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Deep Learning Studies Linking Tokamak Disruption to Neoclassical Tearing Modes (NTM's) [1] GE DONG, Princeton Plasma Physics Laboratory, JULIAN KATES-HARBECK, Harvard University, NICK MCGREIVY, Princeton University, ZHIHONG LIN, University of California, Irvine, WILLIAM TANG, Princeton Plasma Physics Laboratory — Disruptive instabilities are extreme amplitude plasma perturbations that cause abrupt termination of discharges in fusion-grade experiments such as ITER. The Fusion Recurrent Neural Network (FRNN) code is a recently developed AI/deep learning software to predict the onset of disruptions with high accuracy and speed [J. K. Harbeck, Nature (2019)]. FRNN uses measured time series from experiments as input, and can perform training on deep learning architectures such as RNNs. Here we study the effect of adding as input signals physics-based models of NTM's – which feature magnetic islands from positive feedback between tearing magnetic perturbations and bootstrap current. As a first step, we add simple signals such as the pressure gradient profiles and rational surface locations. Preliminary results show these signals improve general model performance, suggesting links between disruptions and NTM's. We also implement a new deep learning architecture based on temporal convolutions. This new algorithm has various benefits in computational and predictive performance, especially when high frequency profile data are introduced (such as the ECEI data), as targeted in our next-step investigations.

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