Technische Berichte

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Titel des Berichts: Learning Spiking Neural Controllers for In-silico Navigation Experiments

Abstract: Artificial neural networks have been employed in many areas of cognitive systems research, ranging from low-level control tasks to high-level cognition. However, there is only few work on the use of spiking neural networks in these fields. Unlike artificial neurons, spiking neuron models are designed to approximate the dynamics of biological neurons. In this work, we developed a virtual environment to explore solving navigation tasks using spiking neural networks. We first used an experimental setup inspired by Floreano and Mattiussi (2001) and compared the results to validate the developed environment. An evolutionary approach is used to set the parameters of a spiking neural network controlling a robot to navigate without collisions. In a second set of experiments, we trained the network via reinforcement learning which was implemented as a reward-based STDP protocol. Our results validate the correctness of the developed virtual environment and demonstrate the usefulness of using such a platform. The virtual environment guarantees the reproducibility of our experiments and can be easily adapted for future research.

Stichworte: navigation; spiking neural networks; learning; neurorobotics; simulation; in-silico experiments

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