All-optical diffractive neural network closes performance gap with electronic neural networks

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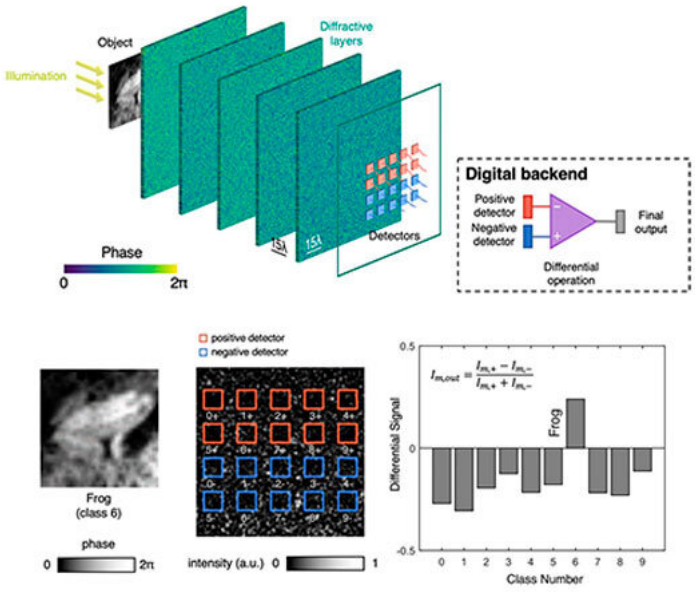

Operation principles of a differential diffractive optical neural network. Since diffractive optical neural networks operate using coherent illumination, phase and/or amplitude channels of the input plane can be used to represent information. Credit: SPIE

A new paper in *Advanced Photonics* demonstrates distinct improvements to the inference and generalization performance of diffractive optical neural networks.

One of the key improvements discussed in the paper, "Class-specific differential detection in diffractive optical neural networks improves inference accuracy," incorporates a differential detection scheme combined with a set of parallel-operating diffractive optical networks, where each individual network of this set is specialized to specifically recognize a sub-group of object classes.

According to SPIE Fellow Aydogan Ozcan of the University of California, Los Angeles, and one of the paper's authors, these results "provide a major advancement to bring optical neural network-based low-power and low-latency solutions for various machine-learning applications."

This latest research is a significant advance to Ozcan's optical machine-learning framework: The technology is especially significant for recognizing target objects more quickly and with significantly less power than standard computer-based machine learning systems. Ultimately, it may provide major advantages for autonomous vehicles, robotics and various defense-related applications, among others.

These latest systematic advances in diffractive optical network designs have the potential to advance the development of next-generation, task-specific, and intelligent computational camera systems.

More information: Jingxi Li et al, Class-specific differential detection in diffractive optical neural networks improves inference accuracy, *Advanced Photonics* (2019). DOI: 10.1117/1.AP.1.4.046001

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