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Internship proposal
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Optical lensless imaging of nanostructured surfaces.

Context

Lensless imaging, also known as coherent diffraction imaging, is an elegant approach to high-resolution microscopy and has witnessed a rapid development in recent years. It is particularly interesting for applications where the use of imaging optics is problematic. This is the case, for example, when using very short wavelength radiation or in miniaturized light microscopes, where both cost and size can be reduced by avoiding imaging optics. In lensless microscopy, diffraction patterns resulting from the object are recorded directly on a detector. The image is then obtained by numerical reconstruction from these recorded diffraction patterns. The main advantages of lensless imaging are: the availability of a considerably larger field of view and the possibility to obtain high lateral and large depth resolution including 3D information.

Objectives

The main objective of the internship concerns the development of an image reconstruction algorithm for optical coherent diffraction imaging of nanostructured surfaces. In particular, the candidate will explore the possibility to obtain images with improved lateral resolution [1]. The algorithm will be implemented within the framework of the GlobalBioIm Matlab library [2] (`https://biomedical-imaging-group.github.io/GlobalBioIm/`).

Practical aspects

We are looking for a highly motivated student, with a background in mathematics and/or electrical engineering (signal/image processing, harmonic analysis). Strong abilities in computer sciences will be appreciated and a taste for optics is a plus.

The intern will be granted the usual stipend of ~ 600 euros/month.

This internship will take place principally within the IRIT laboratory in Toulouse (ENSEEIHT component in Toulouse city center). Moreover, the intern will do regular visits to the CEMES laboratory in Toulouse, hosting the instrument.

It will be co-supervised by Emmanuel Soubies (CR CNRS, IRIT) and Wolfgang Bacsa (Prof., CEMES).

Do not hesitate to contact us for more information.

Bibliography

[1] Wolfgang Bacsa, Revathi Bacsa, and Tim Myers. *Optics Near Surfaces and at the Nanometer Scale*. Springer, 2020.

[2] Emmanuel Soubies, Ferréol Soulez, Michael T McCann, Thanh-an Pham, Laurène Donati, Thomas Debarre, Daniel Sage, and Michael Unser. Pocket guide to solve inverse problems with globalbioim. *Inverse Problems*, 35(10):104006, 2019.