

Problems in Nanophotonics solved with Deep Operator Networks

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Artificial Intelligence (AI) refers to the set of activities performed by a machine that attempt to replicate behaviours considered intelligent by humans. Today, it encompasses a multitude of fields such as image recognition, autonomous driving or recommender systems. Physics is not blind to these and other recent developments in AI and new techniques are being introduced nowadays.

A relatively little known and recently developed facet is the use of AI as a means to surrogate a Mathematical Operator. The technique relies on the Universal Operator Approximation Theorem, which states that a neural network with a simple hidden layer can accurately approximate any nonlinear continuous operator. This theorem suggests the use of deep networks in learning continuous operators from data. In the Institute of Nanoscience and Materials of Aragón (INMA), which a joint Institute between CSIC and the University of Zaragoza, we initiated the study of mathematical operators to solve simple differential equations, in the context of a Final Degree Project. Our aim here is to continue this work going further simple differential equations, trying to solve the PDEs appearing in the problems our group is currently involved in the area of Nanophotonics.