2018-00293 - [Campagne Doctorant 2018/CRI Lille] - PhDThesis: Structure adaptation in Reinforcement Learning (M/F)

Contract type: Public service fixed-term contract
Level of qualifications required: Graduate degree or equivalent
Fonction: PhD Position

About the research centre or Inria department

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

The strategy of the Centre is to develop an internationally renowned centre 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.

Context

Job environnements

This Ph.D. is funded by Inria Lille - Nord Europe, in the French city of Lille (Villeneuve d'Ascq), within the team-project Sequel that is working on all aspects of Sequential Learning. The student will be directly supervised by Odalric-Ambrym Maillard.

The Sequel team is at the heart of a very strong and active research network, that benefits from many international and national collaborations, both in academia and several companies, plus its outstanding geographic location at the crossing of main roads in Europe (50min to Charles de Gaulle Airport, 1h to Paris, 1h30 to London, etc), not to mention the very nice city of Lille, and the physical proximity of other machine learning teams in Lille.

Travel expenses are covered within the limits of the scale in force.

Assignment

Assignments

In this thesis, we want to better understand how the notion of structure modifies the learning guarantees and suggests novel improved algorithms in the context of Markov Decision Processes, Predictive State Representations, as well as Multi-armed bandits.

The objective of this PhD is to study and develop novel decision-making strategies in order to be adaptive to different notions of structure in the context of sequential prediction and reinforcement learning. For instance structure in an MDP may be considered as a notion of equivalence of certain states, or by the presence of specific bottlenecks, or a specific property of the recovery times after playing a sub-optimal action.

For a better knowledge of the proposed research subject:

A more detailed description of the topic, together with bibliographic references are available at the following URL: http://odalricambrymaillard.neowordpress.fr/wp-content/uploads/sites/18032/2018/02/Sujet_de_these_MDPs_StructuresInria.pdf

Collaboration:

Natural collaborators of the candidate will be the member of the Sequel team, due to their complementary skills and points of view on sequential learning as well the other members of the ANR lead by Odalric-Ambrym Maillard: Emilie Kaufmann and Richard Combes. Likely external collaborators include collaborators of the team on RL questions, as well as specific researchers such as Borja Balle (Hankel matrices and Predictive State Representations), Alexandre Proutiere (Structured bandits and MDPs), Ronald Ortner (UCRL) to name a few. Obviously, actual collaborations

General Information

- Theme/Domain: Optimization, machine learning and statistical methods
- Statistics (Big data) (BAP E)
- Town/city: Villeneuve d'Ascq
- Inria Center: CRI Lille - Nord Europe
- Starting date: 2018-10-01
- Duration of contract: 3 years
- Deadline to apply: 2018-05-02

Contacts

- Inria Team: SEQUEL
- Recruiter: Maillard Odalric / odalric.maillard@inria.fr

The keys to success

The keys to success

The candidate should be mathematically strong and interested in solving theoretical problems using probability, statistics and optimization. The student should try to pursue its own goal, beyond and above the PhD proposal, thus proposing novel and disruptive ideas.

Conditions for application

Instructions to apply

Candidates will be treated firstly with a complete file: CV + letter of motivation + one or more letters of recommendation + transcripts from previous years.

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.

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...
will evolve according to the advances made and difficulties encountered during the PhD.

**Main activities**

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In this thesis, we want to better understand how the notion of structure modifies the learning guarantees and suggests novel improved algorithms in the context of MDPs, PSRs, as well as bandits. The objective of this PhD is to study and develop novel decision-making strategies in order to handle (or suggest) various notions of structure 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. The candidate should be mathematically strong and interested in solving theoretical problems using probability, statistics and optimization.

Along the duration of the PhD, the student will have to master a number of tools coming from different fields of research and thus will be provided with a significant but targeted amount of articles and books related to Information theory, Multi-armed bandits, Concentration of measure, Markov Decision Processes, Spectral methods, Hierarchical Reinforcement Learning, to name a few. This continuous training during the whole PhD will be complemented with summer schools, especially the Machine learning summer school and the Ecole d’été de Saint-Flour, and the attendance to regular seminars or research events within the related communities.

**Skills**

**Skills**

Technical skills and level required : Master in Machine Learning or Mathamatical Statistics, prior knowledge of Reinforcement Learning.

Languages : English is mandatory, French is optional.

Relational skills : We are working in a team, thus a strong team spirit is valuable.

Other valued appreciated : Creativity, imagination, self-determination, etc.

**Benefits package**

**Benefits**

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Sports facilities
- Flexible working hours

More information about Lille :

http://www.lille3000.eu/portail/
http://www.lillemetropole.fr/mel.html

**Remuneration**

**Remunating**

The gross monthly salary is 1982€ for the 1st and the 2nd year, 2085€ for the 3rd year.