Contribution ID : **277** Type : **not specified**

14.17 Bayesian based missing input imputation scheme for neural network reconstructing magnetic equilibria in real time

Thursday, 19 April 2018 10:31 (120)

Recently, a neural network paradigm in our fusion community is regarded as one of the prominent technical breakthroughs by disconnecting the usual anticorrelation between the computational speed and the accuracy of numerical simulation results. If a neural network successfully replicates a computationally intensive simulation code, then the network is likely to reproduce the outputs of the code with not only high-fidelity but with fast turnaround as well. Since the network is designed to accomplish the given task with fully intact input parameters, if they are incomplete, i.e., some of them are missing, then the network may fail and result in generating faulty outputs. In order to deal with such a missing input problem, we develop a Bayesian based imputation scheme for a neural network reconstructing magnetic equilibria in real time with off-line-EFIT quality. The input parameters of the network are various magnetic signals, thus the forward model for the imputation is built based on Maxwell's equations. The imputation scheme is complemented by Gaussian process to reduce the number of free-parameters and takes ˜100 usec to infer the replacement inputs, which means that the scheme can be used for real-time applications.

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Session Classification : Session #14. Thursday Morning Poster Session