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Neural Inverse Operators for Solving PDE Inverse Problems

Roberto Molinaro, ETH Zurich

A large class of inverse problems for PDEs are only well-defined as mappings from operators to functions. Existing operator learning frameworks map functions to functions and need to be modified to learn inverse maps from data. We propose a novel architecture termed Neural Inverse Operators (NIOs) to solve these PDE inverse problems. Motivated by the underlying mathematical structure, NIO is based on a suitable composition of DeepONets and FNOs to approximate mappings from operators to functions. A variety of experiments are presented to demonstrate that NIOs significantly outperform baselines and solve PDE inverse problems robustly, accurately and are several orders of magnitude faster than existing direct and PDE-constrained optimization methods.