Machine learning enhances light–Matter interactions in dielectric nanostructures

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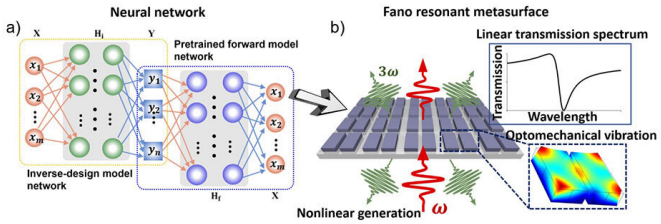

(a) Schematic of a tandem neural-network used for the inverse design of a Fano resonant metasurface for enhancing (b) nonlinear generation and optomechanical vibrations. Credit: SPIE

A paper published in *Advanced Photonics* "Enhanced light–matter interactions in dielectric nanostructures via machine-learning approach," suggests that machine-learning techniques can be used to enhance metasurfaces, optimizing them for nonlinear optics and optomechanics. The discovery has promising possibilities for the development of a wide range of photonic devices and applications including those involved in optical sensing, optoacoustic vibrations, and narrowband filtering.

Metasurfaces are versatile platforms used to manipulate the scattering, color, phase, or intensity of light that can be used for light emission, detection, modulation, control and/or amplification at the nanoscale. In recent years, metasurfaces have been a subject of undergoing intense study as their optical properties can be adapted to a diverse set of applications, including superlenses, tunable images, and holograms.

According to *Advanced Photonics* Co-Editor-in-Chief, SPIE Fellow, and Head of Photonics & Nanotechnology Group at King's College London Anatoly Zayats, this work marks an exciting advancement in nanophotonics. "Optimization of metasurfaces and metamaterials for particular applications is an important and time-consuming problem," said Zayats. "With traditional approaches, only a few parameters can be optimised, so that the resulting performance is better than for some other designs but not necessarily the best. Using machine learning, one can search for the best design and cover the space of parameters not possible with traditional approaches."

More information: Lei Xu et al. Enhanced light–matter interactions in dielectric nanostructures via machine-learning approach, *Advanced Photonics* (2020). DOI: 10.1117/1.AP.2.2.026003

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