Internship Opening

3D Density Reconstruction for Electron Microscopy

Internship place
Nano-D team of INRIA Grenoble – Rhône-Alpes Research Center, Minatec Campus 17 rue des Martyrs 38054 Grenoble France

Density Reconstruction

The goal of the internship is the development of a new 3D reconstruction method by making use of the Fourier projection slice theorem, polynomial representation of the density (Spherical harmonics, Hermite orthogonal functions, etc) and symmetry. The developed method will be useful for a variety of medical and biological applications. Particularly, we will apply it for density reconstruction in Cryo-electron microscopy, which is a form of transmission electron microscopy (EM) where the sample is studied at cryogenic temperatures. Cryo-EM is getting very popular in structural biology, mainly due to the fact that it allows the observation of specimens that have not been stained or fixed in any way, showing them in their native environment, in contrast to X-ray crystallography.

Electron microscopy images are projections of the object showing the distribution of density through the object, similar to medical X-rays. Using the Fourier projection slice theorem, a 3D reconstruction of the object can be generated by combining many images (2D projections) of the object taken from a range of viewing angles. The Fourier slice theorem states that Fourier transform of a projection is a plane passing through the origin in the three-dimensional Fourier space. We will represent the molecular density using a band-limited expansion in an orthogonal basis and write the Fourier slice theorem in terms of the corresponding expansion coefficients.

The method will be tested and validated on a number of Cryo-EM examples.

References:

Desired profile

We are looking for creative, passionate and hard-working individuals with exceptional talent for computer science and mathematics. The successful applicant will be in the process of obtaining a Master’s degree in computer science or an equivalent level. Excellent oral, written and interpersonal communication skills are essential (the working language will be English – knowledge of French is a plus).

Requirements

- Strong computer science background
- Strong knowledge of applied math
- Experience in signal processing is a plus
- Strong oral, written and interpersonal communication skills (working language: English – knowing French is a plus)
- Good knowledge of C++
- Ability to work independently and with a team

Salary

Around 430 Euros net per month, for 6 months. Can be continued as a PhD.

To apply

Send an email to Sergei Grudinin (sergei.grudinin@inria.fr) with:

- A resume
- A motivation letter
- A scan of your Bachelor’s degree transcript and Master’s degree transcript (if you are still a Master student at the time of application, please provide the list of classes that you have taken and the grades you have obtained, as well as the list of classes that you will attend before the internship begins)