



Offre n°2025-08812

Post-Doctoral Research Visit F/M
“Machine learning for adaptive personalization of activities using digital learning technologies to train attentional skills”

Type de contrat : Fixed-term contract

Contrat renouvelable : Oui

Niveau de diplôme exigé : PhD or equivalent

Fonction : Post-Doctoral Research Visit

Niveau d'expérience souhaité : Recently graduated

Contexte et atouts du poste

Inria is the French national research institute for digital science and technology. World-class research, technological innovation and entrepreneurial risk are its DNA. As a technological institute, Inria supports the diversity of innovation pathways: from open source software publishing to the creation of technological startups (DeepTech).

Inria has been present in the Nouvelle-Aquitaine region for more than 20 years thanks to the [Inria Center at the University of Bordeaux](#). This center today employs more than 260 people who collaborate through 20 project-teams with 180 people from our academic and industrial partners (universities of Bordeaux, of Bordeaux-Montaigne, and of Pau-et-Pays-de-l'Adour, Bordeaux INP, ENSTA Paris, CNRS, Inserm, INRAE, TotalEnergies and Naval Group).

Co-supervision: [Hélène Sauzéon](#) and [Pierre-Yves Oudeyer](#) (Inria), [Myra Fernandes](#) (Univ. Waterloo)

Host: Inria centre of the university of Bordeaux, Flowers project-team (<https://flowers.inria.fr>), in the context of the CuriousTech associate team collaboration between Inria and University of Waterloo (<https://flowers.inria.fr/curioustech-associate-team>)

Location: Inria centre of the University of Bordeaux (with visits to University of Waterloo, Canada)

Program/funding: DRI Inria.

Duration: 12 to 24 months (starting November, 2025 and not later than January, 1st 2026)

How to apply: Contact and email pierre-yves.oudeyer@inria.fr, helene.sauzeon@inria.fr and mafernan@uwaterloo.ca with your CV, Letter of motivation and 2 Letters of recommendation (these can be sent within 2 weeks of the date of your application). Please add the following to the Subject line of your email: **Application Inria/Waterloo. Submit by : May 15th 2025. In addition, the application has to be submitted on jobs.inria.fr before June 1, 2025.**

Eligibility: Candidates for postdoctoral positions are recruited after the end of their Ph.D. or after a first post-doctoral period. For the candidates who obtained their PhD in the Northern hemisphere, the date of the Ph.D. defense shall be later than September 1, 2022, and in the Southern hemisphere, later than April 1, 2022.

In order to encourage mobility, the postdoctoral position must take place in a scientific environment that is truly different from the one of the Ph.D. (and, if applicable, from the position held since the Ph.D.). Particular attention is thus paid to French or international candidates who obtained their doctorate abroad.

Mission confiée

Scientific project

Digital learning technologies, especially Intelligent Tutoring systems (IST) 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), based on computational models of curiosity-driven learning in children (Oudeyer 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 (Clement et al., 2024). 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 enhanced motivation in a more diverse set of student profiles than a hand-made sequence built by a pedagogical expert, i.e., a staircase or “one design-for- all” condition.

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, i.e., attention mechanisms. Here we will focus on the objective of training several attentional skills using forms of visual tasks (simple visual games like multi-object tracking -MOT, reproducing some features of forms of action video games that have attentional learning impact (Green and Bavelier, 2003)). The potential impact of such training activities is substantial, 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). ITS have been identified in interventional research as a promising avenue for addressing the challenge of personalization (Adolphe et al., *in press*). However, no concrete study has yet been conducted to provide definitive evidence, as existing works are either proofs of concept or, at best, pilot studies, especially in older adults. Besides this, computer-based attention training focusing on the Multiple Object Tracking (MOT) has been demonstrated as a promising intervention for non demented older adults with small brain vascular lesions who have higher dementia conversion risks (Pèch et al. *Submitted*). Therefore, **the question of whether ITS, particularly personalization algorithms based on Learning progress (LPs), can optimize the number of responders to an attention training program remains an open question for young as well as for older adults.**

To move forward on this issue, we have already developed several algorithms and created a training platform ([FLOWERS-OL](#)) based on the Multiple Object Tracking (MOT) task, integrating a cognitive assessment battery (pre- and post-training evaluation of attention and memory) (Adolphe et al., 2022) along with subjective measures of curiosity (intrinsic motivation), cognitive load, and learning experience. This setup aims to examine the influence of relationships between intrinsic motivation (IM) and attentional performance (AP) during training on the training outcomes (attention and memory performance). We have also initiated a series of experiments in young adults and healthy older adults, and are planning a proof-of-concept study in older adults with neurovascular disorders who have cognitive complaints and mild cognitive deficits. This study is part of the University of Bordeaux's Inria center's involvement in the new university-hospital institute to be created in 2024, i.e. [VBHI](#). It will also include the processing of EEG characteristics and changes associated to MOT performance and training.

