Online Photoactivation Localization Microscopy (PALM) Imaging

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Localization-based super-resolution microscopy enables far-field light microscopy to investigate biological processes on the molecular scale. Recently, the temporal resolution has also been tremendously improved, and the image reconstruction time has been reduced from more than two hours to a few ten seconds. Since image reconstruction relies on post-processing of the data, it is of great importance that the analysis algorithm can keep up with data collection. Online image processing techniques pave the way for dynamic super-resolution imaging in living cells [1-5].

Here, we present online imaging analysis software using a Graphics Processing Unit (GPU) to precisely determine the position of the single molecules by using a maximum likelihood estimator. By parallel processing, we achieve frame rates of 15-25 ms/frame for images sizes of 128 x 128 pixels using Matlab. The speed is comparable to the maximum frame rates of common electron-multiplying charge-coupled device (EMCCD) cameras, thus allowing for real-time data processing. The key to success in live cell imaging is the optimization of experimental conditions and, therefore, the “what you see is what you get” aspect is of great benefit.

Keywords: Online, PALM, GPU, maximum likelihood estimator

REFERENCES