Contribution ID: **56** Type: **Poster**

Rapid Adaptation in Accelerator Control: Leveraging Meta-Reinforcement Learning for Handling Dynamic System Variations

In typical reinforcement learning applications for accelerators, system dynamics often vary, leading to decreased performance in trained agents. In certain scenarios, this performance degradation is severe, necessitating retraining. However, employing meta-reinforcement learning in conjunction with an appropriate simulation can enable an agent to rapidly adapt to environmental changes. This concept is illustrated by meta-training an agent within a simulated environment replicating the electron line of CERN's AWAKE experiment. The task involves guiding the electron towards a specific trajectory. During the simulation, the quadrupoles of the segment are varied randomly, and action masking is employed to mimic magnetic control faults. Our findings reveal that the agent can quickly adjust to specific system configurations with minimal steps. This methodology holds potential for application in any Partially Observable Markov Decision Process (POMDP) characterised by slowly evolving hidden parameters.

Possible contributed talk

No

Are you a student?

No

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Session Classification: Posters