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Real-time Integration of Machine Learning for Beam Size Control at the Advanced Light Source

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The Advanced Light Source (ALS) storage ring employs various feedback and feedforward systems to stabilize the circulating electron beam thus ensuring delivery of steady synchrotron radiation to the users.

In particular, active correction is essential to compensate for the significant perturbations to the transverse beam size induced by user-controlled tuning of the insertion devices, which occurs continuously during normal operation. Past work at the ALS already offered a proof-of-principle demonstration that Machine Learning (ML) methods could be used successfully for this purpose.

Recent work has led to the development of a more robust ML-algorithm capable of continuous retraining and its routine deployment into day-to-day machine operation. In this contribution we focus on technical aspects of gathering the training data and model analysis based on archived data from 2 years of user operation as well as on the model implementation including the interface of an EPICS Input/Output Controller (IOC) into a Phoebus Planel, enabling operator-level supervision of the Beam Size Control (BSC) tool during regular user operation. This deployment ensures real-time integration of machine learning models into the ALS control system.

Primary Keyword

MLOps

Secondary Keyword

active learning

Tertiary Keyword

ML-based optimization

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