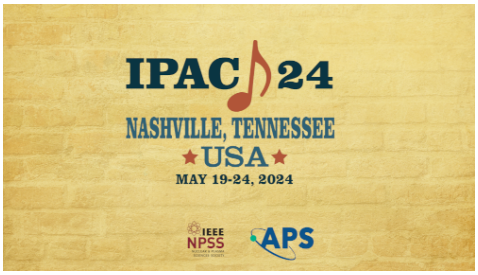

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Machine learning tools for heavy-ion linacs

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

At a heavy ion linac facility, such as ATLAS at Argonne National Laboratory, a new ion beam is tuned once or twice a week. The use of machine learning can be leveraged to streamline the tuning process, reducing the time needed to tune a given beam and allowing more beam time for the experimental program. After establishing automatic data collection and two-way communication with the control system, we have developed machine learning models to tune and control the machine. We have successfully trained different Bayesian Optimization (BO)-based models online for different sections of the linac, including the commissioning of a new beamline. We have demonstrated transfer learning from one ion beam to another allowing fast switching between ion beams, and also transfer learning from a simulation-based model to an online machine model using Neural Networks as the prior-mean for BO. We have also trained a Reinforcement Learning (RL) model online for one beam and deploy it for the tuning of other beams. These models are now being generalized to other sections of the ATLAS linac and can, in principle, be adapted to control other ion linacs and accelerators with modern control systems.

Footnotes

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