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Artificial Retina Based on Photon-Assisted Electrochemical Doping

A light-sensitive organic transistor mimics synapses for vision-like computing and facial recognition.

Researchers at Purdue University have developed an artificial retina based on a photonic-organic electrochemical transistor (related: 2023-MEI-70196). The device is capable of emulating typical synapse behaviors, including paired-pulse facilitation (PPF), short-term plasticity (STP), and long-term plasticity (LTP). This is achieved by means of electrochemical doping facilitated by captured light. When the light source is turned off, some electrons remain separated from holes resulting in nonvolatile memory. Additional advantages include a low writing voltage (1 V), and a high light responsiveness. By leveraging the functions of light sensitivity, data processing, and memory, a single layer synapse array was used for facial recognition with high efficiency. Broader applications include computer vision and high bandwidth computing based on electronics mimicking biological functions (brain synapses, iris, etc). Devices made from this technology are ideal for interfacing biosystems.

Advantages:

- Low writing voltages (1 V)

- Emulation of synapse behaviors

- High light responsiveness

- Interfacing with biosystem

Applications:

- Computer vision

- High bandwidth computing

- Photonics

- Facial recognition

Technology ID

2022-MEI-69888

Category

Artificial Intelligence & Machine Learning/AI-Integrated Imaging Systems & Industrial Vision and Inspection

Computing/Photonic & Optical Computing Technologies

Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

Further information

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Technology Validation:

This technology has been validated through fabrication of a prototype system which was tested in facial recognition applications.

Related Publications:

Ke Chen et al, Organic optoelectronic synapse based on photon-modulated electrochemical doping, Nature Photonics (2023). DOI: 10.1038/s41566-023-01232-x

https://techxplore.com/news/2023-11-human-eye-boost-vision-efficiency.html

TRL: 5

Intellectual Property:

Provisional-Patent, 2023-03-09, United States

PCT-Patent, 2024-03-07, WO

NATL-Patent, 2025-08-11, United States

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