Learning Spiking Neural Controllers for In-Silico Navigation Experiments

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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 little work on the use of spiking neural networks in these fields. In this project, we developed a virtual environment to explore solving navigation tasks using spiking neural networks. We first used an existing experimental setup 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.