pages) and references to :

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