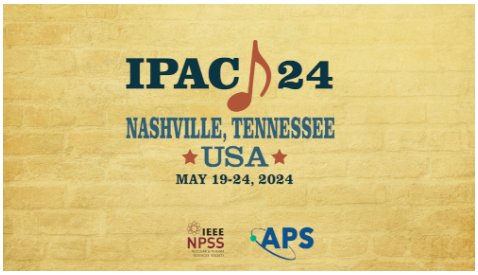

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ML-enhanced online commissioning and optimization of the APS-U accelerator complex

Tuesday, 21 May 2024 16:00 (2 hours)

The Advanced Photon Source (APS) facility has just completed an upgrade to become one of the world's brightest storage-ring light sources. For the first time, multiple machine learning (ML) methods have been developed and used as part of the baseline commissioning plan. One such method is Bayesian optimization (BO) –a tool for efficient online high-dimensional single and multi-objective tuning. In this paper we will present our BO development work, including novel augmentations motivated by experimental needs - fast multi-fidelity measurement techniques, simulation-based uncertainty-aware priors, and time-aware adaptive drift compensation. These techniques were successfully applied to tuning linac and booster transmission efficiency, injection stabilization, enlarging storage ring dynamic and momentum apertures, and many other tasks - results of each will be shown, as well as validation tests at external facilities. Given the success of BO methods at APS, we are planning and will outline future work on tighter ML method integration into the standard control room procedures and software.

Footnotes

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