A GENERAL MONTE CARLO ALGORITHM FOR STOCHASTIC CONTROL WITH MONOTONICITY

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We propose a general Monte Carlo algorithm for stochastic control based on policy iteration, via either a deep neural network approximation or a basis function approximation of the policy functions. To update the policy functions, one can use stochastic gradient descent or stochastic approximation in each iteration. The algorithm has three features: (1) It can handle high dimensional (e.g. over 100 dimensions) and time-inhomogeneous (instead of steady state) stochastic control problems. (2) It has the monotonicity of performance improvement in each iteration step, leading to good convergence properties. (3) It does not require the Bellman equation, which makes it suitable to solve control problems related to recursive utilities. The algorithm is applied to solve various problems, such as stochastic growth, dynamic optimization for recursive utilities, optimal execution in finance, and network monopolistic pricing.