Offer #2025-08813

Research Engineer F/M Swarm behaviours: experimentation with CrazyFlies drones

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Other valued qualifications : PhD thesis

Fonction : Temporary scientific engineer

Level of experience : Up to 3 years

About the research centre or Inria department

The Inria research centre in Lyon is the 9th Inria research centre, formally created in January 2022. It brings together approximately 320 people in 19 research teams and research support services.

Its staff are distributed in Villeurbanne, Lyon Gerland, and Saint-Etienne.

The Lyon centre is active in the fields of software, distributed and high-performance computing, embedded systems, quantum computing and privacy in the digital world, but also in digital health and computational biology.

Context

This Research Engineer position will take palce in the **Chroma team in Lyon**. The team studies algorithms and models to enable autonomous agents/robots to perceive,

decide and adapt to their environment, by combining probabilistic methods, machine learning, planning techniques, multi-agent decision-making and constrained optimisation tools. The team develops and maintains several experimental platforms, and is involved in several academic and industrial projects in the field of mobile and aerial robotics.

This two-year position is part of the INRIA/AID **BioSwarm project: Bio-inspired algorithms for collective research and decision-making in drone swarms**. The work will be carried out in collaboration with Olivier Simonin (CITI/Chroma) and Emanuele Natale (Inria Sophia Antipolis), co-PIs of the BioSwarm project.

Assignment

In this position, the main objective is to study the transition from simplified discrete models of behaviours observed in nature, particularly in insects, to behaviours that can be exploited by a swarm of UAVs. Some properties or tasks can be performed with a high degree of robustness without requiring heavy or centralised communications. Mathematical models of some of these behaviours make it possible to study and demonstrate these properties, but in return it remains difficult and rarely studied how they can be applied to real autonomous systems, such as a fleet of mobile robots (except for works such as [3]). This transition from the mathematical model to the robotic implementation, supported by experimental evaluations, is the objective of this position. The experimental work will be carried out using the CrazyFlies mini-UAV platform available in the Chroma team.

The work will focus on two recent models from the literature:

- The evaluation by agents of their density in a limited space according to a model inspired by the behaviour of ants [1]. This article proposes an algorithm based on random walks. The challenge will be to study how this model, proposed in a discrete 2D framework, can be extended to the continuous 3D context of a fleet of CrazyFlies mini-drones.

- In [2], the mathematical formalisation of a neurological mechanism in the olfactory circuit of Drosophila enabled a new implementation of a classifier for nearest neighbour clustering (NNC) in the difficult configuration of federated learning (FL). We will examine how this model can be adapted to a learning task in a fleet of autonomous drones with limited communications.

Interactions with the PhD student from the BioSwarm project, working on mathematical modelling, wil be necessary. In addition, the experimental work could be based on prior simulation work, in particular with the [Gym PyBullet Drones software] tool (https://utiasdsl.github.io/gym-pybullet-drones/), used in the thesis.

The recruited engineer will be part of the Chroma team working on several robotics projects, and will work in collaboration with the Inria research engineer (IR) in charge of the UAV platform (Nicolas Valle). He/she will be invited to participate to the writting of publications on the project results.

[1] C. Musco, H-H. Su, and N. A. Lynch , "Ant-inspired density estimation via random walks" Proc. Natl. Acad. Sci. (PNAS), 114 (40), pp 10534-10541, 2017

[2] P. Ram and K. Sinha "Federated Nearest Neighbor Classification with a Colony of Fruit-Flies", Proceedings of the AAAI Conference on Artificial Intelligence, 36(7), pp 8036-8044. 2022.

[3] A. Glad, O. Simonin, O. Buffet, F. Charpillet "Influence of Different Execution Models on Patrolling Ants Behavior : from Agents to Robots", 9th International Conference on Autonomous Agents and Multiagent Systems (AAMAS'10), 2010.

Main activities

The activities of the recruited engineer will consist of :

- Adapting and implementing bio-inspired mathematical models or algorithms on a fleet of aerial robots.
- Experiments with a fleet of CrazyFlies drones. A preliminary simulation study should be necessary.
- Evaluate the performance of the tasks carried out with drones, and analyse the properties initially defined in the mathematical models.
- Writting reports on work progress.

Skills

Engineer or Master degree in Robotics or AI/Computer sciences

- Good theoretical and experimental background in robotics and/or AI
- Good level in programming (python and/or C++)

The following qualifications would be an advantage :

- Experience in deploying mobile or aerial robots
- Knowledge/experience in ROS (ROS 1 ou 2)
- Experience in using robotic simulators and/or modelling multi-agent systems
- Fluency in French and English (written and spoken)

Benefits package

- 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 Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage under conditions

Remuneration

From 2692 € (depending on experience and qualifications)

General Information

- **Theme/Domain :** Robotics and Smart environments
  Scientific computing (BAP E)
- **Town/city :** Villeurbanne
- **Inria Center :** Centre Inria de Lyon
- **Starting date :** 2025-07-01
- **Duration of contract :** 2 years
- **Deadline to apply :** 2025-05-18

Contacts

- **Inria Team :** CHROMA
- **Recruiter :**
  Simonin Olivier / olivier.simonin@inria.fr

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

- Interest in research and experiments,
- Experience or knowledge of mobile/aerial robotics,
- Feel at ease in a dynamic scientific environment,

- Enjoying learning and listening are essential qualities for this position,
- The ability to work in a team.

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

Applications must be submitted online via the Inria website. Processing of applications submitted via other channels is not guaranteed.

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.