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Using deep neural networks to augment NIF post-shot analysis KELLI HUMBIRD, Lawrence Livermore National Laboratory, Texas AM University, LUC PETERSON, Lawrence Livermore National Laboratory, RYAN MCCLARREN, Texas AM University, JOHN FIELD, JIM GAFFNEY, MICHAEL KRUSE, RYAN NORA, BRIAN SPEARS, Lawrence Livermore National Laboratory — Post-shot analysis of National Ignition Facility (NIF) experiments is the process of determining which simulation inputs yield results consistent with experimental observations. This analysis is typically accomplished by running suites of manually adjusted simulations, or Monte Carlo sampling surrogate models that approximate the response surfaces of the physics code. These approaches are expensive and often find simulations that match only a small subset of observables simultaneously. We demonstrate an alternative method for performing post-shot analysis using inverse models, which map directly from experimental observables to simulation inputs with quantified uncertainties. The models are created using a novel machine learning algorithm which automates the construction and initialization of deep neural networks to optimize predictive accuracy. We show how these neural networks, trained on large databases of post-shot simulations, can rigorously quantify the agreement between simulation and experiment. This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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