

## Coupling Spline Models and Stochastic Approximation

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The seminal work of Robbins and Monro (1951) brought into being a sequential nonparametric procedure to find the root of a regression function. The nonparametric nature of Robbins-Monro scheme allows broad applicability but also causes slower convergence. In this talk we will present a new approach to stochastic approximation problems. We will first introduce a coupling spline model, which differs from regular spline models in two critical aspects, to address the stochastic approximation problem. Secondly, we construct a coupling algorithm to generate a sequence of approximations to the root. Thirdly, we provide theoretical justification for the algorithm, including the connection with Newton-Raphson method, the solution of coupling spline problem etc. The simulation study demonstrates computational efficiency and faster convergence of the proposed method. With moderate sample sizes, it yields similar accuracy as the optimal Robbins-Monro procedure in the linear case, and in other distinctively nonlinear cases it is several times more accurate as measured by mean square error.

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