Novel imaging method developed for fast-moving objects

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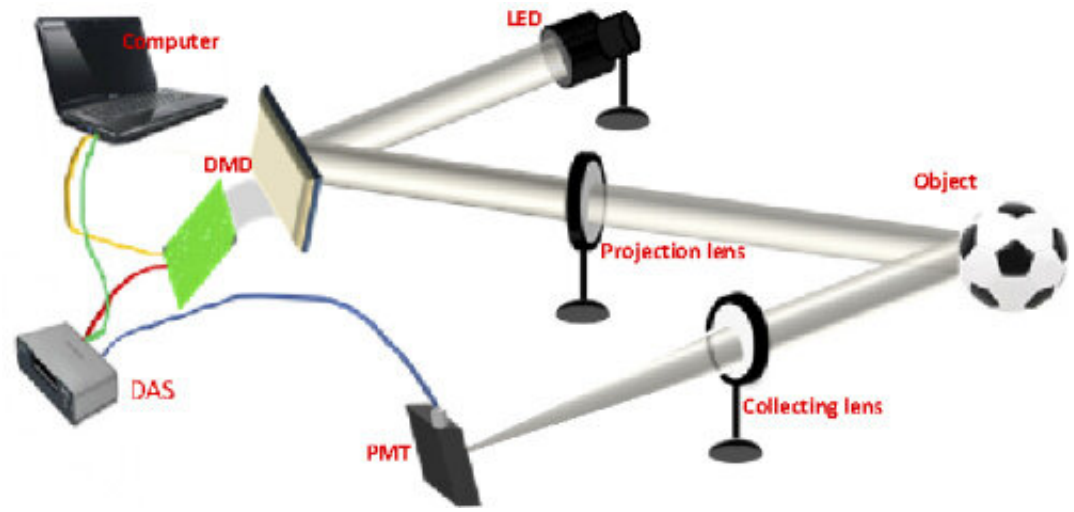

Experimental system. DMD is for digital micromirror device, LED is for light-emitting diode, PMT is for photomultiplier tube, and DAS is for data-acquisition system. Credit: Shi Dongfeng

A research team from the Hefei Institutes of Physical Science (HFIPS) of the Chinese Academy of Sciences (CAS) has proposed a new anti-motion blur single-pixel imaging method for fast-moving objects. This method takes advantage of the wide spectrum and high sensitivity of a single-pixel detector and contributes to breaking through the bottleneck of single-pixel imaging of fast-moving objects.

This research was published in *Optics Letters*.

Based on previous proof-of-principle capturing motion information and imaging information, "This study changes the traditional notion that single-pixel imaging is only suitable for static or slow-moving objects," said Wang Yingjian, who led the team.

Single-pixel imaging has made significant progress in capturing static or slow-moving objects. However, for fast-moving objects, motion blur is the main problem of single-pixel imaging in practical engineering applications.

In order to solve this, the researchers proposed a multi-task tackling system for moving target tracking and imaging. A small amount of information detected by the single-pixel detector was used to locate and track the moving targets. With the increase of detection information over time, imaging of fast-moving objects and motion blur correction were realized synchronously.

The proposed technology fully exploits the characteristics of single-pixel detection and realizes rapid positioning, clear imaging, and recognition of fast-moving targets according to the characteristics of the system's detection information data stream. The proposed technology roadmaps "tracking before imaging" subverts the time-sequence relationship of imaging before tracking in the traditional technical method.

"The experimental results are encouraging," said Dr. Matthew Edgar, formerly from University of Glasgow, "and I am sure that future work in this area will compare and contrast the efficacy of the author's approach with other single-pixel sampling and reconstruction methods for real-world applications where there is rapid and dynamic motion of objects in the scene."

"With this strategy, rapid tracking of an object is demonstrated," said Prof. Randy Bartels from Colorado State University. "This approach has

the potential to scale to very high speeds."

More information: Wei Yang et al, Anti-motion blur single-pixel imaging with calibrated radon spectrum, *Optics Letters* (2022). DOI: 10.1364/OL.460087

Shi Dongfeng et al, Radon single-pixel imaging with projective sampling, *Optics Express* (2019). DOI: 10.1364/OE.27.014594

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