High-throughput add-on live-cell super-resolution imaging

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Super-resolution (SR) imaging with high-throughput is invaluable to fast and high-precision profiling in a wide range of biomedical applications. However, prevalent SR methods require sophisticated acquisition devices and specific imaging control, and may cost a fairly long time on a single field-of-view. Here, we propose an SR method based on the Auto-Correlation with two-step Deconvolution (SACD) that reduces the number of frames required by maximizing the detectable fluorescence fluctuation behavior in each measurement, with further removal of tunable parameters by a Fourier ring correlation analysis. It only needs 20 frames for twofold lateral and axial resolution improvements, while the SR optical fluctuation imaging (SOFI) needs more than 1000 frames. By capturing raw images for ~10 minutes, we record an SR image with ~128 nm resolution that contains 2.4 gigapixels covering an area of ~2.0 mm Ч 1.4 mm, including more than 2,000 cells. As an open-sourced module, we anticipate SACD can offer direct access to SR, which may facilitate the biology studies of cells and organisms with high-throughput and low-cost.

Short Bio:

Haoyu Li is a full Professor at Harbin Institute of Technology. He received his BE and ME in Electrical Engineering from Harbin Institute of Technology in 2009 and 2011, respectively. In 2015, he received his PhD in Electrical Engineering from University College Dublin, Ireland. In 2018, He joined Harbin Institute of Technology as a principal investigator in School of Instrumentation Science and Engineering. In 2022, he received the Excellent Young Scholars from National Natural Science Foundation of China. His research interests include super-resolution microscopy, light-field microscopy, computational imaging, deep-learning imaging methods. In recent years, as the first/corresponding author, he has published more than 50 peer-reviewed journal articles including Nature Biotechnology, Nature Photonics, Nature

Communications, etc. He has applied nearly 50 invention patents, and over 20 patents have been granted.