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Neural network based real-time reconstruction of KSTAR magnetic equilibria with Bayesian-based preprocessing SEMIN JOUNG, SEHYUN KWAK, Y.-C. GHIM, Department of nuclear and quantum engineering, KAIST, Daejeon, Korea — Obtaining plasma shapes during tokamak discharges requires real-time estimation of magnetic configuration using Grad-Shafranov solver such as EFIT. Since off-line EFIT is computationally intensive and the real-time reconstructions do not agree with the results of off-line EFIT within our desired accuracy, we use a neural network to generate an off-line-quality equilibrium in real time. To train the neural network (two hidden layers with 30 and 20 nodes for each layer), we create database consisting of the magnetic signals and off-line EFIT results from KSTAR as inputs and targets, respectively. To compensate drifts in the magnetic signals originated from electronic circuits, we develop a Bayesian-based two-step real-time correction method. Additionally, we infer missing inputs, i.e. when some of inputs to the network are not usable, using Gaussian process coupled with Bayesian model. The likelihood of this model is determined based on the Maxwell's equations. We find that our network can withstand at least up to 20% of input errors. Note that this real-time reconstruction scheme is not yet implemented for KSTAR operation.

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