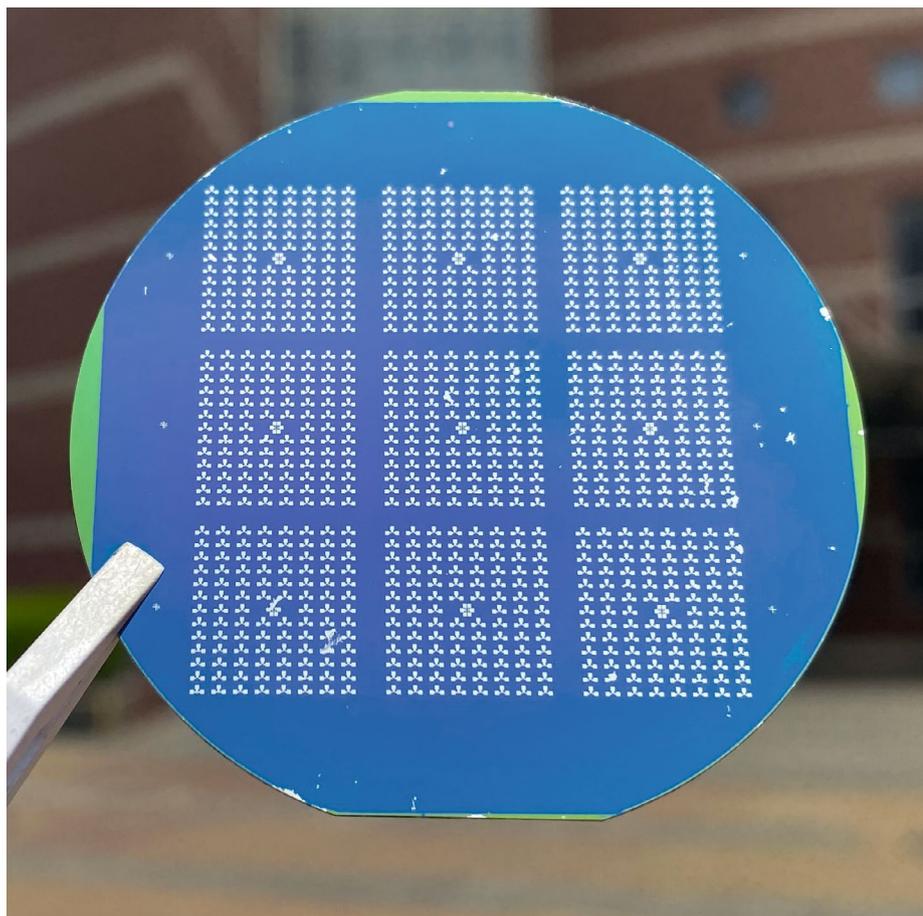


PHOTODETECTORS

Vanadium dioxide remembers the light*Nat. Commun.* **13**, 1729 (2022)Credit: Reproduced under a Creative Commons licence [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

Intelligent vision systems collect optical inputs, turn them into electrical and then digital signals, and use an artificial neural network to extract relevant information. In systems based on complementary metal–oxide–semiconductor (CMOS) technology, these different functions are performed by physically separated components, resulting in large amounts of data being unnecessarily stored, transferred and processed, and thus a high power consumption. Kuijuan Jin, Chen Ge and colleagues now show that vanadium dioxide photodetectors can sense and remember exposure to ultraviolet light, so that sensing, memory and processing can be integrated in the same device.

The researchers — who are based at the Chinese Academy of Sciences, University of Chinese Academy of Sciences, China University of Petroleum, Capital Normal University and Qingdao University — found that ultraviolet light created oxygen vacancies

that lead to a phase transition in the vanadium dioxide films. The subsequent change in electrical resistance — which remains stable after the light is switched off — is directly proportional to the irradiation dosage. The device can be reset using electrolyte gating. Simulations showed that when imaging the MNIST handwritten digit database that had been blurred in the visible spectrum but with added ultraviolet information, the vanadium dioxide sensors increased the recognition rate from 24% to 93%, a process the team compared to how bees use sensitivity to ultraviolet light to locate different flowers. Arrays of the sensors can be integrated on silicon at the wafer-scale, increasing their potential for mass production.

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