Leveraging Cutting-Edge Reinforcement Learning Algorithms (SAC, PPO) for Autonomous Driving Powered by Computer Vision

Department: Département d'Ingénierie des Systèmes Complexes

JOB DESCRIPTION:

Reinforcement Learning (RL) is a branch of machine learning that focuses on learning behaviors to achieve specific goals. In essence, reinforcement learning (RL) is a collection of methods and techniques that enables an agent to learn a strategy, known as the policy, to accomplish a task by interacting with an environment. Specifically, the agent performs actions that alter its own state and the environment's state.

As a result of this interaction, the agent receives feedback as a reward or a penalty. Different families of algorithms leverage these interactions and feedback signals to learn an optimal policy, that is, the sequence of actions that leads to the desired outcome. For this internship, we will use the state-of-the-art SAC and PPO algorithms for an autonomous driving task, powered by computer vision for environmental perception.

Although both algorithms belong to the broader category of policy optimization methods, they differ significantly in how they learn this policy. SAC is an off-policy method, often considered as a hybrid approach, as it combines policy optimization with value-based learning and entropy maximization for better exploration. In contrast, PPO is an on-policy method that strictly belongs to the policy optimization family.

MISSIONS:

The goal of the internship is to train an agent using reinforcement learning until it converges to an optimal policy. In detail, the agent will be trained with the SAC and PPO algorithms to become an autonomous driver on a small circuit, initially in a simulated environment and secondly, in a real-world scenario inside the Autonomous System Platform at ISAE-SUPAERO with a real differential-wheeled robot and a physical circuit.

REQUIRED PROFILE:

The ideal candidate should be a Master's or an Engineering student (preferably with a computer science background) at the Bac +4/+5 level.

The student should possess the following skills:

• Strong knowledge of Python, Anaconda, and the OOP paradigm
• Solid understanding of Machine Learning and Deep Learning (NNs, CNNs)
• Familiarity with PyTorch and OpenCV
• Basic knowledge of Git and GitHub
• Ability to work autonomously and proactively

COMPENSATION: 0000€ / AN

DURATION: 5-6 month - 1st semester 2025

LOCATION: TOULOUSE

APPLICATION PROCESS:

Please send your resume to giuseppe.ferraro@isae-supaero.fr