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Hyper-dimensional time-series data analysis with reservoir computing networks to predict plasma profiles in tokamak[1] AZARAKHSH JALALVAND, Ghent University, JOSEPH ABBATE, RORY CONLIN, EGEMEN KOLEMEN, Princeton University / PPPL, GEERT VERDOOLAEGE, Ghent University, DIII-D TEAM TEAM — A Reservoir Computing Network (RCN) is a special type of recurrent neural network, in which the input and the recurrent connections are randomly generated and only the output weights are trained. Besides the ability to process temporal information, key features of RCN include ease of training and robustness against noise. RCNs have been shown to be very effective for a variety of tasks, e.g., in the analysis of hyperdimensional data and time-evolving chaotic systems. The aim of this work is to extend the application of RCN to the field of tokamak profile control and disruption prediction. We investigate the potential of such neural networks for achieving competitive performance in predicting plasma profiles on confinement time scales using experimental data from DIII-D. We consider the prediction of five profiles, namely, electron density, electron temperature, Ion rotation, safety factor, and plasma pressure. The preliminary experiments demonstrate that the RCN-based plasma profile predictor has similar performance to state-of-the-art (deep) convolutional neural networks and long short-term memory (LSTM) models but with significantly easier and faster training procedure.

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Azarakhsh Jalalvand
Ghent University

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