Proposition de recherche doctorale

Integrative system for segmentation and tracking of 3D+t biological data

Mots clés :

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- **Co-encadrant(s)** :
- **Unité de recherche** : Image and Pervasive Access Lab
- **Ecole doctorale** : École Doctorale Informatique, Télécommunications, Électronique de Paris
- **Domaine scientifique principal**: Divers

Résumé du projet de recherche (Langue 1)

Thanks to the development of new imaging techniques such as spinning-disk microscopy, confocal microscopy or Light Sheet Fluorescence Microscopy (LSFM), acquiring data of live cells or organisms is more and more common in biological researches. In order to obtain quantitativ results from 4D (3D+t) data, cells must be detected and tracked over time. Tracking relies on a prior segmentation or detection of the objects. However even state of the art segmentation algorithms may fail in detecting all cells correctly, especially in case of noisy data, or crowded environment. Usually only gap closings are correctly handled by tracking algorithms. Nevertheless other errors may occur like merged or splitted objects. We want to propose a tracking procedure based on a frame by frame approach and post-processing of special events like merging and splitting. The tracking procedure should be able to detect errors in segmentation and give feedback to the segmentation algorithm to correct and improve the overall rate of correct segmentation and then tracking. Some typical applications of cell tracking are the reconstruction of lineage in early embryogenesis, the study of cell dynamics or cell cycle (see for instance the cell tracking challenge in past ISBI conferences).

Résumé du projet de recherche (Langue 2)

The main challenge in this proposal is to tightly integrate into a unique system 3D cells segmentation and tracking. Many segmentation algorithms are existing, but only a few are suitable for handling feedback and eventually learning of optimal parameters for segmentation. The integrated system can be based on classical optimisation procedure, machine-learning approach, or rules-based methods, depending on the background of the candidate. Finally another information to be taken into account is the {shape} of the cell that will help in the tracking procedure.

Informations complémentaires (Langue 1)

The international IPAL laboratory is located in Singapore, so the candidate will have frequent contact with international collaborators in Asia, Singapore and France.

Informations complémentaires (Langue 2)

The successful candidate will apply for the ARAP programme (A-STAR, Singapore), to get half funding.