Deep Robotics

About Say Hello

Reinforcement learning in robotics

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Reinforcement Learning (RL) is a subfield of Machine Learning where an agent learns by interacting with its environment, observing the results of these interactions and receiving a reward (positive or negative) accordingly. This way of learning mimics the fundamental way in which we humans (and animals alike) learn.

We humans, have a direct sensori-motor connection to our environment that can perform actions and witness the results of these actions on the environment itself. The idea is commonly known as *"cause and effect"*, and this undoubtedly is the key to building up knowledge of our environment throughout our lifetime. The content below will get into the following topics:

How's Reinforcement Learning being used today?

A variety of different problems can be solved using Reinforcement Learning. Because RL agents can learn without expert supervision, the type of problems that are best suited to RL are complex problems where there appears to be no obvious or easily programmable solution. Two of the most popular ones are:

- **Game playing** - determining the best move to make in a game often depends on a number of different factors, hence the number of possible states that can exist in a particular game is usually very large. To cover this many states using a standard rule based approach would mean specifying an also large number of hard coded rules. RL cuts out the need to manually specify rules, agents learn simply by playing the game. For two player games such as backgammon, agents can be trained by playing against other human players or even other RL agents.

- **Control problems** - such as elevator scheduling. Again, it is not obvious what strategies would provide the best, most timely elevator service. For control problems such as this, RL agents can be left to learn in a simulated environment and eventually they will come up with good controlling policies. Some advantages of using RL for control problems is that an agent can be retrained easily to adapt to environment changes, and trained continuously while the system is online, improving performance all the time.

A nice and relatively recent (at the time of writing) example of reinforcement learning is presented at DeepMind's paper Human-level control through deep reinforcement learning.

Why is Reinforcement Learning relevant for robots?