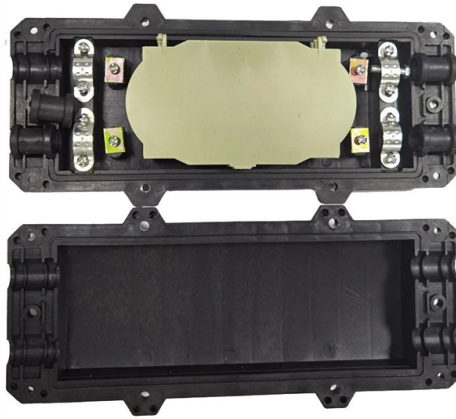


Convolutional Optical Module



AI Overview

A Convolutional Optical Module is an optical system designed to perform convolution operations on light signals, enabling high-speed, parallel, and energy-efficient computation for tasks like image processing and neural network inference.

Overview

Convolutional Optical Modules (COMs) leverage the properties of light to perform convolution operations directly in the optical domain, bypassing some limitations of electronic computation. These modules are particularly useful in optical computing, opto-electronic neural networks, and high-dimensional signal processing, where traditional electronic systems face bottlenecks in speed and energy efficiency .

Key Technologies

- **Spatial Light Modulators (SLMs):** SLMs are used to encode amplitude and phase information of input signals. In complex convolution setups, cascaded SLMs can prepare superpositions of optical modes, such as orbital angular momentum (OAM) eigenmodes, to represent complex vectors .
- **Fourier Optics:** Many COMs operate in a 4F system, where a thin lens performs a Fourier transform of the input signal. Convolution is achieved by modulating the Fourier plane with a kernel encoded on an SLM or metasurface .
- **Metasurfaces:** Flat nanophotonic devices can implement the first convolutional layer of a neural network by modulating the phase of incident light, generating optical feature maps that are then processed electronically .

Article Content

Optical Convolutional Spectrometer

Abstract Optical spectrometers are fundamental across numerous disciplines in science and technology. However, miniaturized

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Cisco offers a comprehensive range of pluggable optical modules in the Cisco ONS pluggables portfolio. The wide

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Describes what an optical module is and FAQs, including the fundamentals, appearance and structure, key performance counters,

Multi-mode optical fiber

Multi-mode optical fiber is a type of optical fiber mostly used for communication over short distances, such as within a building or on a

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Optical convolutional spectrometer

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Opto-Electronic Convolutional Neural Network Design Via

We introduce a two-stage strategy for designing opto-electronic convolutional neural networks (CNNs): first, train a

Optical module

An optical module is a typically hot-pluggable optical transceiver used in high-bandwidth data communications applications. Optical

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Complex-valued neural networks can recognize phase-sensitive data in wave-related phenomena. Here, authors report

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This study introduces optical neural networks (ONNs) designed to accelerate optical convolution operations using a

Monolithically Integrated Optical Convolutional Processors on Thin

Here, we demonstrate monolithically integrated optical convolutional processors on thin film lithium niobate (TFLN) that harness

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Here, a compact on-chip optical convolutional processing unit is fabricated on a low-loss silicon nitride platform to

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An Attention-Based Convolutional Neural Network With Spatial Transformer Module for Automated Optical Inspection

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GlobalFoundries (Nasdaq: GFS) (GF) today announced the introduction of its SCALE™ optical module solution for co

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An optical vector convolutional accelerator operating at more than ten trillion operations per second is used to create

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Schematic of the integrated photonic convolutional processor featuring monolithic data loading (electro-optic

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Timeline of optical neural networks (ONNs) and related optical implementations. Selected partial key milestones and

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In this paper, an optical convolutional neural network (OCNN) is presented that is trained with spatial kernels while

Optical Freespace Michelson Interferometric Reconfigurable Full

Here we demonstrate simultaneous optical two-dimensional reconfigurable full complex convolution by Michelson Interferometric

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We propose a design for an optical convolutional layer based on an optimized diffractive optical element and test our

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Compact optical convolution processing unit based on multimode ...

In this paper, we propose a compact on-chip incoherent optical convolution processing unit (OCPU) integrated on a

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