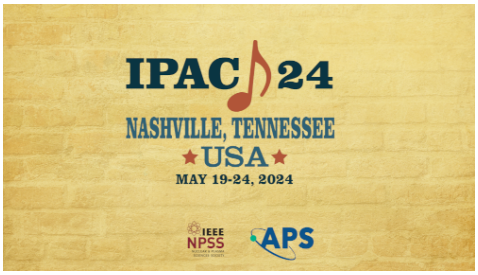

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Online model fine-tuning using multi-fidelity simulations

Thursday, 23 May 2024 16:00 (2 hours)

Modern accelerator design requires extensive simulation to find the best configurations. During accelerator commissioning, the lattice model is rapidly changing due to beam-based measurements, and it is desirable to update simulations to guide further tuning. However, continuous reevaluation is computationally infeasible. We propose a new approach of online multi-fidelity modelling, whereby lattice simulation data is used as a guide to be fine-tuned with sparse sampling of new simulations. Our implementation employs a multi-task Gaussian Process (GP) model to learn the correlation between old and new data as part of the fitting process and quantify prediction confidence. We then run new variable fidelity simulations (i.e. changing number of turns, grid size, etc.) using multi-fidelity Bayesian optimization with objective being to achieve desired accuracy at lowest compute time cost. This method optimally uses both coarse and fine simulations to bring overall model in agreement, saving enormous amounts of compute time and making online retuning feasible. It has proven useful during APS-U commissioning for nonlinear beam dynamics tuning, instability control, and other purposes.

Footnotes

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