Offre n°2024-07486

PhD Position F/M [Campagne DOC MI-NF-GRA-2024]
Knowledge-based reinforcement learning and knowledge evolution

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 Centre Inria de l’Université de Grenoble groups together almost 600 people in 22 research teams and 7 research support departments.

Staff is present on three campuses in Grenoble, in close collaboration with other research and higher education institutions (Université Grenoble Alpes, CNRS, CEA, INRAE,…), but also with key economic players in the area.

The Centre Inria de l’Université Grenoble Alpes is active in the fields of high-performance computing, verification and embedded systems, modeling of the environment at multiple levels, and data science and artificial intelligence. The center is a top-level scientific institute with an extensive network of international collaborations in Europe and the rest of the world.

Contexte et atouts du poste

Doctoral school: MSTII, Université Grenoble Alpes.

Advisor: Jérôme Euzenat (Jerome:Euzenat#inria:fr) and Jérôme David (Jerome:David#univ-grenoble-alpes.fr).

Group: The work will be carried out in the mOeX team common to INRIA & LIG. mOeX is dedicated to study knowledge evolution through adaptation. It gathers researchers which have taken an active part these past 15 years in the development of the semantic web and more specifically ontology matching and data interlinking.

Mission confiée

Cultural knowledge evolution and multiagent reinforcement learning share some of their prominent features. Putting explicit knowledge at the heart of the reinforcement process may contribute to better explanation and transfer.

Cultural knowledge evolution deals with the evolution of knowledge representation in a group of agents. For that purpose, cooperating agents adapt their knowledge to the situations they are exposed to and the feedback they receive from others. This framework has been considered in the context of evolving natural languages [Steels, 2012]. We have applied it to ontology alignment repair, i.e. the improvement of incorrect alignments [Euzenat, 2017] and ontology evolution [Bourahla et al., 2021]. We have shown that it converges towards successful communication through improving the intrinsic knowledge quality.

Reinforcement learning is a learning mechanism adapting the decision making process for maximising the reward provided by the environment to the actions performed by agents [Sutton and Barto, 1998]. Many multi-agent versions of reinforcement learning have also been proposed depending on the agent attitude (cooperative, competitive) and the task structure (homogeneous, heterogeneous) [Bučoniu et al., 2010].

From an external perspective, the two approaches operate in a similar manner: agents perceive their environment, perform an action, receive reward or punishment, adapt their behaviour in consequence. However, a look into the inner mechanisms reveals important differences: the emphasis on knowledge quality instead of reward maximisation, the lack of probabilistic or even gradual interpretation, and even the absence of explicit choice in action or adaptation. Hence these two knowledge acquisition techniques are close enough to suggest replacing one by the other and different enough to cross-fertilise.

This thesis position aims at further exploring the commonalities and differences between experimental
cultural knowledge evolution and reinforcement learning. In particular, its purpose is to study which features of one technique may be fruitful in the context of the other and which may not.

For that purpose, one research direction is the introduction of knowledge-based reinforcement learning. In knowledge-based reinforcement learning, the decision-making process (the choice of the action to be performed) is obtained through accumulated explicit knowledge. Thus the adaptation performed after reward or punishment will have to directly affect this knowledge. This has the advantage that it allows to explain the decisions made by agents. It will also allow for explicit knowledge exchange among them [Leno da Silva et al., 2018].

This promotes a less utilitarian view of knowledge in which the evaluation of the performance of the system has to be disconnected from reward maximisation but to depend on the quality of the acquired knowledge. Of course, these two aspects need to remain related (the acquired knowledge must be relevant to the environment). This separation between knowledge and reward is useful when agents have to change environment or use their knowledge to perform various tasks.

Another use of reinforcement mechanisms relevant to cultural knowledge evolution is related to the motivation for agents to explore unknown knowledge territories [Colas et al., 2019]. By associating an intrinsic reward to the newly acquired knowledge, agents are able to improve the coverage of their knowledge in a way not guided by the environment. Complementing cultural knowledge evolution with exploration motivation, should make agents more active in their understanding of the environment and knowledge acquisition.

These problems may be treated both theoretically and experimentally.

This work is part of an ambitious program towards what we call cultural knowledge evolution partly funded by the MIAI Knowledge communication and evolution chair.

References:


Links:

- MIAI Knowledge communication and evolution: https://moex.inria.fr/cooperation/miai/
- mOeX web site: https://moex.inria.fr
- Lazy lavender: https://gitlab.inria.fr/moex/lazylav

Principales activités

Main activities:

- Analyse the state of the art
- Problem formalization
- Software development
- Propose & design experiments
- Write scientific reports & articles

Compétences

Researched skills:

- Curiosity and openness.
- Interaction with other researchers.
- Autonomous researcher.
- Taste for experimentation.
Knowledge of multi-agent simulation and/or reinforcement learning not required but a plus.

Innovative.

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 (90 days/year) and flexible organization of working hours (except for internship)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage under conditions

Rémunération

1st and 2nd year: 2 100 euros gross salary /month

3rd year: 2 190 euros gross salary / month

Informations générales

- Thème/Domaine: Représentation et traitement des données et des connaissances Statistiques (Big data) (BAP E)
- Ville: Montbonnot
- Centre Inria: Centre Inria de l'Université Grenoble Alpes
- Date de prise de fonction souhaitée: 2024-10-01
- Durée de contrat: 3 ans
- Date limite pour postuler: 2024-04-30

Contacts

- Équipe Inria: MOEX
- Directeur de thèse: David Jérôme / jerome.david@inria.fr

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

CV, cover letter, Master's grades, a letter of recommendation from the Master's course supervisor (or equivalent), possibly a letter of recommendation from the master's supervisor.

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.