Higher-Speed and More Energy-Efficient Signal Processing Platform for Neural Networks

Tech ID: 31652 / UC Case 2019-093-0

ABSTRACT

Researchers at the University of California, Davis have developed a nanophotonic-based platform for signal processing and optical computing in algorithm-based neural networks that is faster and more energy-efficient than current technologies.

FULL DESCRIPTION

Current techniques for signal processing and optical computing in algorithm-based neural networks are incredibly energy-intensive. For example, over 90% of the total energy consumed in typical convolutional neural networks occurs during the convolution process itself. In addition, many neuromorphic computing systems are limited to only four direct connections (N-S-E-W), and thus require repeaters to re-transmit their optical signals. Each repeater also consumes additional energy.

Researchers at the University of California, Davis have developed a platform for signal processing and optical computing in neural networks that offers massive parallel information processing. This platform allows for complex functionalities and photonic computing in compact applications for which low signal loss is important. In addition, it reduces overall hardware requirements and allows for increased miniaturization. The technology thus opens applications for multi-layer, convolution neural networks with high quantity processing and low power consumption in handheld devices and other products where equipment size or energy consumption requirements prohibited their use previously.

APPLICATIONS

- Optical computing and signal processing for algorithm-based neural networks
- Previously-unavailable uses in miniaturized products or hand-held devices

FEATURES/BENEFITS

- Energy consumption reduced by a factor of 1000 compared to conventional neural networks
- Parallel information processing allows for 100x faster network speeds
- Complex photonic computing via a compact and low-loss platform
- Allows for scalable, multi-layer, convolutional neural network on low-power platforms such as hand-held devices

PATENT STATUS

Patent Pending

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OTHER INFORMATION

KEYWORDS

Nanophotonics, Photonics, Neural Networks, Photonic Integrating Circuit, Personal Devices, Energy Consumption

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Communications**
  - Networking
  - Optical
  - Other
- **Energy**
  - Other
- **Nanotechnology**
  - Electronics
  - Other

RELATED CASES

2019-093-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Crystal Orientation Optimized Optical Frequency Shifter
- Hyperspectral Compressive Imaging
- Multi-Wavelength, Nanophotonic, Neural Computing System

- Athermal Nanophotonic Lasers
- Ultra-High Resolution Multi-Platform Heterodyne Optical Imaging
- Multi-Wavelength, Laser Array
- Optical Interposers for Embedded Photonics Integration
- Ultrahigh-Bandwidth Low-Latency Reconfigurable Memory Interconnects by Wavelength Routing
- Development of a CMOS-Compatible, Nano-photonic, Laser
- Energy Efficient and Scalable Reconfigurable All-to-All Switching Architecture
- Compressive High-Speed Optical Transceiver
- All-Optical Regenerators
- Tensorized Optical Neural Network Architecture
- Silicon Based Chirped Grating Emitter for Uniform Power Emission
- Energy-Efficient All-Optical Nanophotonic Computing
- 3D Photonic and Electronic Neuromorphic Artificial Intelligence

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