Neural Operators for Solving PDEs and Inverse Design

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ABSTRACT
Deep learning surrogate models have shown promise in modeling complex physical phenomena such as photonics, fluid flows, molecular dynamics and material properties. However, standard neural networks assume finite-dimensional inputs and outputs, and hence, cannot withstand a change in resolution or discretization between training and testing. We introduce Fourier neural operators that can learn operators, which are mappings between infinite dimensional spaces. They are discretization-invariant and can generalize beyond the discretization or resolution of training data. They can efficiently solve partial differential equations (PDEs) on general geometries. We consider a variety of PDEs for both forward modeling and inverse design problems, as well as show practical gains in the lithography domain.

CCS Concepts/ACM Classifiers
• Computing methodologies → Machine learning
→ Machine learning approaches → Neural networks

Author Keywords
Deep learning; neural networks; Fourier neural operators;
partial differential equations; lithography.

BIOGRAPHY
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