SEQUENTIAL MONTE CARLO MULTI-MODEL-BASED OPTIMIZATION

Xi Chen, Department of Industrial & Enterprise Systems Engineering, University of Illinois at Urbana-Champaign, IL 61801, USA, xchen37@illinois.edu
Enlu Zhou, Department of Industrial & Enterprise Systems Engineering, University of Illinois at Urbana-Champaign, IL 61801, USA, enluzhou@illinois.edu

Model-based optimization methods are stochastic search methods that iteratively find candidate solutions by generating samples from a parameterized probabilistic model on the solution space and update the parameter of the model based on the performance of the candidate solutions. In this work, we propose a multi-model-based method, sequential Monte Carlo multi-model-based optimization (SMCMO), where the candidate solutions are generated from multiple probabilistic models at each iteration. Using multiple models helps to better capture the multi-modal property of the objective function than only using a single model in traditional model-based methods. To develop a mechanism to generate and adaptively propagate multiple models, we view the optimization problem as a parameter estimation problem that iteratively estimates the parameter of the optimal probabilistic model based on the observations or performance of the candidate solutions. We conduct the parameter estimation by sequential Monte Carlo method, which tracks the posterior distribution of the parameter given the history of observations, providing a proper way to determine the diversity of the models based on the spread of the posterior distribution of the parameter. We prove the convergence of SMCMO, and carry out numerical experiments to illustrate its performance.