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Ken-ichi Kitayama
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Introduction

The exponential increase in the amount of data created every day has led to a new era in data exploration and utilization. Optical sensors capture a massive amount of data and optical network transport this data across long distances. The field of biological research and healthcare has been transformed by the developments in photonics ranging from advanced imaging, tomography, and spectroscopy. Optical image sensors are able to acquire a vast amount of data at video frame rates. These trends are fueling the need and the opportunity for artificial intelligence (AI) techniques to process and extract insight from such large datasets. Integration of optical sensors with digital algorithms represents a huge near-term opportunity. At the same time, processing of data closer to the sensor, i.e. at the edge, will reduce the burden on the communication networks and alleviate bottlenecks in server-side processing. Opportunity also exists for photonic hardware accelerators that taking advantage of all-optical signal processing including spatial Fourier transformation and time stretch dispersive Fourier transformation of temporal data. Optical implementation of neural networks may offer power and speed advantages and may find utility in certain applications.

Early examples for convergence of AI and photonics include integration of artificial intelligence with various types of microscopy for classification of biological cells and tissue and AI enhancement of image resolution and denoising. Integration of deep learning with label-free time stretch microscopy has led to detection and classification of rare cancer cells in blood with high accuracy. Deep learning has been used to learn the mapping resulting from mode mixing in multimode fibers. Machine learning algorithms have shown promise in improving signal detection in optical communication and sensing. In the field of cybersecurity, optics can offer means to generate and distribute keys for encrypted communication.

The goal of this conference is to serve as a unique platform for bringing together artificial intelligence and photonics researchers from around the world to showcase the newest trends and best practices.

Bahram Jalali
Ken-ichi Kitayama

