Multi-Wavelength, Nanophotonic, Neural Computing System

Tech ID: 31651 / UC Case 2019-788-0

ABSTRACT

Researchers at the University of California, Davis have developed a multi-wavelength, Spiking, Nanophotonic, Neural Reservoir Computing (SNNRC) system with high-dimensional (HD) computing capability.

FULL DESCRIPTION

To continue to increase the processing speeds of next-generation computers, researchers are investigating artificial neural networks (ANN). These neural networks attempt to replicate some aspects of biological neural networks in order to mimic the structure and processing capabilities of neurons. Hardware-based ANNs can be electronic or photonic. However, ANNs constructed with electronics consume considerable energy and perform calculations relatively slowly. On the other hand, photonics - which rely on the behavior of light and light-particle interactions, allow for faster computational speeds and lower overall energy consumption, but have other limitations.

Researchers at the University of California, Davis have addressed the various limitations mentioned above by developing a SNNRC that delivers faster computational processing speeds with a reduced hardware footprint and significantly lower energy consumption. It targets new artificial intelligence engines that provide cluster-scale capabilities at a chip scale – using silicon photonics. This computing framework mimics a biological neural network by spiking, which means that is only fires its artificial neurons when a membrane potential reaches a critical value. Since this technique uses nanophotonics, it also requires significantly less hardware than current systems.

APPLICATIONS

- Next-generation computing capability using photonics
- Leverages ANNs to help detect (for example) malware or malicious signature data

FEATURES/BENEFITS

- Reduces power consumption by 100x
- Decreases latency by 100x
- Simplifies hardware by 1000x
- Cluster-scale capability in a chip scale
- Scalable photonic system

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20220044100	02/10/2022	2019-788

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OTHER INFORMATION

KEYWORDS

Neural Networks, Nanophotonics, Spiking, Reservoir Computing, SNNRC, next-generation computing capabilities, high-dimensional computing

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Computer**
  - Hardware
  - Other
- **Nanotechnology**
  - Electronics
- **Security and Defense**

Additional Patent Pending

- Cyber security

RELATED CASES

2019-788-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Higher-Speed and More Energy-Efficient Signal Processing Platform for Neural Networks
- Crystal Orientation Optimized Optical Frequency Shifter
- Hyperspectral Compressive Imaging
- 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
- Adapting Existing Computer Networks to a Quantum-Based Internet Future