Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

A Hybrid Deep Learning architecture for general disruption prediction across tokamaks[1] JINXIANG ZHU, CRISTINA REA, KEVIN MONTES, ROBERT GRANETZ, RYAN SWEENEY, ROY ALEXANDER TINGUELY, Massachusetts Institute of Technology MIT — The cross-machine data-driven study presented in this contribution shows clear evidence that non-disruptive data is machine-specific but disruptive data contains crucial general knowledge about disruptions, independent of the considered device. A Hybrid Deep Learning (HDL) architecture for disruption prediction is found to achieve high predictive accuracy on C-Mod, DIII-D and EAST tokamaks with limited hyperparameter tuning. Near-future burning plasma tokamaks will need to run disruption-free or with very few unmitigated disruptions, therefore successfully predicting disruptions on new tokamaks with limited disruption data from themselves will be crucial. The availability of data across different existing devices allows us to design numerical experiments to test transfer learning capabilities of the deep learning predictor. Surprisingly, it is found that the HDL algorithm achieves relatively good accuracy on EAST (AUC=0.959) when including 20 disruptive shots, thousands of non-disruptive data, and combining this with more than a thousand disruptive discharges from DIII-D and C-Mod. This holds true for all permutations of three tokamaks. These cross-machine studies are crucial to evaluate the performances of a general disruption prediction scheme and test its extrapolabilty.

[1]Work supported by US DOE under DE-FC02-04ER54698 and DE-SC0014264.

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Date submitted: 28 Jun 2020 Electronic form version 1.4