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Greedy annealed importance sampling for seismic inversion

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In a Bayesian framework, solution of an inverse problem is given by the posterior probability density (PPD) function of the model. We report on the development of a new stochastic method, named greedy annealed importance sampling (GAIS), to draw samples from PPD to provide unbiased estimates of uncertainty. The advantages of this new technique are unbiasedness and fast convergence by searching the important regions of the posterior distribution. Traditional importance sampling and the Markov Chain Monte Carlo (MCMC) methods (Metropolis-Hastings/Gibbs' sampler) can also yield unbiased estimates but they are computationally very slow. Very fast simulated annealing (VFSA) is an approximate method but is very fast. The estimates are, however, biased.

Greedy annealed importance sampling (GAIS) combines VFSA and GIS to improve the speed of a traditional importance sampling and maintain unbiasedness. GAIS starts to seek important regions starting with models that are close to the important regions already located by VFSA and estimate the expectation value very accurately. The examples of poststack and prestack inversion demonstrate superior performance of GAIS compared to VFSA.

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