SMLM flight simulator workshop

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Abstract

Super resolution has enabled the study of the cellular architecture under the diffraction limit of light for the first time, while retaining the advantages of conventional fluorescence microscopy (e.g. staining specificity). Although, single molecule localisation microscopy (SMLM) leads to the biggest gain in spatial resolution (typically 10-30nm), it remains paradoxically rarely used as a routine tool in biology laboratories, and overall, suffers from the lack of reproducibility of the produced images. Both the complexity of the image acquisition with many user-defined parameters to set (e.g. intensity of the excitation/activation laser, frame rate), and the lack of guide lines to do so, contribute to these limitations. We will present during this workshop a novel easy-to-use simulation platform, or **SMLM flight simulator**, that aims at tackling both issues. This simulator runs in real-time allowing effective interactivity. It generates hundreds of images from a 3D structure defined by hundreds of thousands of points. Our flight simulator consists of a virtual microscope set up that recreates the environment of SMLM acquisition setup. The platform is designed for instance for the training of new users in producing reliable SMLM data sets. It also allows for the validation of new quantitative methods, as well as enables experienced users to fully characterised the feasibility of future experiments.

We will provide in this workshop a quick overview of the SMLM flight simulator platform, focusing on applications to a range of cellular structures. We practice simulations on given structure or on structure provided by the community.

Take away:

- For experienced SMLM users: You will be able to generate synthetic data sets with the simulator, that can be used for further **validation of your quantitative methods**.
- For new comers to SMLM: You will have experienced a **synthetic imaging session** and learn what to look for when doing an SMLM acquisition to get reliable output images.

Program of the workshop:

1: Introduction of the workflow of parameters tuning / simulation / localization / assessment

2: Discussion on well characterised biological structures that can be used for simulations (e.g. microtubules). We will try to simulate 3D structure selected by the participant.

3: Practical work:

- Installation of the SMLM flight simulator package
- Tutorial on the user interface
- Generation of SMLM synthetic data sets from a structure chosen by the participant

4: Discussion and analysis of the produced results

Requirements

No a priori knowledge is required for participation to this workshop. Basic knowledge of SMLM.

A computer with Fiji installed is required.