2-year (1+1) post-doctoral position available at CEA Grenoble

"Advanced reconstruction methods for cryo-electron tomography of biological samples"

Within the framework of a CEA-funded interdisciplinary project, we are looking for a candidate for a 2-year (1+1) postdoctoral position, on the topic of advanced reconstruction methods for cryo-electron tomography of biological samples. The starting date will ideally be October 2024.

Research topic:
Cryo-electron tomography (CET) is a powerful technique for the 3D structural analysis of biological samples in their near-native state. CET has seen remarkable advances in instrumentation in the last decade but the classical weighted back-projection (WBP) remains by far the standard CET reconstruction method. Due to radiation damage and the limited tilt range within the microscope, WBP reconstructions suffer from low contrast and elongation artefacts, known as 'missing wedge' (MW) artefacts. Recently, there has been a revival of interest in iterative approaches to improve the quality and hence the interpretability of the CET data.

In this project, we propose to go beyond the state of the art in CET by exploring deep learning (DL) methods for denoising and correction of distortions in the reconstructions. These approaches have the potential to improve the resolution of the CET reconstructions and facilitate the segmentation and sub-tomogram averaging tasks.

The post-doctoral fellow will conduct a comparative study of iterative algorithms used in life science, and DL approaches optimized in this project for thin curved structures. For the DL approaches, the postdoc will take advantage of the large number of CET datasets available in the public database EMPIAR for training the DL models. The postdoc will then apply the developed tools to CET datasets collected at IBS on sporulating Bacillus subtilis bacteria, as a simple two-cellular compartment model. The resolution of the reconstructions will be assessed quantitatively by Fourier Shell Correlation (FSC) and Noise-compensated Leave-One-Out (NLOO) methods, and qualitatively by applying the same (automated) segmentation protocols to the obtained volumes.

The candidate will have access to in-house Python codes and open source libraries, as well as to the computing resources needed to carry out the comparative study of the selected reconstruction approaches.

The candidate will interact closely with all members of the project, and will be expected to communicate results effectively in the form of oral presentations in national/international conferences and articles in peer-reviewed journals.

Research field: cryo-electron tomography, deep learning, structural biology.

Profile: Eligible qualifications for this position include:
- PhD in Physics/Materials Science/Structural Biology with a strong background in image analysis;
- Proficiency in scientific Python;
- Experience in deep learning frameworks such as Keras, Tensorflow or Pytorch;
- Excellent written and verbal communication skills in English.

Applications deadline: July 30th, 2024. Please send a CV, a short cover letter and the contact details of two referees to: Zineb Saghi (zineb.saghi@cea.fr) and Guy Schoehn (guy.schoehn@ibs.fr).