**2022-05156 - Post-Doctoral Research Visit F/M Fair and Optimal Design of (Repeated) MarketPlace**

**Contract type:** Fixed-term contract  
**Level of qualifications required:** PhD or equivalent  
**Function:** Post-Doctoral Research Visit  
**Level of experience:** Recently graduated

### About the research centre or Inria department

Located at the heart of the main national research and higher education cluster, member of the Université Paris Saclay, a major actor in the French Investments for the Future Programme (Idex, LabEx, IRT, EquipeX) and partner of the main establishments present on the plateau, the centre is particularly active in three major areas: data and knowledge, safety, security and reliability, modelling, simulation and optimisation (with priority given to energy).

The 450 researchers and engineers from Inria and its partners who work in the research centre’s 28 teams, the 60 research support staff members, the high-level equipment at their disposal (image walls, high-performance computing clusters, sensor networks), and the privileged relationships with prestigious industrial partners, all make Inria Saclay Île-de-France a key research centre in the local landscape and one that is oriented towards Europe and the world.

### Context

The post-doc will be hired by Inria and integrate the EEL team of Criteo. (s)he will join the FairPlay team, a new team jointly created by Criteo, Institut Polytechnique de Paris (ENSEA and École Polytechnique), and Inria. As such the post-doc will spend time both in Criteo and in CREST in Saclay where the team is hosted. The post-doc will have access to Criteo data on-site whenever useful to test algorithms on real data.

### Assignment

**Context:**

Online ads platforms are nowadays used to advertise not just products, but also opportunities such as jobs, houses, or financial services. This makes it crucial for such platforms to respect fairness criteria (be it only for legal reasons). Despite this pressing need, there is currently no technical solution in place to provably prevent discriminations. One of the main challenge is that ad impression decisions governed by complex marketplaces with multiple agents that involve asymmetry and asynchronicity of decisions, which are not currently well understood in particular in the repeated setting (which happens in practice). To better understand these marketplaces and develop fair and efficient algorithms, it is necessary to propose and analyze new theoretical models and algorithms.

**Objectives:**

The main objective of the post-doc is to develop new theoretical models and algorithms with theoretical guarantees for ad marketplaces that respect fairness notions; and to test them. The first goal is theoretical and is divided in two main axes:

- Development of matching algorithms for marketplaces that respect fairness constraints, potentially on both sides (buyers and sellers). One of the key difficulty is that this objective is in contradiction with privacy considerations since measuring fairness requires access to sensitive attributes.
- Incorporating random structures, in particular random graphs, in the design and optimization of algorithms. Indeed, current learning algorithms focus typically today on worst-case guarantee that lead to poor performance in many practical cases which are not worst case.

The last goal, depending on the progress of the theoretical goal above, will be to construct a simulator of marketplace that would make sellers and buyers interact under the umbrella of the marketplace. By modeling the agents behaviors (e.g., through reinforcement learning algorithms), it would then become possible to evaluate the impact of changes in the marketplace on the market and eventually to perform empirical design of mechanisms for such complex marketplaces.

### Collaborations

The post-doc will work with Vianney Perchet from Criteo/ENSEA and Patrick LOISEAU from Inria, but collaboration with other members of the FairPlay team is welcome.

### Main activities

Main activities: Understanding the state-of-the-art, developing novel algorithms and proving theoretical guarantees; developing and testing the solutions, communicating the work (papers, talks, etc.)

### Skills

Technical skills and level required: PhD level in the fields mentioned above fields

Languages: English mandatory, French is not mandatory

Relational skills: Taste for collaborative research

Other valued appreciated: Interest in theory and applications to online marketplaces

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**General Information**

- **Theme/Domain:** Optimization, machine learning and statistical methods  
- **Statistics (Big data) (BAP E)**  
- **Town/City:** Palaiseau  
- **Inria Center:** CRI Saclay - Île-de-France  
- **Starting date:** 2022-10-01  
- **Duration of contract:** 1 year, 11 months  
- **Deadline to apply:** 2022-09-02

### Contacts

- **Inria Team:** FAIRPLAY  
- **Recruiter:** Loiseau Patrick / patrick.loiseau@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 in cooperation 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

The candidate should have a PhD in mathematics, computer science, economics, or a related field. (s)he should have a strong background in mathematics (probability in particular) and in either online learning or game theory, and be interested in marketplaces as well as in societal aspects. Programming capabilities will also be appreciated.

### Instruction to apply

**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.

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**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.
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
- Social security coverage

Remuneration
Monthly salary: 2,653 euros