Statistics > Machine Learning

Optimal Reinforcement Learning for Gaussian Systems

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The exploration-exploitation tradeoff is among the central challenges of reinforcement learning. A hypothetical exact Bayesian learner would provide the optimal solution, but is intractable in general. I show that, however, in the specific case of Gaussian process inference, it is possible to make analytic statements about optimal learning of both rewards and transition dynamics, for nonlinear, time-varying systems in continuous time and space, subject to a relatively weak restriction on the dynamics. The solution is described by an infinite-dimensional differential equation. For a first impression of how this result may be useful, I also provide an approximate reduction to a finite-dimensional problem, with a numeric solution.

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