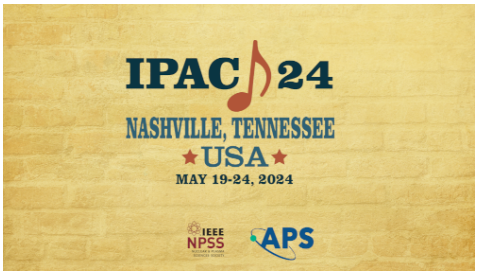

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Towards latent space evolution of spatiotemporal dynamics of six-dimensional phase space of charged particle beams

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

Addressing the charged particle beam diagnostics in accelerators poses a formidable challenge, demanding high-fidelity simulations in limited computational time. Machine learning (ML) based surrogate models have emerged as a promising tool for non-invasive charged particle beam diagnostics. Trained ML models can make predictions much faster than computationally expensive physics simulations. In this work, we have proposed a temporally structured variational autoencoder model to autoregressively forecast the spatiotemporal dynamics of the 15 unique 2D projections of 6D phase space of charged particle beam as it travels through the LANSCE linear accelerator. In the model, VAE embeds the phase space projections into a lower dimensional latent space. A long-short-term memory network then learns the temporal correlations in the latent space. The trained network can evolve the phase space projections across further modules provided the first few modules as inputs. The model predicts all the projections across different modules with low mean squared error and high structural similarity index.

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Primary author: RAUTELA, Mahindra (Los Alamos National Laboratory)

Co-authors: SCHEINKER, Alexander (Los Alamos National Laboratory); WILLIAMS, Alan (Los Alamos National Laboratory)

Presenter: RAUTELA, Mahindra (Los Alamos National Laboratory)

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