

A scalable two-step convolution unit for all optical convolutional neural network

Ziyu Gu, Yesheng Gao, Xingzhao Liu
State Key Laboratory of Advanced Optical Communication Systems and Networks, Shanghai Jiao Tong University, Shanghai 200240, China

With the rapid development of artificial intelligence, Deep neural networks (DNNs), especially convolutional neural networks (CNNs) have played crucial role in solving object classification and pattern recognition problems but with massive computational requirements of convolution operations. In recent years, optical technique has been developed for CNNs due to its ultrafast processing speed and inherent parallel computing characteristics. This paper introduces a scalable two-step convolution unit for designed all optical convolutional neural network including convolution, pooling layers, nonlinear activation functions and fully connected layers. We replace the pooling layers by normal convolution with stride larger than one without abandoning the spatial dimensionality reduction. To evaluate imaging quality of the scalable two-step convolution unit, No-Reference Structural Sharpness (NRSS) and Image Information Entropy (IIE) were used as evaluation indexes. The values of NRSS and IIE show that the optical outputs reserve the outline and structure of simulated images. Our proposed architecture is expecting to benefit the area of achieving ultra-fast and high-efficiency object classification and pattern recognition.

Biography

Ziyu Gu has received the B.S. degree in electrical engineering from Xidian University, Xi'an, China, in 2018, and he is currently working toward the Ph.D. degree in the State Key Laboratory of Advanced Optical Communication Systems and Networks from Shanghai Jiao Tong University. His research interests include photonic integration and feature extraction.

Presenting author details
Full name: Ziyu Gu
Contact number: (+86)18601717636
Twitter account:
Linked In account: ysgao@sjtu.edu.cn
Session name/ number: Photonics and its Devices
Category: (Oral presentation/ Poster presentation)