Offer #2022-04974

PhD Position F/M Social and safe navigation of autonomous vehicles in erratic environment

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

Level of experience : Recently graduated

About the research centre or Inria department

CHROMA is a bi-located team (Grenoble and Lyon), and the place of work is Grenoble (research center of Montbonnot).

The Inria research centre in Lyon (previously the Lyon branch of the Inria centre in Grenoble) is the 9th Inria research centre, formally created in December 2021. It brings together approximately 270 people (including 110 Inria employees) in 15 research teams and research support services.

Its staff are distributed at this stage on 2 campuses: in Villeurbanne La Doua (Centre / INSA Lyon / UCBL) on the one hand, and Lyon Gerland (ENS de Lyon) on the other. A third site should be opened in the course of 2022. The teams are mainly hosted with our partners.

The centre's teams work closely with research and higher education institutions (ENS de Lyon, UCBL, INSA Lyon, etc.), their laboratories, and other research organisations in Lyon (CNRS, INRAE, competitiveness clusters, etc.), but also with Lyon and regional economic players. Many international collaborations are also underway.

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

The PhD thesis is funded by the ANR project Annapolis (https://project.inria.fr/annapolis/) and co-supervised by Anne Spalanzani (CHROMA team in Grenoble), and Philippe Martinet (ACENTAURI Team in Sophia Antipolis).

- The overall objective of CHROMA is to address fundamental and open issues that lie at the intersection of the emerging research fields called “Human Centered Robotics”, “Multi-Robot Systems” and “AI for humanity”. Their goal is to design algorithms that allow autonomous agents to perceive, decide, learn, and finally adapt to their environment. Their approach for addressing this challenge is to bring together probabilistic methods, machine learning, planning techniques, multi-agent decision making, and constrained optimisation tools. This is done in cooperation with other disciplines such as sociology for the purpose of taking into account human models, or physics to consider self-organized systems. Two main themes are addressed: i) Perception and situation awareness in human-populated environment, by focusing on bayesian perception and sensor fusion, ii) Decision making for single and multi-robot systems.

- ACENTAURI is a robotic team led by Ezio MALIS that studies and develop intelligent, autonomous and mobile robots that can help humans in their day-to-day lives at home, at work or during their displacements. The team focuses on perception, decision and control problems for multi-robot collaboration by proposing an original hybrid model-driven / data driven approach to artificial intelligence and by investigating efficient quantum algorithms. The team focuses on robotic applications in smart territories, smart cities and smart factories. In these applications several collaborating robots will help humans by using multi-sensor information eventually coming from infrastructure. The team demonstrates the effectiveness of the proposed approaches on real robotic systems like cars AGVs and UAVs together with industrial partners.

Assignment

The PhD student will be co-directed by Anne Spalanzani (Chroma team in Grenoble), and Philippe Martinet (acentauri Team in Sophia Antipolis). He/she is expected to spend 18 months in both sites.

Contacts: Anne.Spalanzani@inria.fr, Philippe.Martinet@inria.fr

Main activities

Urban centers are increasingly invaded by new means of Powered Personal Mobility Platforms (PPMP) such as electric scooters, Hoverboards, Gyro-wheels, etc.), directly or indirectly at the source of unpredictable behaviors in the traffic environment. The "Mobility Law 2019" bill1 provides for the return of the scooters to the traffic lane when the dedicated bicycle lanes do not exist. In such a context, autonomous vehicles suffer from their limited perception obtained only from on-board sensors (forced to undergo the movements of the vehicle) and sometimes reduced in the measurement field by bulky obstacles (buses, trucks, etc.) or an occluding environment (buildings or urban structures). In such situation, unforeseen and unexpected events take source from the presence of new electrical mobility systems, or from behaviors of unstable pedestrians using (or not) new PPMP and respecting (or not) the traffic rules.

The PhD will seek new models or concepts to consider unpredictable behaviors of the new means of individual electric transport, to interpret and analyze scenes under constant evolution, and finally to decide the best future and safe motion of the self-driving car even in highly dynamic environments with unexpected and dangerous events.

The goal of the PhD is to propose social and safe navigation functions which can be used to control an autonomous and intelligent car where PPMP may follow erratic behaviors. The trajectories of the autonomous vehicle are expected to be safe and socially compliant and the decisions of the vehicle will be based on the estimated intentions of all agents of the scene. The idea is to associate a risk level to each intention by estimating its coherence with the traffic and social rules. We plan to explore MPC (Model Predictive Control) technique which is well known for considering physical characteristics of the systems. However, the nature of our problem pushes us to consider more advanced techniques to consider the uncertainty of observation and modelling. In this aim, the Phd will investigate the novel technique called MPPI (Model Predictive Path Integral) which has been introduced in 2016 [5-6] and extended to dynamic environment in [7-8]. MPPI is a Sample Based technique a bit different from Sample Based MPC.

Work program

- State of the art on risk-based navigation, sensor based navigation, navigation among crowds, behavior modelling, SMPC, MPPI.
- PPMP's typical behavior modelling and detection of dangerous zones.
- Development and evaluation of a social and safe behavior anticipating where are the dangerous zones to avoid.
- Development and evaluation of a social and safe behavior in outdoor environment, tests on the zoe car.

Skills

The ideal candidate has a strong background in planning, control and robotics. The candidate must be a proficient user of C/C++ and ROS and any relevant computer vision library (e.g., ViSP, OpenCV, PCL). Scientific curiosity, large autonomy and ability to work independently are also expected.

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 (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

Remuneration

1st and 2nd year: 1 982 euros gross salary /month

3rd year: 2 085 euros gross salary / month

General Information

- **Theme/Domain :** Robotics and Smart environments
- **Town/city :** Montbonnot
- **Inria Center :** Centre Inria de Lyon
- **Starting date :** 2022-12-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2022-10-31

Contacts

- **Inria Team :** CHROMA
- **PhD Supervisor :**
  Spalanzani Anne / anne.spalanzani@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.

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

Interested candidates must send to Anne.Spalanzani@inria.fr and Philippe.Martinet@inria.fr the following material:

- a motivation letter with any relevant information for proving a good match with the description of the activities and expected profile of the candidates
- a detailed CV
- name of at least two referees
- transcripts in Bachelor, Master1 and Master2

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.