2023-06700 - Post-Doctoral Research Visit F/M
Localisation and mapping fusion from vehicles and infrastructure sensors

Contract type: Fixed-term contract
Level of qualifications required: PhD or equivalent
Function: Post-Doctoral Research Visit

About the research centre or Inria department
The Inria centre at Université Côte d’Azur includes 37 research teams and 8 support services. The centre’s staff (about 500 people) is made up of scientists of different nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d’Azur, CNRS, INRAE, INSERM ...), but also with the region’s economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d’Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Context
The 18 months postdoc is funded by the ANR project Annapolis (https://project.inria.fr/annapolis/) and will be hosted by the ACENTAURI team at Centre Inria d’ Université Côte d’Azur in collaboration with the ARMEN team at L2N2 in Nantes. ANNAPOLIS will increase the vehicle’s perception capacity both in terms of precision, measurement field of view and information semantics, through vehicle to intelligent infrastructure communication. The project will also seek new models or concepts to take into account 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.

ACENTAURI is a robotic team located in Sophia-Antipolis that studies and develops intelligent, autonomous and mobile robots that collaborate between them to achieve challenging tasks in dynamic environments. The team tackle perception, decision and control problems for multi-robot collaboration by proposing an original hybrid model-driven/data driven approach to artificial intelligence and by studying efficient algorithms. The team focus on robotic applications like environment monitoring and transportation of people and goods. In these applications, several robots will share multi-sensor information eventually coming from infrastructure. The effectiveness of the proposed approaches are demonstrated on real robotic systems like cars, AGVs and UAVs together with industrial partners.

ARMEN (Autonomie Des Robots et Maîtrise des interactions avec l’Environnement) is a robotic team located in Nantes that works on control-based design, on perception of the environment and on interaction with the environment.

Assignment
The main objective of this postdoc is to investigate the the fusion strategy of two different attention maps built using multi-sensor 3D localization and mapping from vehicles and from infrastructure perception network units (RSU).

The first scientific problem we want to deal with in this postdoc is to build a hybrid / unified environment representation. We will focus on the environment representation through the analysis of multi-sensor data [1]. Here, the extraction and the tracking of key properties in each perception unit (ego-vehicle and RSU) such as geometric (metric maps and occupancy grids maps) [2] [3], semantic [4] and contextual information [5] from sensor data and their integration over time, allow them to build a digital representation of the vehicle’s state that will be extended environment through the exchange of data by wireless communications [6]. This augmented multimodal representation of the vehicle neighborhood will serve as a basic knowledge to plan its movements in a safe and robust way (WP4) in presence of risky motion prediction of other vehicles and obstacles [10]. A unified representation will be built by these perception units in order to optimize the exchange of data:

- The autonomous vehicle (or ego-vehicle) will build 3D maps (e.g. multi-sensor SLAM approaches), will be precisely localized using onboard 3D lidars, Camera, GNSS and IMU, HD maps (as a prior for SLAM), and will detect and track objects while building semantic maps using deep neural networks for semantic segmentation and HD maps building [2] [4] [7] [8] [9].
- The infrastructure perception network units (RSU) are static and use the same sensors as the ego-vehicle, except that their precise localization within HD maps will be known in advance. They will also provide the same geometric, semantic and contextual information as the ego-vehicle [10].

Each perception unit must be able to perform self-localization (except the RSU) in their respective environment frame and track both static and mobile obstacles. Multi-sensor odometry and SLAM/MOT-based techniques will be investigated for self-localization as well as the fusion of multiple localization techniques in dynamic environments [2] [9].
Gross Salary: 2788 € per month

Benefits package

- Social security coverage
- Access to vocational training
- Social, cultural and sports events and activities
- 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.)
- Professional equipment available
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
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Remuneration

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