Offer #2023-07019

Internship / Stage fin études d'Ingénieur ou M2 - Multi-scale segmentation of 2D/3D microsocopy images with deep learning and convolutional neural networks

Contract type: Internship agreement

Level of qualifications required: Graduate degree or equivalent

Fonction: Internship Research

Context

The advent of deep learning methods revolutionized image segmentation in computer vision. It also had a major impact in segmentation of microscopy images [1] and it is now possible to routinely segment individual nuclei and cells with high accuracy [2, 3]. The same methods have also been used for segmentation of other biological objects such as ovocytes [4]. The access of large amounts of annotated data in 2D [5] actually allows to train widely versatile models. Unfortunately, scale invariance remains a major hurdle and objects of different sizes are still difficult to accurately segment. The goal of this internship is to propose a method to combine segmentation masks obtained at different scales to accurately identify biological objects demonstrating a large range of sizes.


Assignment

You will develop a new method to combine segmentation masks obtained at different scales with 'Cellpose' for 2D and 3D images. Both classical computer vision approaches and machine learning approaches will be explored.

This internship will be a collaboration between SAIRPICO research team at INRIA Rennes (Beaulieu campus) and FAIIA shared facility at Rennes University (Villejean campus).

The candidate will have access to a GPU and adequate equipment during the internship.

Main activities

Ces travaux nécessiteront des compétences en apprentissage profond et une bonne compréhension des réseaux convolutifs et récurrents (notamment les architectures utilisées dans RAFT et ARFlow) ainsi qu’une connaissance de PyTorch. Toute expérience de développement avec ce type de framework et de travaux en open source sera un plus.

For this purpose, the candidate will:

- perform an study of the literature for image segmentation in fluorescence microscopy (e.g., Cellpose, StarDist);
- implement a variant of ‘Cellpose’ CNN-based algorithm;
- design the training datasets;
- evaluate the algorithm on experimental images and quantitatively compare it to existing segmentation methods;
- Write a report.

**Skills**

Technical skills and level required:

Languages:

Relational skills:

Other valued appreciated:

**General Information**

- **Theme/Domain**: Vision, perception and multimedia interpretation
  - Biologie et santé, Sciences de la vie et de la terre (BAP A)
- **Town/city**: Rennes
- **Inria Center**: Centre Inria de l'Université de Rennes
- **Starting date**: 2024-03-01
- **Duration of contract**: 6 months
- **Deadline to apply**: 2024-01-31

**Contacts**

- **Inria Team**: SAIRPICO
- **Recruiter**: Kervrann Charles / charles.kervrann@inria.fr

**About Inria**

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**The keys to success**

Technical skills and level required: image processing and analysis, deep learning (CNNs), Python, and Keras, Tensorflow or Pytorch.

**Warning**: you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

**Instruction to apply**

**Defence Security**: This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

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