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香港城市大學
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Integrated Lithium Niobate Microwave Photonic Processing Engine

Communications & Information

Computer/AI/Data Processing and Information Technology

Nanotechnology and New Materials

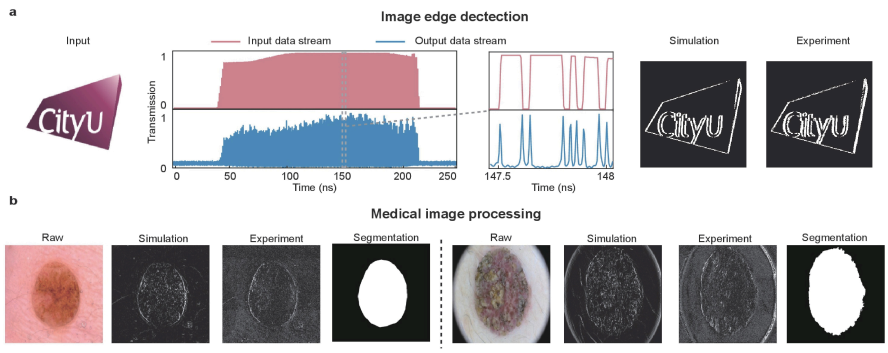

Table. Performance comparison with the traditional electronic processor

	Differentiation algorithm	Convolution algorithm	LN MWP chip
Segmentation accuracy	95.6%	95.9%	97.3%
Computation time	120 μs	380 μs	0.244 μs
Energy consumption	201 nJ	1227 nJ	3.76 nJ

Remarks

1. International Exhibition of Inventions of Geneva (IEIG) 2024 - Silver Medals

IP Status

Patent filed

Technology Readiness Level (TRL) ? 5

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Opportunity

The rapid expansion of wireless networks, the Internet of Things (IoT), and cloud-based services is posing pressing challenges to electronic bandwidth and power consumption of underlying radio frequency (RF) systems. The burgeoning artificial intelligence technologies also demand ultrahigh-speed, low-power, and low-latency processing and computation of analog signals much beyond those offered by traditional electronic integrated circuits. The current invention exhibits ultrahigh operation bandwidth, processing speed, and low energy consumption. The invention uses an integrated lithium niobate (LN) platform to develop a high-performance analog signal processing engine, providing compact, low-power, low-latency, and cost-effective solutions for future wireless communications, Internet of things, high-resolution radar systems and photonic artificial intelligence.

Technology

This invention describes an integrated analog signal processing engine based on a thin-film lithium niobate (LN) photonic platform. The invention could perform multi-purpose processing and computation tasks of analog signals up to 256 Giga samples per second (GSa/s) at CMOS-compatible voltages (~1 V). Specifically, the invention combines a high-speed electro-optic (EO) modulation block to faithfully perform microwave-optic conversion at low power, and a multi-purpose low-loss signal processing section that can be configured for a variety of signal processing tasks. Both parts are integrated on the same LN photonic chip based on a 4-inch wafer-scale process.

Advantages

- Higher signal processing bandwidth than current photonic platforms and traditional electronic processor
- Lower energy consumption than current photonic platforms and traditional electronic processor
- Excellent compatibility with other photonic functional components and scalability toward more advanced photonic integrated circuits

Applications

- High-speed wireless communication (5/6G)
- Internet of things
- High-resolution radar systems
- Photonic artificial intelligence
- Medical and scientifical imaging