Job description

Position type: PhD Student
Functional area: Lille (Villeneuve d'Ascq)
Research theme: Applied Mathematics, computation and simulation
Project: SEQUEL
Scientific advisor: odalric.maillard@inria.fr
HR Contact: gwenael.desfontaines@inria.fr
Keywords: Machine Learning, Statistics, Bandits, Reinforcement Learning.

Link to online application:
https://emea3.recruitmentplatform.com/appproc/index.cfm?event=createSessionAfterSession
Clear&ID=PNGFK026203F3VBQB6G68LOE1&jobboard=0&nPTID=18212&bSessionClea
r=true&nProfileIdFoundInAGP=

Understanding the dynamics of complex systems, and how to optimally act in them impacts all aspects of human societies where a careful management of natural, energetic, human and computational resources is required. To overcome the limitations of human capabilities to process large amounts of data, researchers from the field of machine learning and mathematical statistics for sequential *decision making* pursue the long-term goal of developing an optimal and automatic method that can, from *partial* observations and sequential interactions with a *complex* system, learn an *optimal* behavior.

A key difficulty to design a solution for these problems is that typically, when a decision is made, one only gets to see a *noisy* effect of that decision, and little about the effect of other alternatives. This gives rise to the study of the fundamental **exploration-exploitation** trade-off: Shall we follow a strategy that has been used a lot in the past and has empirically proven good until now (*exploitation*), or shall we explore a less known but potentially promising strategy (*exploration*)?

Despite key advances in the understanding of sequential decision making under uncertainty over the last decade, specifically in multi-armed bandit theory and in reinforcement learning, much remain to be done in order to build the next generation of sequential learners that can interact with complex and possibly evolving systems in an autonomous way.

Beyond the desired safety requirements that can be obtained by providing **provably near-optimal performance guarantees**, the two intertwined bottlenecks that must be studied and currently prevent the development of the field include the adaptation to the **non-stationary** nature of the environment, and the often partially hidden **structure** of the environment generating the observation signal.

About Inria and the job

Inria is a research institute dedicated to promoting 'scientific excellence in the service of technology transfer and society as a whole'. Inria employs 2700 people, drawn from the world's most prestigious universities and spread across eight research centers in France, in order to address the latest challenges in computer science and mathematics.

The Inria Lille - Nord Europe research center was founded in 2008 and employs 360 people, including 300 scientists working in sixteen research teams. Recognized for its outstanding contribution the socio-economic development of the Nord - Pas-de-Calais Region, the Inria Lille - Nord Europe research center undertakes research in the field of computer science in collaboration with a range of academic, institutional and industrial partners.

The Inria Lille - Nord Europe research center, at the heart of what is now known at the "Creativalley", benefits from both an outstanding geographic location at the crossing of all main connecting roads in Europe, which makes it an especially active place for research, and from a high-quality transportation network. These two components confer to the Inria Lille - Nord Europe research center the availability to provide optimal welcoming and logistics conditions for permanent and invited researchers as well as students.

The strategy of the center is to develop an internationally renowned center of excellence with a significant impact on the City of Lille and its surrounding area. It works to achieve this by pursuing a range of ambitious research projects in such fields of computer science as the intelligence of data and adaptive software systems. Building on the synergies between research and industry, Inria is a major contributor to skills and technology transfer in the field of computer science.

Mission

The Inria team **SequeL** is a very active, united, hard-working, internationally renowned and connected research team specialized on theoretical and applied aspects of machine learning for sequential decision making with noisy or partial feedback. It feeds a regular research seminar, classes in several masters and has direct connections with a number of companies. SequeL was the organizing team of the 32nd International Conference in Machine Learning that was held in Lille in 2015, and is generally experienced in managing international research events. SequeL has strong connection with other research groups in Europe and beyond. Moreover, other research teams working on complementary topics (e.g. Magnets, Sigma, Links) are physically located within walking distance of the SequeL offices, which triggers rich scientific interactions.

The French ANR – "**BA**n**D**its **A**gainst non-**S**tationarity and **S**tructure" (BADASS) is a four-year project, headed by Odalric-Ambrym Maillard, in collaboration with Emilie Kaufmann and Richard Combes, that focuses on non-stationarity and structure in multi-armed bandit and reinforcement learning theory. It has specific funding to invite researchers, organize workshops, train students and generate a rich scientific activity around these questions. It also involves strong international connections with other leading research institutes in the world as well as some companies.

The objective of this PhD, under the direct supervision of Odalric-Ambrym Maillard, is to study and develop novel decision-making strategies in order to handle two main points: first the **non-stationary** nature of the observations, second the possibly unknown **structure** of the signals, both in the context of sequential prediction and reinforcement learning.

The proposed strategies will be developed with a generic application purpose and thus be given **theoretically grounded** performance guarantees under application-friendly assumptions.

For more information, please send an email to odalric.maillard@inria.fr.

Job offer description

The successful candidate will be part of an ambitious research program. She or he will be brought to the highest level in mathematical statistics, information theory and machine learning for sequential decision making via an intensive training program, and is expected to master a large amount of tools from these different fields by the end of the PhD. Meanwhile, the candidate will have the opportunity to enjoy the beautiful, alive and welcoming city of Lille, as well as top working conditions for doing research in France. The standard activities of a PhD student include writing research articles (in English) in top conferences or journals of the fields, absorbing a vast amount of literature, communicating actively with her/his advisor, and suggest or try a number of novel and original ideas.

Skills and profile

- A solid mathematical background, specifically in mathematical statistics and/or optimization, information theory, signal processing, machine learning. Having followed several classes related to these fields is mandatory.
- Sense of organization, autonomy, rigor
- A strong commitment or true motivation for doing research.
- A taste for teamwork, for theory, for applications.
- Basic pedagogical skills.
- Good writing and speaking abilities in English.

Holding a Master related to Mathematical Statistics or Machine Learning is mandatory.

Benefits

- French courses
- Help for housing
- Partial support for transportation costs
- Scientific resident card and help for visa
- On-site restoration
- All scientific missions covered by Inria (including Machine Learning Schools, etc.)

Additional information

Duration : 36 months
Starting date of the contract :   01/10/2017
Salary : 1982 euros the two first years and 2085 euros the third year
Scientific contact : Odalric-Ambrym Maillard <odalric.maillard@inria.fr>
HR contact : gwenael.desfontaines@inria.fr

Link to online application:
https://emea3.recruitmentplatform.com/appproc/index.cfm?event=createSessionAfterSessionClear&ID=PNGFK026203F3VBQB6G68LOE1&jobboard=0&nPTID=18212&bSessionClear=true&nProfileIdFoundInAGP=

Security and defense procedure
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.

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