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Cross-tokamak disruption prediction via domain adaptation and generalization

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Unmitigated disruptions at high performance discharge are unacceptable for future reactors, while they are not able to provide enough data to train a predictor with acceptable performance along. However, current can bear disruptions, and have accumulated a large amount of data with various disruption patterns. In the meantime, domain adaptation (DA) and domain generalization (DG) are now very promising ways to make full use of knowledge from source domain and adapt/generalize them to target domains with very little data, even 0 shot.
For disruption prediction, a basic idea is to apply DA/DG algorithms to every stage throughout training. While still maintaining the advantages of deep models, multiple DA/DG algorithms are applied and more physical features/constraints are introduced to the model. Several numerical experiments are carried out where J-TEXT and HL-2A serve as the source tokamak and EAST serve as the target. In DA case, which 20 discharges from EAST are added into the training set, AUC reaches .8724 for the best model. In DG case, which uses none data or information from EAST, AUC reaches .8343 for the best. Both DA and DG cases perform acceptable on the target domain.

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