The FNAL accelerator complex initial ML efforts and a conceptual AI roadmap for operations*

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Abstract

In preparation for higher proton intensity with the PIP II and LBNF accelerator upgrades at Fermilab, AI/ML applications research, development, and deployment are underway to improve all aspects of operating a large accelerator complex: beam control, hardware performance, and system management. These efforts include development of tools and techniques that enable guided optimization, semi-autonomous operations, de-noising and data mining, digital twinning (e.g., virtual laboratories), anomaly detection, and failure anticipation. Fermilab's Accelerator Division sees many opportunities to employ AI/ML and are planning to incorporate the AI operational concept into future hardware and software upgrades. With nearly 200,000 active devices being monitored, increased personnel workloads, and HEP program demands, AI is a requirement to running a robust facility. This talk will highlight recent ML work, planned work and the AI landscape in both beam physics and accelerator operations.

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