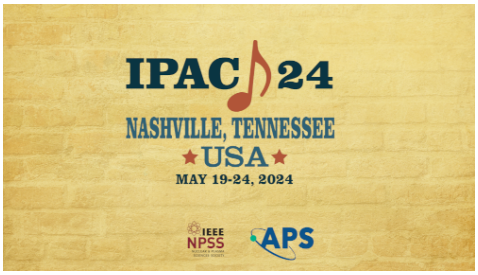

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Accelerator system parameter estimation using variational autoencoded latent regression

Monday, 20 May 2024 16:00 (2 hours)

A particle accelerator is a time-varying complex system whose various components are regularly perturbed by external disturbances. The tuning of the accelerator can be a time-consuming process involving manual adjustment of multiple components, such as RF cavities, to minimize beam loss due to time-varying drifts. The high dimensionality of the system (˜100 amplitude and phase RF settings in the LANSCE accelerator) makes it difficult to achieve optimal operation. The time-varying drifts and the dimensionality make system parameter estimation a challenging optimization problem. In this work, we propose a variational autoencoded latent regression (VAELR) model for robust estimation of system parameters using 2D unique projections of a charged particle beam's 6D phase space. In VAELR, VAE projects the phase space projections into a lower-dimensional latent space, and a dense neural network maps the latent space onto the space of system parameters. The trained network can predict system parameters for unseen phase space projections. Furthermore, VAELR can generate new projections by randomly sampling the latent space of VAE and also estimate the corresponding system parameters.

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