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Implementing deep learning-based disruption predictor in a shifting data environment of new tokamak：HL-3

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A deep learning-based disruption prediction algorithm has been implemented on a new tokamak, HL-3, for the first time. An Area Under receiver-operator characteristic Curve (AUC) of 0.940 has been realized, despite the limited training data obtained during the first two campaigns. Besides the well-known issue of lacking training data, a new issue is addressed that the data environment of new device is quite unstable. The plasma scans from low to high parameter space, bringing a shifting distribution of disruption causes and diagnostic data. This problem is often overlooked in previous implementations on steadily operating tokamaks and calls for more attention in future tokamaks like ITER. To address these challenges, novel modules including predict-first neural network (PFNN), data augmentation, pseudo data placeholders are developed and implemented, which promotes the accuracy by up to 20%. A series of advantages are also brought by the modules, including the robustness to function with missing input channels, and the interpretability to identify which parameter of plasma is under abnormal condition. The results demonstrate that the deep learning-based algorithm can provide reliable disruption alarms on a new tokamak, with the support of dedicated data collection and algorithm implementation.

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