Contribution ID: **70** Type: **Short talk**

Training Deep Surrogate Models with Large Scale Online Learning

Wednesday 22 March 2023 16:00 (10 minutes)

The spatial and temporal resolution of Partial Differential Equations (PDEs) plays important roles in the mathematical description of the world's physical phenomena. In general, scientists and engineers numerically solve PDEs by the use of computationally demanding solvers. Recently, deep learning algorithms have emerged as a viable alternative for obtaining fast solutions for PDEs. Models are usually trained on synthetic data generated by solvers, stored on disk and read back for training. We propose an online training framework for deep surrogate models implementing several levels of parallelism focused on simultaneously generating numerical simulations and training deep neural networks. This approach suppresses the I/O and storage bottleneck associated with disk loaded datasets, and opens the way to training on significantly larger datasets. The framework leverages HPC resources, traditionally used to accelerate solver executions, to parallelize the data generation with the training. Experiments compare the offline and online training of four surrogate models, including state-of-the-art architectures. Results indicate that exposing deep surrogate models to more dataset diversity, up to hundreds of GB generated on 300 nodes and 1200 cores, can increase model generalization capabilities. Fully connected neural networks, FNO, and Message Passing PDE Solver prediction accuracy is improved by 68%, 16% and 6%, respectively. Work in progress targets larger scale simulations.

JLESC topic

Scientific applications (AI, deep surrogate models), Novel programming models (online training on data generated in parallel)

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