2018-00602 - Social Navigation of autonomous vehicles in shared spaces

About the research centre or Inria department

Grenoble Rhône-Alpes Research Center groups together a few less than 800 people in 35 research teams and 9 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 field 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.

Context

Within the framework of a partnership (you can choose between)

- collaboration between 2 Inria teams: Chroma (Grenoble https://team.inria.fr/chroma/en/), Choral (Sophia antipolis)
- public with French National Research Agency (ANR). In the scope of the Hianic project (https://project.inria.fr/hianic/)

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

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

Assignment

Classical autonomous vehicles navigation relies on geometric and kinematics constraints. This is adapted to simple, structured and predictable environments. When encountering an obstacle, these vehicles either stop or a collision is avoided by handling control back to drivers. Outdoor mobile robot applications are becoming progressively more demanding. It is to focus on safe and predictable interaction between cyberscars and other road users in complex and human populated urban environments. A social and cognitive dimension is required in the intelligent vehicles so that these latter will follow socially adapted behaviors that will be understood and predicted by passengers and pedestrians, will communicate their intentions to move or stop, will be safer. This must be understood that vehicles will not simply stop during uncertain situations but will be proactive and negotiate their paths and velocities, byconveying their course and direction of travel to surrounding road users.

The goal of the PhD is to propose social navigations functions which can be used to control an autonomous and intelligent car where vehicles and pedestrians are evolving in a shared space. 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, but also with the passenger’s perception of their field of travel.

Main activities

- State of the art on social navigation, proactive behavior, risk-based navigation, sensor based navigation, leader following, navigation among crowds.
- Implementation of state-of-the art navigation strategies among people and tests of their limitation in simulation using ROS
- Development and evaluation of a social proactive behavior in indoor environment, tests on a wheeled robot (wheelchair, pepper, ...).
- Development and evaluation of a social proactive behavior in outdoor environment, tests on the zoe car.

Skills

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
Benefits package

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities