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Multi-Objective Bayesian Optimization for Online Accelerator Tuning[1] RYAN ROUSSEL, University of Chicago, ADI HANUKA, AURALEE EDELEN, SLAC National Accelerator Laboratory — Maximizing the performance of an accelerator facility often necessitates multi-objective optimization, where operators must balance trade-offs between multiple objectives simultaneously, often using limited, temporally expensive beam observations. Usually, accelerator optimization problems are solved offline, prior to actual operation, with advanced beamline simulations and parallelized evolutionary algorithms. Unfortunately, it is not feasible to use these methods for online multi-objective optimization, since beam measurements can only be done in a serial fashion, and these optimization methods require a large number of measurements to converge to a useful solution.Here, we introduce a multi-objective Bayesian optimization scheme, which finds the full Pareto front of an accelerator optimization problem efficiently in a serialized manner.This method uses a set of Gaussian process surrogate models, along with a multi-objective acquisition function, which reduces the number of observations needed to converge by at least an order of magnitude over current methods.We also demonstrate how this method can be modified to specifically solve optimization challenges posed by the tuning of accelerators.

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