Offer #2023-06702

Engineer F/H: Large-scale simulator for research and teaching in Artificial Intelligence and Artificial Life

**Contract type**: Fixed-term contract

**Level of qualifications required**: Graduate degree or equivalent

**Function**: Temporary scientific engineer

**Context**

The Flowers project-team (20 people approx, including students, researchers and research engineers), at the Inria Center of University of Bordeaux and at Ensta ParisTech studies models of open-ended development and learning. It tackles a major scientific challenge in artificial intelligence and cognitive sciences: to understand how humans and machines can efficiently acquire world models, as well as open and cumulative repertoires of skills over an extended time span. Processes of sensorimotor, cognitive and social development are organized along ordered phases of increasing complexity, and result from the complex interaction between the brain/body with its physical and social environment.

In this context, simulation environments play an important role. In fact, many recent breakthroughs in Artificial Intelligence have been facilitated by the proposition of novel and challenging simulation environments (e.g. Chevalier-Boisvert, 2018; Fan et al., 2022).

The objective of this Research Engineer position is to design, implement and evaluate an integrated large-scale multi-agent simulation environment to study open-ended mechanisms in both Artificial Intelligence (AI) and Artificial Life (ALife). We target to meet the following desiderata (that are currently not jointly met in existing simulation environments):

- Many environments in AI are grid-world (e.g. Chevalier-Boisvert, 2018). Instead, we target environments where each agent or object is represented as a particle (or a set of particles), in the spirit of Lowe et al. (2017). The objective is to facilitate potential future scaling from 2D to 3D and to embed a simple physics engine (e.g. collisions)
- The simulation engine will be implemented using a Python Library facilitating highly-parallel computing on GPUs (e.g. using JAX or Taichi-Lang), targeting research applications in AI and ALife.
- The environment will allow large-scale eco-evolutionary simulations, in the spirit of Hamon et al. (2023), Heinemann (2002).
- The environment can be run headless (for fast computation on GPU clusters) or with a web-based interactive visual interface (for real-time visualization and interaction with a user).
- The environments will allow complex, potentially open-ended interactions between the agents and the objects, in the spirit of Fan et al., (2022), Garcia Ortiz et al. (2021).
- The environment will allow massively multi-agent simulations, in the spirit of Zheng et al. (2018), Suarez et al. (2019).
- The environment can be controlled in real-time from a Jupyter Notebook, allowing to use it for teaching, in the spirit of Moulin-Frier (2015).
- The environment can be easily installed on multiple platforms (mostly pure Python)

We have already implemented a prototype version of the simulator meeting most of these desiderata. This can serve as a basis for future development in the context of the project, although we are open to other designs proposed by the candidate. The current design uses the following tech stack:

- The core simulation engine is written in JAX, allowing execution on either CPU or GPU
- The GUI uses a combination of the Bokeh, Panel and Param libraries

On the research side, we aim to extensively use this simulator to achieve the research program developed in Moulin-Frier (2022, Chapter 3)

**References**


Assignment

- To design and implement a simulator meeting the aforementioned desiderata
- To reproduce and extend recent contributions of the Flowers team in the simulator, e.g. Hamon et al. (2023)
- To assist in the proposition of practical sessions for teaching based on jupyter notebooks
- To communicate about the software and support potential users

Main activities

The candidate will interact with PhD students and post-docs from the Flowers team to understand their research challenges and collaboratively setting up AI and ALife experiments using the simulator. Depending on the background and interest of the candidate, s/he will be able to contribute on the research side, to co-author scientific publications and to attend to conferences. The candidate will also supervise Master student interns who will help in the project.

Skills

Prior experience in at least one of the following topics will be appreciated:

- Writing clean, documented and maintainable code
- Large-scale software engineering projects
- Research or personal projects related to AI or ALife
- Graphical User Interfaces
- Web technologies
- Knowledge or interest in computational ecology / evolutionary biology / physics / complex systems

Languages: fluent in English, both written and spoken. French language is appreciable but not required.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Possibility of teleworking 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

Remuneration

According to experience.

General Information

- Theme/Domain: Robotics and Smart environments
- Town/city: Talence
- Inria Center: Centre Inria de l’université de Bordeaux
- Starting date: 2023-12-01
- Duration of contract: 1 year
- Deadline to apply: 2023-12-31

Contacts
About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

The keys to success

We are looking for candidates with both strong software engineering skills and a strong interest for research in Artificial Intelligence and in Artificial Life.

*Warning*: you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

- Have a look at some of the papers or webpages mentioned in the offer
- Apply with a CV, a cover letter explaining your interest in the project, and links to previous projects (e.g. reports, software repositories, blog posts). You can mention projects you are particularly proud of, even if they do not directly relate to the proposed project.
- The position will be open until filled. We therefore recommend to apply as soon as possible (at least sending a quick email to express interest, the files can come later).

The contract is for one year. We will consider extensions depending on the success of the project and funding opportunities.

Defence Security:

This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy:

As part of its diversity policy, all Inria positions are accessible to people with disabilities.