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*Information Relaxation and the Duality-Based Dynamic Programming.*

We use the information relaxation technique to develop a value iteration method to solve stochastic dynamic programming problems. Each iteration generates a confidence interval estimate for the true value function so we can use the gap between the upper and lower bounds to assess the quality of the policy. We show that the resulted sequences of suboptimal policies converge to the optimal one within finite number of iterations. A regression-based Monte Carlo algorithm is introduced to overcome the curse of dimensionality in the implementation of this approach for high dimensional cases. The paper also discusses how to extend this approach to reinforcement learning. As numerical illustrations, we apply the algorithm in two financial applications such as optimal order execution and portfolio selection. (Received September 19, 2018)