RL: Deep The Big Picture

Marius Lindauer







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RL with Function Approximation

- ▶ Linear value function approximators (VFA) assume value function is a weighted combination of a set of features, where each feature is a function of the state
 - Linear VFA often work well given the right set of features
 - But can require carefully hand designing that feature set
 - Same argument as in traditional ML vs. deep ML
- ► An alternative is to use a much richer function approximation class that is able to directly go from states without requiring an explicit specification of features
 - ► E.g., the state is simply an image (or a sequence of images)
- Local representations including Kernel based approaches have some appealing properties (including convergence results under certain cases) but can't typically scale well to enormous spaces and datasets
- → RL with deep neural networks is often state of the art these days!

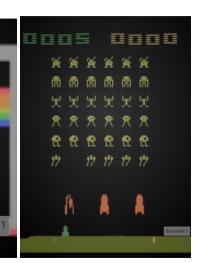
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The Benefit of Deep Neural Network Approximators

- Uses distributed representations instead of local representations
- ► Universal function approximator
- ➤ Can potentially need exponentially less nodes/parameters (compared to a shallow net) to represent the same function
- ► Can learn the parameters using stochastic gradient descent

Learning from Images





Deep Reinforcement Learning

- ▶ Use deep neural networks to represent
 - Value, Q function
 - Policy
 - (Model of the environment)
- Optimize loss function by stochastic gradient descent (SGD)