2021-04213 - Post-Doctoral Research Visit F/M Validation of AI-based perception components in autonomous vehicles

Type de contrat : CDD
Niveau de diplôme exigé : Thèse ou équivalent
Fonction : Post-Doctorant

A propos du centre ou de la direction fonctionnelle

Grenoble Rhône-Alpes Research Center groups together a few less than 650 people in 35 research teams and 8 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

Contexte et atouts du poste

The candidate will have the opportunity to work together with experts in both CHROMA and CONVECS research teams of the INRIA Grenoble Rhône-Alpes research center.

The overall objective of the CHROMA group is to address fundamental and open issues that lie at the intersection of “Human-Centered Robotics” and “Multi-Robot Systems”. Our goal is to design algorithms and develop models allowing mobile robots to navigate and operate in dynamic and human-populated environments. CHROMA is involved in all decision aspects pertaining to robot navigation tasks, including perception and motion-planning. Our approach for addressing this challenge is to bring together probabilistic methods, planning techniques and multi-agent decision models. The Autonomous Vehicles research represents an important part of this work and it involves several academic and industrial projects, including collaborations with companies such as Renault and Toyota.

The activities of CONVECS focus on the formal modeling and verification of asynchronous concurrent systems, which are instantiated in various domains (communication protocols, distributed algorithms, embedded systems, networks-on-chip, etc.). To this aim, CONVECS proposes new generation formal languages for specifying the behavior and the properties of concurrent systems, and devises efficient verification algorithms and tools running on sequential and massively parallel machines. The research results of CONVECS are instantiated in the CADP verification toolbox (http://cadp.inria.fr), which assists the various phases of the design process (compilation and rapid prototyping, interactive and guided simulation, model checking and equivalence checking, conformance test generation, co-simulation, performance evaluation) and is widely used in academia and industry.

The work will be developed in the framework of the project PRISSMA (www.prissma.fr) that puts together the main French experts in autonomous driving and validation from both academia and industry. This 3-year project has the goal of studying and finding new suitable approaches to validate AI-based algorithms for perception and decision making in autonomous driving, and investigating how simulations and experiments in real environments can help to solve this challenge.

Mission confiée

Context: Assessment of the safety and security of autonomous vehicles and definition of the principles of the validation process for their components, with a particular attention to algorithms based on artificial intelligence.

The rapid development of Artificial Intelligence (AI) and its vast diffusion in all sectors of activity raise specific questions in terms of guarantees on their proper functioning. In particular, automotive systems, where both perception and decision-making algorithms rely on probabilistic AI-based approaches, require a thorough validation of all their components before being used in everyday life. However, guaranteeing safety and reliability poses a significant challenge due to the complexity of these solutions and the inevitable uncertainties on the road.

Objective: The main expected work will be to study and design formal validation methodologies for perception and decision-making solutions for autonomous driving. This work will mainly take into consideration the perception algorithm developed in the CHROMA team, the CMCDOT. This grid-based approach is a Bayesian filtering system for environment representation through dynamic occupation grids, allowing parallel estimation of occupation probabilities, inference of velocities and prediction of the risk of collision. An important part of the work will be conducted through tests on a realistic autonomous driving simulator (e.g., Carla) and in real experiments carried out with our fully autonomous car (Renault Zoe) with the support of several research engineers in the team. A strict collaboration with a PhD student working within the PRISSMA project is also expected.
Some relevant related work:


Principales activités

**Main activities:**

- Study of behavioral modeling of the simulated vehicle environment (e.g., dynamic, static obstacles, road configuration, etc.) for the automatic generation of relevant test case scenarios.
- Formal modeling of the critical subsystems and verification of their functional properties (e.g., absence of deadlocks, detection and correct prediction of collisions, etc.).
- Study of formal validation methodologies for Bayesian perception and prediction methods.
- Generation of conformance test cases in controlled environments from a formal model of the environment and the system for the evaluation of KPIs. Study of the coverage of relevant tests against the formal model.
- Participating in carrying out real experiments with the autonomous vehicle of the team in collaboration with other team members.
- Participating in the project organization, meetings, preparation of deliverables, etc.

Compétences

The candidate must have a PhD in computer science, AI or robotics.

Required knowledge: formal methods for concurrent systems and/or robotic systems and AI-based algorithms; a direct experience with autonomous vehicles and with ROS will also be appreciated.

Languages: proficiency in English; knowledge of French is welcome.

Avantages

- 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 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

Rémunération

2 653€ gross salary / month

Informations générales

- **Thème/Domaine** : Robotique et environnements intelligents
  Ingénierie logicielle (BAP E)
- **Ville** : Montbonnot
- **Centre Inria** : CRI Grenoble - Rhône-Alpes
- **Date de prise de fonction souhaitée** : 2022-02-01
- **Durée de contrat** : 12 mois
- **Date limite pour postuler** : 2021-12-10

Contacts

- **Equipe Inria** : CHROMA
- **Recruteur** :
  Renzaglia Alessandro / alessandro.renzaglia@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 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3500 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 180 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

The candidate should have a strong interest in formal methods and/or robotics as well as a taste for software development and
**Consignes pour postuler**

**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.

**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.