Cyclophobic Reinforcement Learning: Learning object representations via exploration

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Abstract

One of the trademarks of reinforcement learning is that the learning agent is in an experimental setting. Here, the goal of the agent is to navigate an environment successfully by performing a set of tasks. Especially deep learning has contributed to the ability to solve complex problems thanks to the high functional capacity of neural networks. However, generalization proves difficult as the fitted models are too fragile when the task becomes more complex and the environments are changed. I propose that a natural way to approach generalization is to learn a representation of the objects that represent the task in the environment. For this, we take a brief look at category theory reasoning about how one can describe abstract objects from a functional perspective. That is, to represent objects by the transformations they elicit. In this sense, exploring the environment systematically is an important component for finding objects and thus define an appropriate inductive bias via cycles that characterizes the impact on curiosity of a state-action pair. Finally the objects in the environment are characterized via the unique action they perform together with a partial raw view, where the agent sees only what's immediately in front. I test this on the MiniGrid Key-Door environment which only provides a reward when finding the goal. We perform similar to state of the art methods, with a much simpler algorithm and requiring almost 10x less steps to achieve similar performance.

This is a work in progress. All current files can be seen at: Cyclophobic reinforcement learning