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Detection of Disruption Precursors with Semi-Supervised Learning[1] KEVIN MONTES, JINXIANG ZHU, CRISTINA REA, ROBERT GRANETZ, Massachusetts Institute of Technology MIT, DIII-D TEAM TEAM
— This contribution presents a novel application of a label spreading[2] algorithm to detect disruption precursors in a large dataset, given few manually labeled examples. A high detection accuracy (>85%) for H-L back transitions is demonstrated on a dataset of hundreds of discharges with manually identified events for which <3% of the transitions are labeled. Since the only necessary inputs are a dataset of 0D signals sufficient for manual detection of the event and a few recorded times at which the event occurs, this technique can in principle be used to detect a large variety of precursor events in a disruption database. As an example, the same algorithm is used to detect radiative collapses and initially rotating locked modes with high accuracy, despite their different dynamics and prevalence in the dataset. This implies that the construction of large event databases can be accelerated, automatically detecting new events with increasing fidelity as the user adds manually labeled data. This kind of disruption precursor data can improve the ability to train and interpret machine learning-based prediction algorithms, which rely on datasets too large to completely assemble by hand.

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[2]Zhou D. et al., Advances in Neural Information Processing Systems 16, 321-328 (2004)

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