A stationary stochastic approximation algorithm for estimation in generalized linear mixed models

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Abstract

Estimation in generalized linear models is challenging because the marginal likelihood is an integral without closed form. Among those leading solutions such as Laplace approximation and Monte Carlo integration the marginal likelihood is approximated and the maximum likelihood estimate (MLE) can only be reached with error. An alternative, the simultaneous perturbation stochastic approximation (SPSA) algorithm, is designed to find the exact MLE under the same circumstances. However, SPSA does not directly provide the error if the algorithm is stopped in a finite steps. In order to estimate MLE properly with an error bound (variance), we design the stationary SPSA (SSPSA) algorithm. Assuming that the marginal likelihood is quadratic around the MLE, the SSPSA takes the form of a random coefficient vector autoregressive model. Under some mild conditions, the algorithm yields a stationary sequence where the mean of this sequence is asymptotically unbiased to the MLE and has a close-form variance.