Contribution ID: **549** Type: **Poster**

Disruption Predictor Based on Neural Network and Anomaly Detection

Wednesday, 15 May 2019 17:35 (20 minutes)

Existing disruption predictor based on machine learning techniques, have good prediction performance but all these methods need large training datasets with many disruptions to develop successful predictors. Future machines are unlikely to provide enough disruption samples since they cause excessive machine damage and these models cannot extrapolate to machines other than it was trained on. In this paper, a disruption predictor based on deep learning and anomaly detection technique has been developed. It regards the disruption as an anomaly, and learns on non-disruptive shots only. The model is trained to extract the hidden features of various non-disruptive shots with a convolutional neural network and a LSTM(Long Short-Term Memory) recurrent neural network. It will predicted the future trend of selected diagnostics, then using the predicted future trend and the real signal to calculate a outlier factor to determine if a disruption is coming. It is tested with J-TEXT discharges and can get comparable if not better performance to current machine learning disruption prediction techniques, but without requiring disruption data set. This could be applied to future tokamaks and reduce the dependency on disruptive experiments.

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Session Classification: Poster facult.

Track Classification: Plasma Control