Likelihood Ratio Gradient Estimation for Stochastic Recursions

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In this paper, we develop mathematical machinery for verifying that a broad class of general state space Markov chains reacts smoothly to certain types of perturbations in the underlying transition structure. Our main result provides conditions under which the stationary probability measure of an ergodic Harris-recurrent Markov chain is differentiable in a certain strong sense. The approach is based on likelihood ratio 'change-of-measure' arguments, and leads directly to a 'likelihood ratio gradient estimator' that can be computed numerically.