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Predicting Heat Transport across Multiple Tokamaks with Neural Networks CHRISTOPHER LUNA, Arizona State University, ROBERT BUDNY, Princeton Plasma Physics Laboratory, ORSO MENEGHINI, STERLING SMITH, General Atomics, JAMES PENNA, MIT — Three multi-layer, feed-forward, back-propagation neural networks have been built and trained on heat transport data from DIII-D, TFTR, and JET respectively. A comparative analysis shows that previous success of neural networks in predicting heat transport in DIII-D [1] is reproduced for TFTR and JET. The effect of using different neural network topologies has been investigated across all of the devices. It is found that the neural networks can consistently predict the total species' heat fluxes for all of the devices, however they have difficulty in predicting the individual components of the heat fluxes in presence of significant transient variations in stored energy (i.e. non-steady-state conditions). Such limitation has been addressed by providing the time-derivative information of the plasma parameters that are input to the neural network. Finally, an attempt is made to draw a connection between the most consistently successful neural network topologies and their relevance to the physics of heat transport in tokamak plasmas.
[1] O. Meneghini, et al., Phys. Plasmas 21 (2014) 060702

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