Artificial intelligence for autonomous driving in winter conditions

Record number : OPR-616

Overview

RESEARCH DIRECTION

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INFORMATION

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ADMINISTRATIVE UNIT(S)

Faculté de génie
Département de génie électrique et de génie informatique
Département de génie mécanique
Institut interdisciplinaire d'innovation technologique (3IT)

LEVEL(S)

2e cycle
3e cycle
Stage postdoctoral

LOCATION(S)

3IT - Institut interdisciplinaire d'innovation technologique

Project Description

There have been many recent advancements in the field of autonomous driving in the past decade. Part of these developments is due to the success of machine learning techniques to train classification algorithms that allow vehicles to recognize and locate themselves in their surroundings, for example to detect lines on the road and signs. Machine learning schemes are however much less suited to the challenges of automatically controlling the vehicle maneuvers, especially in dynamic situations, as it would take an unrealistic number of experiences to generate the data to train the algorithm. Typically, the control of vehicles at low-level is rather based on classical control schemes and methods based on dynamic models such as predictive control (MPC). However, these methods are limited in scenarios where dynamic models are unreliable, such as when driving in winter conditions. Automating winter driving is a challenge for both types of approach (data-driven and model-based), and the development of "hybrid" methods, to have the best of both worlds, is actually a major open issue in the field. One of the laboratory's research axes is to tackle this problem for the Quebec-flavored context of driving in winter conditions, more particularly the development of algorithms to optimize automatic emergency maneuvers.

The proposed project consists of developing algorithms capable of automatically choosing and performing an emergency maneuver when the situation requires it. More particularly, the goal is to develop an intelligence which adjusts the maneuver according to the type of road condition (snow, ice, etc.) which will be estimated in real time. The algorithms will be developed and tested using a 1/5 scale vehicle platform that was developed in the lab. The work for this project will thus consist in a combination of programming, mathematical analysis and field tests with robotic platforms.

Keywords: Robot, machine learning, controls, stochastic control.

Website: https://alexandre-girard.ca/research/students/

Discipline(s) by sector

Sciences naturelles et génie

Génie électrique et génie électronique,
Génie mécanique

Funding offered

Yes

The last update was on 24 October 2025. The University reserves the right to modify its projects without notice.