2019-01431 - Post-Doctoral Research Visit F/M (BN19)

Machine learning for adaptive personalization of sequences of exercises in digital learning technologies to train attentional skills

Type of contract : CDD de la fonction publique
Contrat renouvelable : Oui
Niveau de diplôme exigé : Thèse ou équivalent
 Fonction : Post-Doctorant
Niveau d’expérience souhaité : Jeune diplômé

A propos du centre ou de la direction fonctionnelle

The Flowers team studies computational mechanisms allowing robots and humans to acquire open-ended repertoires of skills through life-long learning. This includes the processes for progressively discovering their bodies and interaction with objects, tools and others. In particular, we study mechanisms of intrinsically motivated learning (also called curiosity-driven active learning), autonomous unsupervised exploration, imitation and social learning, multimodal statistical inference, embodiment and maturation and self-organization.

Of particular interest to the Flowers team is the formation of repertoires of sensorimotor and interaction skills as well as their relation with the acquisition and evolution of languages.

The team is also working on applications of this research in three fields: adaptive human-computer interfaces, educational technologies and open-source robotics for art and education.

Contexte et atouts du poste

Digital learning technologies offer great opportunities for personalizing sequences of training exercises, which can enable more efficient learning and higher motivation for diverse profiles of human learners. Recently, in the KidLearn project, the Flowers team developed a personalization algorithm (Zpdes, Clement et al., 2015, 2018), based on computational models of curiosity-driven learning in children (Dudéy et al., 2016), which was tested in a large scale experiment where 500 children aged 7-8 used a tablet-based educational app to learn various mathematical concepts. The algorithm, leveraging multi-armed bandit techniques and a cognitive model of intrinsic motivation, personalized adaptively for each student the sequence of exercises through sequential tuning of hierarchical parameters. The experiment showed that this form of adaptive personalization enabled more learning efficiency and more motivation in a more diverse set of student profiles than a hand-made sequence built by a pedagogical expert.

This postdoc aims at studying whether and how this proof of concept of the cognitive and motivational learning impact of such an algorithm could be adapted and scaled up to a different domain. While the KidLearn project considered learning abstract mathematical concepts (number decompositions), it is an open question whether it could be applied to train subjects for tasks like low level perceptual/attentional learning. Here we will focus on the objective of training several attentional skills using forms of visual tasks (simple visual games like multi-object tracking, reproducing some features of forms of action video games that have attentional learning impact, Green and Bavelier, 2003).

The potential educational and societal impact of such training activities is large, as such visual training tasks have been shown to produce long-term cognitive improvement in a wide diversity of skills ranging from spatial cognition, bottom-up and top-down attentional control, multitasking, inhibition, verbal cognition, sciences, reading, professional skills like surgery, visual disorders like amblyopia, or dyslexia, and from college-aged students to adults (Bediou et al., 2018).

Mission confiée

The postdoc will begin by familiarization with the Zpdes algorithm, the experimental and software infrastructure used in the KidLearn experiment, as well as the results of the KidLearn experiment. She/he will also familiarize with the recent results studying what are the required characteristics of digital attentional visual tasks needed to produce robust and generalizable attentional skill learning. This will enable to formalize precisely the novel constraints imposed by these forms of low-level perceptual exercises, leading to address a technical challenge consisting in adapting the Zpdes algorithm in this context. Indeed, here cognitive load and forgetting can lead to regular decreases of performances (non-monotonic learning dynamics), as well as to exercises where the performance result has several dimensions, which is not currently dealt with the Zpdes algorithm. The candidate will then design an experimental protocol, including appropriate visual exercises and their parameterization, and experimental psychology methods to assess the perceptual/attentional learning efficiency, tested with adults (potentially using online tests, testing with children will be considered if there is enough time). Different versions of the algorithm as well as standard personalized baseline algorithms used in the literature will be compared.

This project will involve a collaboration with Daphne Bavelier, professor at the university of Geneva and world specialist of the educational impact of visual games on various attentional, cognitive and motivational skills.

Principales activités

Keywords: adaptive personalization, digital learning technologies, machine learning, attentional skills, visual games.

References:


Informations générales

- Thème/Domaine : Neurosciences et médecine numériques
- Biologie et santé, Sciences de la vie et de la terre (BAP A)
- Ville : Toulouse
- Centre Inria : CRI Bordeaux - Sud-Ouest
- Date de prise de fonction souhaitée : 2019-10-01
- Durée de contrat : 1 an
- Date limite pour postuler : 2019-03-31

Contacts

- Equipe Inria : FLOWERS (ODG-S)
- Recruteur : Dudéy Pierre-yves/pierre-yves.dudey@inria.fr

A propos d’Inria

Inria, l’institut national de recherche dédié aux sciences du numérique, promeut l’excellence scientifique et le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3000 scientifiques pour relever les défis des sciences informatiques et mathématiques, souvent à l’interface d’autres disciplines. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 160 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

Candidates should have an outstanding expertise in at least one of these areas, and ideally have experience in several of them:

- Machine learning algorithms applied to personalization in educational technologies
- Intelligent tutoring systems, e-learning
- Methodologies for assessing educational technologies with users
- Cognitive modelling of attentional skills in humans

Other requirements:

- Good skills in programming languages such as python and javascript
- Motivation to work on a project that combines machine learning, cognitive sciences and user studies

A CV and letter of motivation should be sent both through this web site and to pierre-yves.dudey@inria.fr

Consignes pour postuler

Thank you to send :
- CV
- Cover letter
- Support letters (mandatory)
- List of publication

Sécurité défense :
Ce poste est susceptible d’être affecté dans une zone à régime restreint (ZZR), 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.


KidLearn project: https://flowers.inria.fr/research/kidlearn/

Web site of Flowers Lab: https://flowers.inria.fr

Avantages

- Subsidized restoration
- Public transport partially reimbursed
- Leave: 7 weeks of annual leave + 10 days of RTT (full-time basis) + possibility of exceptional leave authorizations (e.g. sick children, moving)
- Possibility of teleworking (after 6 months of seniority) and organisation of working time
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports services (Inria Social Work Management Association)
- Access to vocational training
- Social Security

Rémunération

2653€ / month (before taxes)

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.