ULTRA-FAST, UNIVERSAL SUPER-RESOLUTION RADIAL FLUCTUATIONS (SRRF) ALGORITHM FOR LIVE-CELL SUPER-RESOLUTION MICROSCOPY

Yubing Han[1], Xiao Lu[1], Zhimin Zhang[1], Wenjie Liu[1], Yuchen Chen[1], Xu Liu[1,2], Xiang Hao[1], Cuifang Kuang[1,2,3]

1 State Key Laboratory of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou, Zhejiang 310027, China

2 Collaborative Innovation Center of Extreme Optics, Shanxi University, Taiyuan, Shanxi 030006, China

3 Ningbo Research Institute, Zhejiang University, Ningbo 315100, China

E-mail: cfkuang@zju.edu.cn

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ABSTRACT

For a long term, spatial resolution of fluorescence microscopy was strictly restricted by the diffraction limit. To solve this problem, various super-resolution technologies have been developed. Super-Resolution Radial Fluctuations (SRRF), an emerging type of super-resolution microscopy, directly analyze raw images and generate super-resolution results without fluorophore localization, thereby showing more advantages in handling high-density data. Here, by speeding up the process of the algorithm with graphics processing unit (GPU) and programming with Python language, we expand the universality and improve the computing speed of the SRRF algorithm. We further apply our SRRF algorithm in different live-cell super-resolution microscopy methods with two types of fluorescence fluctuation sources: (i) direct Stochastic Optical Reconstruction Microscopy (dSTORM) in which fluorophores themselves blink under specific buffer and laser condition; (ii) Structural Illumination Microscopy (SIM) and modulated Airyscan in which fluorescence fluctuations are artificially introduced with modulated laser illumination. With improved spatiotemporal resolution and image quality, our SRRF algorithm demonstrates its capability in live-cell super-resolution imaging, indicating its wide applications in life sciences.

REFERENCE

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