References :

- Adolphe, M., Sawayama, M., Maurel, D., Delmas, A., Oudeyer, P. Y., & Sauzéon, H. (2022). An open-source cognitive test battery to assess human attention and memory. *Frontiers in Psychology*, 13, 880375.
- Adolphe, M., Pech, M., Sawayama, M., Maurel, D., Delmas, A., Oudeyer, P. Y., & Sauzéon, H. (in press). [Exploring the Potential of Artificial Intelligence in Individualized Cognitive Training: a Systematic Review](#). *PlosOne*
- Bediou, B., Adams, D. M., Mayer, R. E., Tipton, E., Green, C. S., & Bavelier, D. (2018). Meta-analysis of action video game impact on perceptual, attentional, and cognitive skills. *Psychological bulletin*, 144(1), 77.
- Clement, B., Roy, D., Oudeyer, P-Y., Lopes, M. (2015) [Multi-Armed Bandits for Intelligent Tutoring Systems](#), Journal of Educational Data Mining (JEDM), Vol 7, No 2.
- Clément, B., Sauzéon, H., Roy, D., & Oudeyer, P. Y. (2024). Improved performances and motivation in intelligent tutoring systems: combining machine learning and learner choice. *arXiv preprint arXiv:2402.01669*.
- Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, 423(6939), 534.
- Meade, M. E., Meade, J. G., Sauzeon, H., & Fernandes, M. A. (2019). Active navigation in virtual environments benefits spatial memory in older adults. *Brain sciences*, 9(3), 47.
- Oudeyer, P. Y., Gottlieb, J., & Lopes, M. (2016). Intrinsic motivation, curiosity, and learning: Theory and applications in educational technologies. In *Progress in brain research* (Vol. 229, pp. 257-284). Elsevier.
- Pech, M., Maxime, A., Oudeyer, P. Y., & Sauzéon, H. Broadening the Lens: A Review of Multi-Object Tracking Task and its Use in Cognitive Training. *Available at SSRN 5159108*.
- Pelánek, R. (2016). Applications of the Elo rating system in adaptive educational systems. *Computers & Education*, 98, 169-179.
- Sivashankar, Y., He, P., Sauzéon, H., & Fernandes, M. A. (2024a). Motoric engagement, but not decision-making, during encoding influences route memory. *Spatial Cognition & Computation*, 24(4), 271-296.
- Sivashankar, Y., Fernandes, M., Oudeyer, P. Y., & Sauzéon, H. (2024b). The beneficial role of curiosity on route memory in children. *Frontiers in Cognition*, 3, 1346280.
- KidLearn project: <https://flowers.inria.fr/research/kidlearn/>

MOT-Flowers-OL platform (demo) : https://flowers-ol.bordeaux.inria.fr/flowers_demo

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

Principales activités

Work description. The postdoc will begin by becoming familiar with the Zpdes algorithm, the experimental and software infrastructure used in the MOT-Flowers-OL experiment, as well as the results of the KidLearn experiment. She/He will also familiarize themselves with recent results identifying the required characteristics of digital attentional visual tasks needed to produce robust and generalizable attentional skill learning. This will enable precise formalization of the novel constraints imposed by these forms of low-level perceptual exercises, allowing the research to address the technical challenge of adapting the Zpdes algorithm in this context. Indeed, here cognitive load and forgetting can lead to regular decreases in non-monotonic learning dynamics and performance. It can also lead to exercises where the performance result has several dimensions, which are not currently adequately addressed with the Zpdes algorithm. Importantly, we would like explore using the Elo rating system to structure the space of exercises, to both complement ZPDES and use as a tool to measure the evolution of skills of participants (Pelánek, 2016). The candidate will then contribute in the design of an experimental protocol, including appropriate MOT exercises and their parameterization, and will adapt experimental psychology methods to assess the adaptative MOT training effectiveness, for use in with older adults (using online tests including attention tasks as well as working memory and episodic memory) for whom clinical (cardiovascular health), cognitive and EEG data will be collected. Different versions of the algorithm as well as standard personalization baseline algorithms used in the literature will be compared.

Compétences

Technical skills and level required :

- Good skills in programming languages such as Python and Javascript

Languages : English (French is wellcome too!)

Relational skills : Motivation to work on a project that combines machine learning, cognitive sciences and user-experience studies

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Rémunération

2927€ / month (before taxes)

Informations générales

- **Thème/Domaine** : Robotics and Smart environments
Software Experimental platforms (BAP E)
- **Ville** : Talence
- **Centre Inria** : [Centre Inria de l'université de Bordeaux](#)
- **Date de prise de fonction souhaitée** : 2025-11-01
- **Durée de contrat** : 12 months
- **Date limite pour postuler** : 2025-05-30

Contacts

- **Équipe Inria** : [FLOWERS](#) (DRI)
- **Recruteur** :
Sauzéon Hélène / Helene.Sauzeon@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.

L'essentiel pour réussir

Required knowledge and background:

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 digital technologies
- Intelligent tutoring systems, e-learning
- Methodologies for assessing technologies with users
- Cognitive modelling of attentional skills in humans

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

Thank you to send:

- CV
- Cover letter
- Support letter (mandatory)
- List of publication

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.