



Offre n°2024-07475

PhD Position F/M Ph.D. W/M: Robust approaches in sequential decision and learning problems.

Le descriptif de l'offre ci-dessous est en Anglais

Type de contrat : CDD

Niveau de diplôme exigé : Bac + 5 ou équivalent

Fonction : Doctorant

A propos du centre ou de la direction fonctionnelle

The Inria University of Lille centre, created in 2008, employs 360 people including 305 scientists in 15 research teams. Recognised for its strong involvement in the socio-economic development of the Hauts-De-France region, the Inria University of Lille centre pursues a close relationship with large companies and SMEs. By promoting synergies between researchers and industrialists, Inria participates in the transfer of skills and expertise in digital technologies and provides access to the best European and international research for the benefit of innovation and companies, particularly in the region. For more than 10 years, the Inria University of Lille centre has been located at the heart of Lille's university and scientific ecosystem, as well as at the heart of Frenchtech, with a technology showroom based on Avenue de Bretagne in Lille, on the EuraTechnologies site of economic excellence dedicated to information and communication technologies (ICT).

Contexte et atouts du poste

Multi-armed bandit theory has witnessed tremendous progress over the last decade, yielding algorithms achieving strong learning guarantees (regret minimization, best-arm identification) in increasingly challenging context involving sequential decision-making in uncertain environment. In particular, recent works obtained non-parametric optimal algorithms, enabling application of multi-armed bandit to a large range of applications when reward distributions are not easily modelled with classical families.

Recently, a complementary bandit model considering Huber-outlier distributions (mixture between a parametric distribution of interest and an arbitrary one) has been studied, offering an interesting complementary perspective compared to non-parametric assumptions and modelling arbitrarily bad outlier observations, something often encountered in real applications.

This Ph.D. will focus on the problem of model misspecification in the context, i.e. we study the problem of sequential learning when some context, or feature, vector is available but we do not want to force strong assumptions on the context and assume only nonparametric or even corrupted model on the context. To summarize, we want to study both Regret minimization or Best-arm identification objectives, in the contextual setup assuming either Huber-outlier or Non-parametric distributions.

Mission confiée

The Ph.D. focuses on basic research, theory of multi-armed bandits, nonparametric and robust statistics, and for this reason the candidate will have to get familiar with both the literature in multi-armed bandit and the literature of nonparametric and robust statistics.

Principales activités

The suggested plan of this academic thesis consists in execution of three tasks or work packages, mainly oriented on development of fundamental approaches. Each will be accompanied by publications in international top-rated journals and conferences, in the spirit of open and reproducible science, open-source code, etc.

Task 1: Exploitation of uncertain or corrupted context in linear bandits.

When the context is corrupted or uncertain, exploiting the information given by the context is not obvious, and it may even be detrimental to consider a non-informative context as it makes the learning process more complicated. In this first task, we want to study the specific case of linear bandits that feature a simple link between context and reward and is a natural extension from univariate to multivariate in order to begin understanding uncertain contexts in the sequential setting. Complementary to the linear case, bandits with auxiliary information may also be a relevant

structure to explore.

Task 2: Sequential optimality in corrupted environment.

The goal is to establish, in a corrupted environment, optimality of an algorithm. Even for the simple problem of estimating a univariate mean in corrupted environment, optimal strategies were discovered only very recently. We propose to extend recent works on optimal estimation in corrupted environment to the problem of sequential estimation in order to better understand the link between sequential setting and the loss of information via corruption.

Task 3: Implementation of nonparametric and robust methods.

All the algorithms described previously should be implemented and tested, against state-of-the-art algorithms and perform well in practice. By testing on realistic environment (that are already developed by the host team) that have potentially a complex structure, we want to get practical evidence on the interplay between uncertain context and sequential learning to understand better the theoretical questions that should be asked in order to ascertain the efficiency of our algorithm when used in real applications. We are interested in particular in applications to agriculture because agriculture features very uncertain context and up to now the usual bandit strategies struggled to be efficient with such nonparametric problem.

Compétences

Skills required : Master level mathematic and statistics skills are required. In regard to computer skills, familiarity with Latex, Python and/or R are important.

Languages : English

Avantages

- 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 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

Rémunération

1st & 2nd year : 2100 € (grossly salary by month)

3rd year: 2190 € (grossly salary by month)

Informations générales

- **Thème/Domaine** : Optimisation, apprentissage et méthodes statistiques
Statistiques (Big data) (BAP E)
- **Ville** : Villeneuve d'Ascq
- **Centre Inria** : [Centre Inria de l'Université de Lille](#)
- **Date de prise de fonction souhaitée** : 2024-10-01
- **Durée de contrat** : 3 ans
- **Date limite pour postuler** : 2024-06-30

Contacts

- **Équipe Inria** : [SCOOOL](#)
- **Directeur de thèse** :
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A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de

nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

The PhD position requires a solid background in statistics, probability, Markov chains, concentration of measure and confidence regions, a good knowledge of multi-armed bandit, active sampling and Markovdecision processes methods, strong analytical skills, as well as the capacity to code, conduct relevant numerical experiments and prove theoretical guarantees of the considered strategies. The successful candidate must be familiar with usual probability and statistics theory and must be interested in fundamental mathematical research, is expected to learn quickly, have a solid mathematical background, and have good to excellent programming skills. After getting familiar with the relevant literature, and through numerous discussions with the PhD advisor, the candidate will investigate such questions and is expected to publish its outcome in the top-tier conferences and journals of the field.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.