2020-02718 - PhD Position F/M Deep Probabilistic Reinforcement Learning for Audio-Visual Human-Robot Interaction

Type de contrat : CDD
Niveau de diplôme exigé : Bac + 5 ou équivalent
Fonction : Doctorant

A propos du centre ou de la direction fonctionnelle
Grenoble Rhône-Alpes Research Center groups together a few less than 800 people in 39 research teams and 8 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientifc achievements and collaborations in both Europe and the rest of the world.

Contexte et atouts du poste
The PhD work will take place at Inria Grenoble, in Montbonnot-Saint-Martin, in the Perception Team, headed by Radu Horaud. It will be supervised by Chris Reineke (Post-doctoral Researcher) & Xavier Alameda-Pineda (Inria Research Scientist).

Mission confiée
Reinforcement learning, and in particular deep reinforcement learning (DRL), became very popular in the recent, successfully addressing a wide variety of tasks such as board game playing. It has also been popular in addressing computer vision or pattern recognition tasks for which a differentiable loss function is difficult to find or does not exist [1]. The most popular methodology in DRL is to approximate the so-called action-value function, leading to deep Q networks (DQN) [2] and its derivatives. In these methods, both the action policy and the system’s transition function are implicitly learned within the neural network that approximates the action-value. This is limiting since it is unclear how to incorporate prior knowledge of the policy or of the system. Alternatives to the mainstream methodology exists and they can be based, for instance, in parametrising a deterministic policy, and optimizing the parametrisation by gradient descent [3]. Probabilistic alternatives based on the EM algorithm were first proposed in the late 90’s [4], and revisited in the 2010’s, see for instance [5].

In parallel, progress on deep learning lead to the conception of variational auto-encoders (VAE), which are non-parametric probabilistic generative models. The use of VAE for reinforcement learning is at its very early stage [6], in which all actions, rewards and observations are jointly considered to infer a latent state, which is designed to encode the generation process of both the policy and the value function. In this PhD we would to investigate the use of VAE-based RL for audio-visual human-robot interaction. We aim to combine VAE for RL with probabilistic models developed for other tasks, such as speaker tracking or speech enhancement. VAE is a prominent research line but we are open to other ideas. Our team has expertise in probabilistic models for a variety of tasks [8,9] as well as on reinforcement learning for HRI [10].

Our team is searching for a motivated PhD candidate to investigate new approaches for deep reinforcement learning (DRL) in the field of audio-visual human-robot interaction. Although its high potential, DRL is still in its infancies when it comes to real-world applications such as robotics. Our group investigates DRL methods for the control of robots based on audio-visual inputs [10]. Our current project, in cooperation with several European partners [11], develops new approaches to enable health-care robots to interact and communicate with groups of people by providing information or guiding them. In difference to existing methods we are looking into approaches that combine visual and auditory information which improve for example the identification of an active speaker or their location.

References

Informations générales
- Thème/Domaine : Vision, perception et interprétation multimédia
- Ville : Montbonnot
- Centre Inria : CRI Grenoble - Rhône-Alpes
- Date de prise de fonction souhaitée : 2020-10-01
- Durée de contrat : 3 ans
- Date limite pour postuler : 2020-07-08

Contacts
- Équipe Inria : PERCEPTION
- Directeur de thèse : Alameda-pineda Xavier / xavier.alameda-pineda@inria.fr

A propos d'Inria
Inria est l'instut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 200 équipes-projets agiles, en général communément avec des partenaires académiques, impliquent plus de 3500 scientifques 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 scientifques et entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 180 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.

Consignes pour postuler
Dependant on the evolution of the health crisis linked to the Covid 19, it will be possible to take up a teleworking position.

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.

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.


**Compétences**

Research Master's degree, or equivalent, in a discipline connected to signal and information processing, computer vision and machine learning. The candidate should be willing to study independently new approaches and to develop their own ideas in this field, getting inspiration from the previous description and the progress on the literature. The candidate should have preferably a background in artificial intelligence, machine learning, computer science or applied mathematics. Moreover, a candidate should have knowledge in programming, preferable in Python.

**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 (after 6 months of employment) 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 and 2nd year: 1 982 euros brut /month

3rd year: 2 085 euros brut / month