Intrinsically Motivated Reinforcement Learning

T Sudhamsh Goutham, Nitish Srivastava

CS 365: Artificial Intelligence
Department of Computer Science and Engineering, IIT Kanpur

March 8, 2010
Outline

- Reinforcement Learning
- Intrinsic Motivation
- Experiment Playroom
- Methodology
Reinforcement Learning

- A class of ML algorithms
- Learns how to act given an observation of the world
- Action changes the environment
- Feedback in terms of Rewards
- Maximize a long-term Reward
Reinforcement Learning

- Formulated as Markov Decision Processes
- Related to Dynamic Programming Algorithms
Intrinsic Motivation

- For its own sake
- Not as steps of a bigger problem
- No external reward. Doing for the sake of happiness or intrinsic enjoyment.
- Act, Play, Explore for development of broad competence
Intrinsically Motivated Reinforcement Learning

Standard RL view

Intrinsically Motivated RL view
Experiment - Playroom

A grid with different objects

- light switch
- ball
- bell
- movable buttons
- toy that can make sounds
Agent Description

Agent has:
- Eye
- Hand
- Visual Marker

Agent can:
- Move eye to hand
- Move eye to marker
- Move eye to random object
- Move hand to eye
- Move hand to marker
- Move marker to eye
- Move marker to hand
- if both hand and eye are on same object: use the object
Modeling intrinsic reward

- Modeling novelty response of dopamine neurons
- Intrinsic reward for salient event proportional to the error in its prediction according to the learned option model for that event
- The intrinsic reward is used to update the value function the agent is using to determine its behavior in the playroom.
- Agent tries to repeatedly achieve the salient event. RL improves both
  - policy for achieving the event
  - option-model that predicts the event
- As option policy and option model improve, the intrinsic reward diminishes and the agent gets “bored with the associated salient event and moves on.
References