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Surrogate models for identifying robust, high yield regions of parameter space for ICF implosion simulations[1] KELLI HUMBIRD, J. LUC PETERSON, SCOTT BRANDON, JOHN FIELD, RYAN NORA, BRIAN SPEARS, Lawrence Livermore National Laboratory, Texas AM University — Next-generation supercomputer architecture and in-transit data analysis have been used to create a large collection of 2-D ICF capsule implosion simulations. The database includes metrics for approximately 60,000 implosions, with x-ray images and detailed physics parameters available for over 20,000 simulations. To map and explore this large database, surrogate models for numerous quantities of interest are built using supervised machine learning algorithms. Response surfaces constructed using the predictive capabilities of the surrogates allow for continuous exploration of parameter space without requiring additional simulations. High performing regions of the input space are identified to guide the design of future experiments. In particular, a model for the yield built using a random forest regression algorithm has a cross validation score of 94.3% and is consistently conservative for high yield predictions. The model is used to search for robust volumes of parameter space where high yields are expected, even given variations in other input parameters. Surrogates for additional quantities of interest relevant to ignition are used to further characterize the high yield regions.

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