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Interpretation of Machine Learning Disruption Predictions on DIII-D[1] K MONTES, C REA, R GRANETZ, MIT PSFC, A PAU, O SAUTER, EPFL, DIII-D TEAM, JET TEAM — Chains of precursors leading to disruptive events on hundreds of DIII-D discharges are compared with predictions from the Disruption Prediction using Random Forests (DPRF) algorithm embedded in the DIII-D plasma control system. Using a feature contribution method developed for random forest algorithms, the input features driving each prediction are identified and shown to correlate with the occurrence of relevant physics precursors. In contrast to other black-box approaches, this lends an element of interpretability to the application of a machine-learning based disruption predictor. This introduces the possibility of pairing predictions with appropriate actuator responses in order to avoid disruptions. Disruptions initiated by locked modes and radiative events, for example, are shown to be prevalent in DIII-D but could be preventable using relevant actuators if properly identified with sufficient warning time. These examples are compared with similar cases on JET in order to motivate the development of an interpretable, cross-device predictor that can satisfy constraints for next generation tokamaks.

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Kevin Montes
Massachusetts Institute of Technology

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