Offre n°2024-08305

PhD Position F/M Online Learning with Limited Resources

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 center at Université Côte d'Azur includes 42 research teams and 9 support services. The center's staff (about 500 people) is made up of scientists of different nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regional economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Contexte et atouts du poste

The position is part of a new Marie Curie Training Network called FINALITY, in which Inria joins forces with top universities and industries, including IMDEA, KTH, TU Delft, the University of Avignon (Project Leader), the Cyprus Institute, Nokia, Telefonica, Ericsson, Orange, and others. The PhD students will have opportunities for internships with other academic and industry partners and will be able to participate in thematic summer schools and workshops organized by the project.

Only people who have spent less than one year in France in the last 3 years are eligible.

The candidate will receive a monthly living allowance of about €2,735, a mobility allowance of €414, and, if applicable, a family allowance of €458 (gross amounts).

Mission confiée

Online learning algorithms [Hazan22,Shalev12] have shown substantial promise across various future networks' applications, including caching [Bhattacharjee20,Paschos19,SiSalem23], resource allocation in radio access networks [Kalntis24], and machine learning model placement [SiSalem24].

This thesis focuses on advancing online learning algorithms that offer theoretical guarantees against an adversary who selects the sequence of inputs with the goal to jeopardize system performance. Such adversarially robust algorithms are particularly beneficial for scenarios characterized by highly dynamic user demands and/or rapidly evolving network conditions.

A key metric in evaluating the robustness of these algorithms is regret, which measures the largest discrepancy between the algorithm's experienced cost and that of the optimal static policy in hindsight (i.e., one that has prior knowledge of the entire input sequence). The objective is to develop algorithms with sublinear regret growth relative to input sequence length, ensuring that their per-input-average cost asymptotically approaches that of the best static policy.

Online gradient descent, follow-the-perturbed-leader or follow-the-regularized-leader [Hazan22] exemplify algorithms that achieve sublinear regret in practical applications. However, their computational and memory requirements often exceed the capacities of edge devices and/or are incompatible with tight latency constraints, largely due to for large state storage and/or projection operations over the feasible state space.

This thesis aims to design online learning algorithms optimized for reduced memory and computational overhead, making them more suitable for resource-constrained and latency-sensitive environments. Initial strategies for complexity reduction include batch processing of inputs [Faticanti24, SiSalem23], input sampling [Mazziane23], and constraint relaxation [Carra24]. Building on these approaches, this work will explore novel methods to further streamline these algorithms while preserving robust performance.

References

[Bhattacharjee20] R Bhattacharjee, S Banerjee, and A Sinha, Fundamental Limits on the Regret of Online Network-Caching, 2020

[Carra24] D Carra, G Neglia, An Online Gradient-Based Caching Policy with Logarithmic Complexity and Regret Guarantees, arXiv preprint arXiv:2405.01263

[Faticanti24] F Faticanti, G Neglia, Optimistic online caching for batched requests, Elsevier Computer Networks 244, 2024

[Hazan22] E Hazan, Introduction to Online Convex Optimization, The MIT Press, 2022

[Kalntis24] M Kalntis, G Iosifidis and F A Kuipers, Adaptive Resource Allocation for Virtualized Base Stations in O-RAN with Online Learning, IEEE Transactions on Communications, 2024

[Mazziane23] Y B Mazziane, F Faticanti, G Neglia and S Alouf, No-Regret Caching with Noisy Request Estimates, 2023 IEEE Virtual Conference on Communications (VCC), 2023

[Paschos19] G S Paschos, A Destounis, L Vigneri, G Iosifidis, Learning to Cache With No Regrets, IEEE INFOCOM, 2019

[Shalev12] S Shalev-Shwartz, Online Learning and Online Convex Optimization, Foundations and Trends in Machine Learning, 2012

[SiSalem24] T Si Salem, G Castellano, G Neglia, F Pianese, A Araldo, Toward inference delivery networks: Distributing machine learning with optimality guarantees, IEEE/ACM Transactions on Networking, 2024

[SiSalem23] T Si Salem, G Neglia, and S Ioannidis, No-regret Caching via Online Mirror Descent. ACM Trans. Model. Perform. Eval. Comput. Syst. 8, 4, Article 11, 2023

Principales activités

Research

Compétences

The candidate should have a solid mathematical background (in particular on optimization) and in general be keen on using mathematics to model real problems and get insights. He should also be knowledgeable on machine learning and have good programming skills.

We expect the candidate to be fluent in 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
- Social, cultural and sports events and activities
- Access to vocational training
- Contribution to mutual insurance (subject to conditions)

Rémunération

The candidate will receive a monthly living allowance of about €2,735, a mobility allowance of €414, and, if applicable, a family allowance of €458 (gross amounts)

Informations générales

- **Thème/Domaine :** Optimisation, apprentissage et méthodes statistiques
  Système & réseaux (BAP E)
- **Ville :** Sophia Antipolis
- **Centre Inria :** Centre Inria d'Université Côte d'Azur
- **Date de prise de fonction souhaitée :** 2025-03-01
- **Durée de contrat :** 3 ans
- **Date limite pour postuler :** 2025-03-31

Contacts

- **Équipe Inria :** NEO
- **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.

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

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

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.