Designing self-driving agents for racing games*

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Abstract

In this paper we present the results obtained from experiments with reinforcement learning (RL) in the area of self-driving cars. Teaching an AI agent to drive by itself, without any exterior help or guidance is a rather tedious and complex task. The reason for this is that there are way too many stimuli that an agent can experience, so arming an agent with all this knowledge means gathering data for nearly any possible situation. Instead of manually gathering this data, however, we can use deep reinforcement learning, where the agent learns by its own mistakes and therefore gets better over time.

There has already been some research done related to self-driving agents in RL. However, in these experiments the researchers achieved their goals by lowering the complexity of the problem, for example by telling the agent the optimal degree of turning the steering wheel or the optimal speed etc during the training process. However, we wanted to let the AI come up with its own distinct strategies without any human intervention. That is why in our experiments the agent only sees its environment through some pre-installed sensors. Except for these sensor values and the state of the vehicle (e.g. speed), the agent is not given any other information.

In our research, we set up a number of simulated racing tracks in Unity with varying difficulties and properties and then let the agent explore them one by one in a curriculum fashion. We studied a relatively new and rarely used algorithm called augmented random search and made some suggestions on how to modify it to better suit the said problem. All the tracks used in the experiments were constructed by us, the communication between the agent and the environment was resolved using the Unity Machine Learning Agent Toolkit and the agents used either the original or a slightly modified version of the augmented random search algorithm.

Keywords: deep learning; reinforcement learning; augmented random search; Unity; self-driving car

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