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Real-time Artificial Intelligence for Accelerator Control: A Study at the Fermilab Booster

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We describe a method for precisely regulating the gradient magnet power supply (GMPS) at the Fermilab Booster accelerator complex using a neural network (NN). We demonstrate preliminary results by training a surrogate machine-learning model on real accelerator data, and using the surrogate model in turn to train the NN for its regulation task. We additionally show how the neural networks that will be deployed for control purposes may be compiled to execute on field-programmable gate arrays (FPGAs). This capability is important for operational stability in complicated environments such as an accelerator facility.

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