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Using Machine Learning to Automate Mesh Management for HYDRA Simulations[1] CHRISTOPHER YANG, University of California, Berkeley, JAY SALMONSON, CHRISTOPHER YOUNG, Lawrence Livermore National Laboratory, SUJAY KAZI, Massachusetts Institute of Technology, JOSEPH KONING, JAYSON PETERSON, Lawrence Livermore National Laboratory — Multi-physics HYDRA simulations for inertial confinement fusion (ICF) experiments at the National Ignition Facility use mesh relaxation directives to manage the state of the arbitrary Lagrangian-Eulerian (ALE) mesh and prevent entanglement. Generating an effective meshing strategy throughout a full ICF laser-driven hohlraum simulation is a laborious process that to date must be done by hand. Machine learning techniques are well-suited to address this challenge. We take a supervised learning approach that uses semantic segmentation via DenseNet103 [1] to imitate existing, expert-labeled mesh management strategies for 2D hohlraum simulations. DenseNet103 achieves high (98.73%) prediction accuracy on test data, and we demonstrate successful control over ALE mesh management in a HYDRA hohlraum simulation. We also investigate adversarial autoencoders for generating a smooth latent space inside the semantic segmentation algorithm, in preparation for fine-tuning the mesh management policy with reinforcement learning. Thus, this approach may be improved upon and extended to handle new use cases such as 3D hohlraum simulations. [1] S. Jgou et al. "The One Hundred Layers Tiramisu: Fully Convolutional DenseNets for Semantic Segmentation." PROC CVPR IEEE (2017)

[1]Prepared by LLNL under Contract DE-AC52-07NA27344.

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