

2018-01191 - PhD Position F/M Support of the Interactive Visual Exploration and Classification of Temporal Development in 3D Datasets using the Example of Cell Division Data

Type de contrat : CDD de la fonction publique
Niveau de diplôme exigé : Bac + 5 ou équivalent
Fonction : Doctorant

A propos du centre ou de la direction fonctionnelle

Located at the heart of the main national research and higher education cluster, member of the Université Paris Saclay, a major actor in the French Investments for the Future Programme (Idex, LabEx, IRT, EquipeX) and partner of the main establishments present on the plateau, the centre is particularly active in three major areas: data and knowledge; safety, security and reliability; modelling, simulation and optimisation (with priority given to energy).

The 450 researchers and engineers from Inria and its partners who work in the research centre's 31 teams, the 100 research support staff members, the high-level equipment at their disposal (image walls, high-performance computing clusters, sensor networks), and the privileged relationships with prestigious industrial partners, all make Inria Saclay Île-de-France a key research centre in the local landscape and one that is oriented towards Europe and the world.

Contexte et atouts du poste

In this PhD project within the computer science domains of visualization and human-computer interaction (HCI) we want to investigate how to best support the visual exploration of temporal developments of biologic organisms. In a collaboration between Inria and Inra, we want to analyze segmented 3D datasets of plant embryos which have developed up to, at least, the 8th stage of cell division (256 cells; the datasets are roughly of size 300x300x100 voxels). In the project we want to investigate visualization techniques and interactive tools to classify cell types based on their shape, identify sister cells that originated from a single cell in the previous division stage, and thus construct a tree of cell division history from only a single 3D microscopy image.

Mission confiée

For a better knowledge of the proposed research subject :

https://www.aviz.fr/wiki/uploads/Research/2016_INRA-INRIA_internship.pdf

Principales activités

For this purpose we need to combine several visualization and interaction techniques. In particular, the biologists need to be able to focus on a local neighborhood in the dataset to assess shapes and potential divisions, for example by using abstraction techniques from illustrative visualization. In addition, we need to be able to interact both with the 3D dataset as well as with the abstract data such as the inheritance tree or data about the shared surface between two adjacent cells. We also want to be able to visualize a progression of the classified cell division history to assess if the proposed division tree is plausible.

In addition to analyzing single datasets independently, we also want to exploit existing classifications for the annotation of new datasets. In particular, we not only want to be able to compare datasets with each other but also to employ machine learning techniques that allow us to assist the biologists by identifying similar situations and by suggesting potential division patterns based on the local segmented geometry. This suggestion should also provide a certain level of confidence such that the biologist can make use of the suggestion or decide differently if needed. The use of machine learning should also allow us to classify and analyze mutant embryos in which the cell division does not follow a normal path.

Ultimately, we thus want to investigate several important research questions within the scope of this proposed PhD work which are highly relevant to visualization and HCI: (1) how can we best combine both 3D and standard 2D interaction techniques for essentially time-dependent data that has both 3D and 2D aspects, (2) how can we use abstraction to allow the biologists to concentrate on local 3D neighborhoods, without losing the context of the entire dataset, (3) how can we best visualize alternative decision trees such that different potential division histories can be analyzed and compared to each other, and (4) how can we make use of machine learning techniques to support the interactive data analysis, without taking the human out of the loop.

Compétences

- Highly motivated student who has completed a MSc or equivalent degree in computer graphics, visualization, HCI, or related computer science topics,
- Experience with software development, in C++ and/or Java,
- Experience in modern computer graphics (GPU) and/or visualization programming,
- Experience in the use of machine learning algorithms,
- Able to communicate on a regular basis with supervisors and end-users,
- Distribute time between the two labs (details negotiable),
- Receptive to directions and feedback from supervisors, and
- Able to clearly and concisely communicate in English in written and spoken form.

Avantages

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave

Informations générales

- **Thème/Domaine** : Interaction et visualisation
Calcul Scientifique (BAP E)
- **Ville** : PALAISEAU
- **Centre Inria** : CRI Saclay - Île-de-France
- **Date de prise de fonction souhaitée** : 2019-09-01
- **Durée de contrat** : 3 ans
- **Date limite pour postuler** : 2019-08-31

Contacts

- **Equipe Inria** : AVIZ
- **Directeur de thèse** :
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A propos d'Inria

Inria, l'institut national de recherche dédié aux sciences du numérique, promeut l'excellence scientifique et le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3000 scientifiques pour relever les défis des sciences informatiques et mathématiques, souvent à l'interface d'autres disciplines. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 160 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

Consignes pour postuler

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.

Attention : Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

- Flexible working hours
- Sports facilities

Rémunération

Monthly gross salary : 1st and 2nd year, 1.982 euros

Monthly gross salary : 3rd year, 1.982 euros