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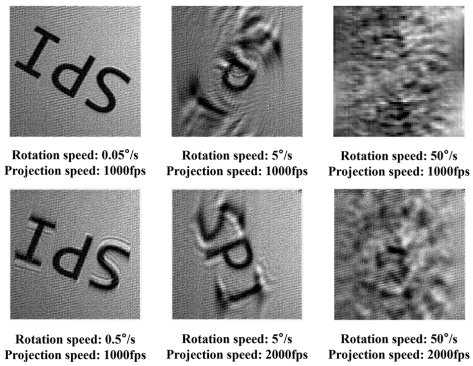
Rotationally Synchronized Single-pixel Imaging can capture fast-rotating objects at a low frame rate.



As modern digital cameras boast an ever-increasing pixel count, emerging technology enables photography with just one pixel. Single-pixel imaging (SI) can capture wavelengths and reach frame rates outside the range of modern cameras.

Ma et al. propose a technique, Rotationally Synchronized Single-pixel Imaging (RS-SI), to image dynamic objects in rotation. RS-SI can be used for defect detection in the rotating parts of machinery, such as energy turbines and engine blades.

With previous technology, obtaining the imaging resolution and speed required for capturing fast-rotating objects remained elusive.

"RS-SI smartly tackles this problem by capturing a fast-rotating object at a low frame rate," said author Mengchao Ma. "RS-SI patterns are designed to be relatively stationary. When the target object rotates, these patterns allow the light intensity signal acquired by the single-pixel detector to be identical to that of static states, allowing a fast-rotating object to be consistently captured even when the imaging speed is significantly below the rotation speed."

Simulation and experimental results confirm that RS-SI can reconstruct images of a rotating object at up to 422.0 rpm without advanced knowledge of the speed. The device also succeeded capturing objects rotating at variable speeds. For this task, RS-SI outperforms expensive ultra-high-speed cameras in image quality and shorter acquisition time while being easy to use.

Despite its outstanding performance, it does not overcome all photography obstacles.

"This approach only applies to pure rotation and not random motion," said Ma. "Furthermore, simultaneously photographing numerous spinning objects presents a challenge. We will concentrate on multiple object imaging and arbitrary motion imaging in the future."

Source: "Rotationally synchronized single-pixel imaging for a fast-rotating object," by Mengchao Ma, Chen Wang, Yiqi Jia, Qingtian Guan, Wenbo Liang, Chunyang Chen, Xiang Zhong, and Huaxia Deng, *Applied Physics Letters* (2023). The article can be accessed at https://doi.org/10.1063/5.0157288.