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Interpretable data-driven disruption predictors to trigger avoidance and mitigation actuators on different tokamaks[1] CRISTINA REA, KEVIN MONTES, Massachusetts Institute of Technology , WENHUI HU, IPP-CAS, JAYSON BARR, General Atomics, KEITH ERICKSON, PPPL, ROBERT GRANETZ, Massachusetts Institute of Technology , QIPING YUAN, DALONG CHEN, BIAO SHEN, BINGJIA XIAO, IPP-CAS, DIII-D TEAM, EAST TEAM
— This contribution details advancements of interpretable data-driven algorithms for disruption prevention across different tokamaks and in response to ITER needs. The Disruption Prediction via Random Forest (DPRF) algorithm is currently in use in both the DIII-D [1] and EAST PCS. DPRF predicts impending disruptions in real-time, while simultaneously identifying the drivers of the disruptivity through local measures of interpretability, i.e. feature contributions. DPRF performances on both devices allow predictions and contributions to be computed in less than 200us. On DIII-D, DPRF includes real-time calculations of peaking factors for temperature, density and radiation profiles. Such profile-based indicators prove to be relevant metrics in impurity accumulation events leading to disruptions in scenarios close to ITER baseline. Preliminary studies of DPRF integration with a proximity controller architecture [2] for continuous plasma state optimization on DIII-D will also be discussed. On EAST, DPRF was trained using high-density disruptive data, and it shows an accurate alarm rate (>85%) on real-time data, up to 1s prior to the disruption. DPRF was also used to trigger EAST mitigation system in dedicated experiments. [1] C. Rea et al 2019 Nucl. Fusion 59 096016; [2] J. Barr et al IAEA FEC 2020.

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