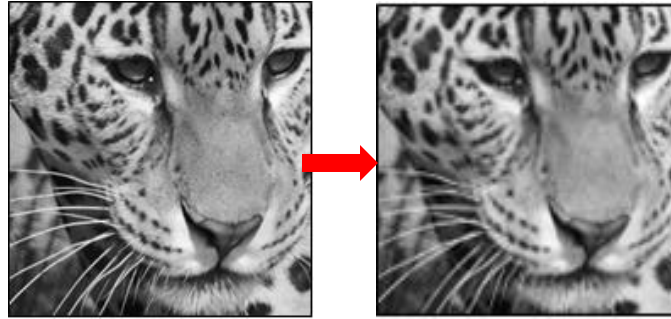
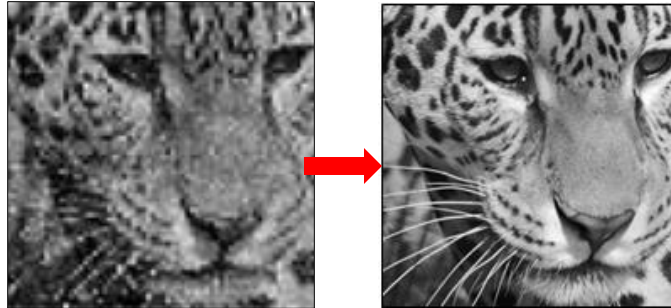


Integrated Photonic Encoders for Ultrafast and Low Power Image Processing

4X Compressed



Denoised



Scientific Achievement

A novel analog photonic approach for low power and high-speed image compression and denoising.

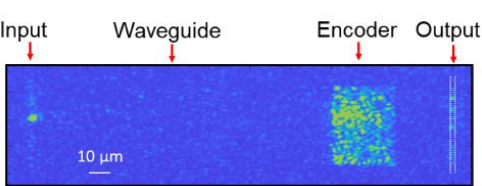
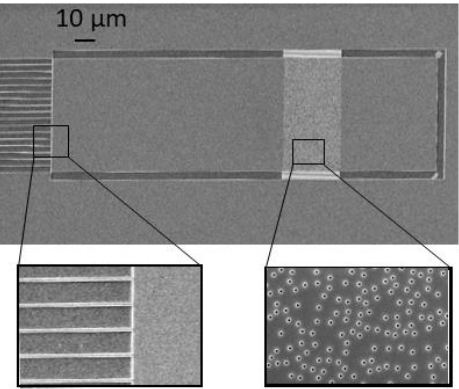
Significance and Impact

Silicon photonics-based approach implemented on a CMOS compatible platform utilizes significantly smaller number of mathematical operations for compression resulting in 100x lower power and latency compared to digital approaches.

Research Details

- Encoding approach is based on an autoencoder framework where an analog silicon photonics-based encoder performs random encodings of blocks of images for compression.
- This approach can perform compression with $\sim 100x$ fewer mathematical operations compared to JPEG and can allow 4X larger compression ratios compared to JPEG.

Wang, X.; Redding, B.; Karl, N.; Long, C.; Zhu, Z.; Skowronek, J.; Pang, S.; Brady, D.; Sarma, R. Integrated Photonic Encoder for Low Power and High-Speed Image Processing. *Nature Communications* **2024**, *15* (1). DOI:10.1038/s41467-024-48099-2.



The image is optically encoded block-wise and then transformed using a photonic encoder that performs a kernel-type random projection. Scanning electron micrograph of the encoder and an optical measurement is shown on left. An example of compressed and denoised image using experimentally measured encoding matrices is shown on the right.

Work was performed, in part, at the Center for Integrated Nanotechnologies