Data-Driven Joint Inversions for PDE Models

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March 28, 2022

Abstract

The task of simultaneously reconstructing multiple physical coefficients in partial differential equations from observed data is ubiquitous in applications. In this work, we propose an integrated machine learning and model-based iterative reconstruction framework for such joint inversion problems where additional data on the unknown coefficients are supplemented for better reconstructions. Our method couples the supplementary data with the PDE model to make the data-driven modeling process consistent with the model-based reconstruction procedure. We characterize the impact of learning uncertainty on the joint inversion results for two typical model inverse problems. Numerical evidences are provided to demonstrate the feasibility of using data-driven models to improve joint inversion of physical models.

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