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Predicting Heat Transport across Multiple Devices with Neural Networks[1] C.J. LUNA, ASU, R.V. BUDNY, PPPL, O. MENEGHINI, ORNL, S.P. SMITH, GA, J. 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 neu- ral networks in predicting heat transport in DIII-D [1] is reproduced for both TFTR and JET. The effect of using different neural network topolo- gies 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 indi- vidual components of the heat fluxes in presence of significant transient variations in stored energy (i.e. non steady-state conditions). Such lim- itation 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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Christopher Luna
ASU

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