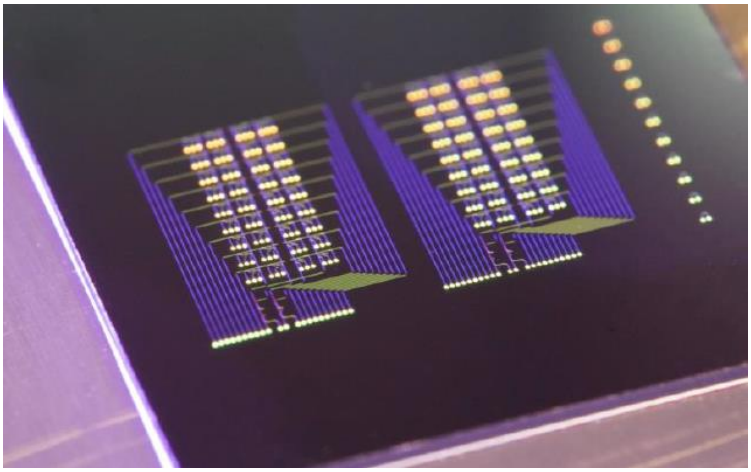
UNIVERSITÄT HEIDELBERG
ZUKUNFT SEIT 1386

Scalable photonic integrated crossbar array

Technology Offer

Ref. No.: 1021-24



Category

Silicon Photonics

Keywords

- integrated photonics
- photonic tensor core
- matrix-vector multiplication

Development stage

Prototype

Seeking

Licensee

IP status

Patent pending

Background

The photonic crossbar array (PCA)-based tensor core holds significant potential for achieving faster computing speeds with lower energy consumption, addressing the growing demand for computational power particularly in fields driven by artificial intelligence (AI), such as machine learning or data analytics. The low latency of such systems is also one of their key advantages and could enable significant improvements in several fields which require a fast data processing (e.g. autonomous vehicles). By leveraging the advantages of photonics – such as high bandwidth and low energy consumption – PCAs can offer substantial advantages over traditional electronic systems.

However, the scaling of crossbar arrays is hindered by challenges such as low output signals and fabrication errors. Large-scale crossbar arrays are essential to enhancing computational speed and energy efficiency. The offered technology provides a novel solution to overcome these challenges, enabling the efficient scaling of photonic crossbar arrays.

Contact

ScienceValue Heidelberg GmbH
Berliner Straße 47 | 69120 Heidelberg | Germany
+49 (0)6221 - 567435 | www.sciencevalue-heidelberg.de/en
ScienceValue-Heidelberg@med.uni-heidelberg.de

SVH ScienceValue Heidelberg

Technology

The proposed approach combines mode division multiplexing (MDM) with photonic integrated circuits, which allows multiple small crossbar arrays to be combined into a larger, more powerful array. Mode division multiplexing is a technology that capable of coupling multiple data streams into the same waveguide with negligible insertion loss. This allows for the scaling of crossbar arrays without introducing additional loss to the output signal or significantly complicating the manufacturing process.

This method represents a significant advancement in overcoming the current limitations of photonic crossbar arrays. It not only allows for the creation of large, high-performance photonic processors but does so with a manufacturing process that remains scalable, cost-effective, and efficient. In turn, it paves the way for the widespread adoption of photonic systems in AI, machine learning, telecommunications, and high-performance computing, offering a solution that could help meet the next generation of computational demands while maintaining high energy efficiency computing.

Benefits

- Enables scalability of photonic crossbar arrays
- Low energy consumption
- Low losses even with larger dimensions

Applications

- Matrix-Vector multiplication based on PIC

Publications

Contact

ScienceValue Heidelberg GmbH
Berliner Straße 47 | 69120 Heidelberg | Germany
+49 (0)6221 - 567435 | www.sciencevalue-heidelberg.de/en
ScienceValue-Heidelberg@med.uni-heidelberg.de

SVH
ScienceValue Heidelberg