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Trust Region Bayesian Optimization for Online Accelerator Control

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Bayesian optimization (BO) is an effective tool in performing online control of particle accelerators. However, BO algorithms can struggle in high dimensional or tightly constrained parameter spaces due to its'inherent bias towards over-exploration, leading to slow convergence times for relatively simple problems and high likelihoods of constraint violations. In this work, we describe the application of Trust Region BO (TurBO), which dynamically limits the size of parameter space when performing optimization or characterization. As a result, the convergence of BO towards local extrema is greatly enhanced and the number of constraint violations is substantially reduced. We describe the performance of TurBO on benchmark problems as well as in experiments at accelerator facilities including ESRF and AWA.

Primary Keyword

bayesian optimization

Secondary Keyword

Tertiary Keyword

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