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Fitting surrogate models of ICF radiation hydrodynamic simulations to multimodal experimental data with unknown inputs[1] BOGDAN KUSTOWSKI, JIM A. GAFFNEY, BRIAN K. SPEARS, RUSHIL ANIRUDH, Lawrence Livermore National Laboratory — Neural network surrogates of the computer simulators begin to play an important role in the uncertainty quantification of the predictions of the ICF experiments, as well as in the design optimization. In this paper, we address three big challenges in building reliable surrogate models: (i) simulation-experiment bias, which needs to be suppressed given sparse experimental data, (ii) incorporating multimodal diagnostic data to better constrain the surrogate model, and (iii) inferring unknown inputs for the indirect-drive, high-resolution capsule simulations, for which we build the surrogate model. The first challenge is addressed by partial retraining of the simulation-trained model to match the experimental data. The second challenge is addressed by compressing different types of diagnostic data into a small set of variables using an autoencoder network, which takes advantage of the correlations in the data. The third challenge is addressed by iteratively improving the surrogate model and the inferred capsule inputs. We demonstrate that our technique brings the error of scalar observable predictions to within the experimental error and corrects major errors in the predictions of the experimental X-ray images.

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