

Deep-Learning-Assisted Spectroscopic Super-Resolution Single-Molecule Localization Microscopy

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Spectroscopic Single-Molecule Localization Microscopy (sSMLM), by capturing the spectroscopic signatures along with the spatial distribution, has been shown great potential in multicolor and functional super-resolution imaging. However, extracting accurate spectral information in sSMLM remains challenging due to the poor signal-to-noise ratio (SNR) of spectral images set by limited photon budget from single-molecule fluorescent emission and inherent electronic noise during the image acquisition using digital cameras. To address the above concerns, we recently reported a self-supervised deep-learning network that can significantly suppress the noise and accurately recover low SNR spectra from high-SNR spectra. By validating the qualitative and quantitative performance of Spec2Spec on simulated and experimental data, we demonstrated that Spec2Spec can achieve 6-fold improvement in SNR and 3-fold enhancement in SSIM, further facilitating 94.6% spectral classification accuracy and nearly 100% data utilization ratio in multicolor sSMLM imaging.



Short Bio:

Biqin Dong received his B.S. degree in Physics in 2006 and his Ph.D. degree in Condensed Matter Physics in 2011 from Fudan University, Shanghai, China. From 2012 to 2018, he was a joint Postdoctoral Fellow in the Departments of Mechanical Engineering and the Departments of Biomedical Engineering at Northwestern University, USA. From 2018 to 2019, he was a staff optical engineer at Bruker Nano Surfaces, USA. He has published 2 book chapters and more than 60 peer-reviewed journal articles, including those in Nature Communications, PNAS, Advanced Materials, Nano Letters, and Optica. His research has been featured on the cover of Advanced Materials, IEEE TBME, and Journal of Applied Physics. He has been awarded the 2017 Cozzarelli Prize from PNAS and 2017 PicoQuant Young

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