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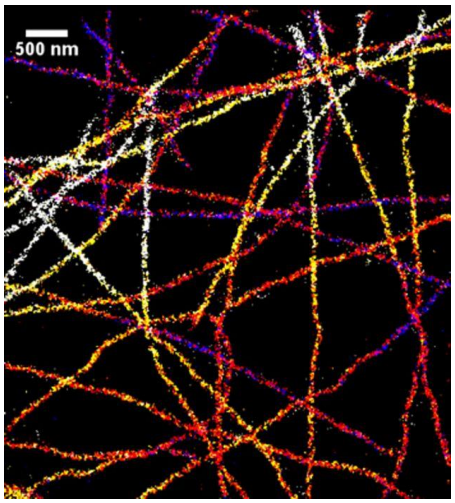
Master Thesis Project

A New Approach to 3D STORM Microscopy Analysis

Super-resolution microscopy methods have recently allowed us to visualize biological structures using fluorescence microscopy down to the nanometer scale. In particular, STORM [1], a type of localization microscopy that relies on fluorescent dyes imaged in an adapted chemical environment is a popular technique due to the use of standard dyes and standard inverted microscopes. However, imaging away from the coverglass is complicated by the fact that optical aberrations induce changes in the point-spread function of the microscope as a function of depth, which can only be taken into account indirectly with existing methods.



In this project, we want to develop new protocols for 3D-STORM analysis. In particular we want to develop an algorithm that only requires some priori knowledge of the optical system used (objective, camera) and can perform 3D fitting directly on the experimental data.

This project is mostly compuational and combines aspects of sample preparation (cell biology, immunochemistry, and chemistry), microscopy, and image/data analysis (ImageJ /Python/ Matlab).

References:
[1] Huang, Bo, et al. "Three-dimensional super-resolution imaging by stochastic optical reconstruction microscopy." Science 319.5864 (2008): 810-813.
[2] Nicolas Olivier, Debora Keller, Pierre Gönczy, Suliana Manley. "Resolution doubling in 3D-STORM imaging through improved buffers." PloS One 8.7 (2013): e69004.
[3] Nicolas Olivier, et al. "Simple buffers for 3D STORM microscopy." Biomedical optics express 4.6 (2013): 885-899.

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