Proposition de recherche doctorale

Probabilistic Behavioral Planning for Self-driving Vehicles

Planning de comportement probabiliste pour véhicules autonomes

Mots clés :
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- Domaine scientifique principal: Sciences et technologies de l'information et de la communication

Résumé du projet de recherche (Langue 1)

Autonomous vehicles (AVs) could bring great benefits to society, from reducing road fatalities and injuries, to drastically reducing the carbon footprint of transportation systems, to providing independence to those unable to drive. Further, AVs offer the AI community many high-impact research problems in diverse fields including: computer vision, probabilistic modelling, and multi-agent decision making, to name a few.

In the context of this Ph.D. Thesis project, the focus is on the development of new methodologies to enable decision components to operate an AV, based on its current understanding of the surrounding environment, while taking into account the probabilistic – and thus uncertain – nature of the problem, such that safety considerations and objectives can be systematically fulfilled. In particular, the focus of this Thesis is on the topic of probabilistic, hierarchical reinforcement learning, by addressing the following challenges: 1) integration of the notion of uncertainty, which we will achieve through the language of probability used in the context of Bayesian inference applied to the basic reinforcement learning method; 2) automatic learning of abstract representation of actions, such as to render the reinforcement learning method more data efficient, the learned procedures transferable across sub-actions, or in other words, to learn skills rather than tasks; 3) cast the overall learning problem as a multi-objective optimisation task, whereby aspects related to efficiency, safety and comfort are jointly optimised.

This Thesis is supported by Renault Software Labs, which will provide a useful environment to evaluate the mechanisms proposed in the project, for example by using proprietary or open-source driving simulators, and raw data or derived data to build the environment in which the reinforcement learning agent will operate.