P R A C T I C A L   C O U R S E

Learning to drive in The Open Racing Car Simulator (TORCS)

Problem description:

In recent years, several simulated car racing competitions like the Simulated Car Racing Championship (SCRC) [4] arose from a substantial amount of research in computational intelligence applied to simulated car racing. As it difficult to pose autonomous driving as a supervised learning problem due to strong interaction with the environment, it is an interesting application domain for Reinforcement Learning (RL) approaches.

The goal of this practical project is to implement an artificial driver, that learns to drive and keep within lane boundaries in the simulated environment of The Open Racing Car Simulator (TORCS) [6]. The students are expected to investigate and experiment with RL algorithms [3] in the Neural Engineering Objects (Nengo) [2] simulator to learn driving commands from available sensor sources (e.g. range finders [4]). Interesting questions are for example the choice and design of reward functions or potential split-up of the driving task to learn several sub-tasks like steering, acceleration etc. separately. Finally, the students are expected to link their implementation with an existing interface [1] to TORCS in the framework of the Robot Operating System (ROS) [5].

Tasks:

This practical project is designed for 2 or more students (or two teams) with interest in autonomous driving and machine learning as well as strong experience in Python coding and at least some knowledge about ROS.

- Familiarization with the principles and software needed for this project (e.g. ROS, RL, Nengo)
- Training of Spiking Neural Networks (SNNs) for RL in Nengo to generate driving commands
- Integration in the current ROS-framework for TORCS [1]
- Experimental evaluation

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Bibliography:

[1] https://github.com/fmirus/torcs_ros.
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