

## Sparse Optimization for Inverse Problems with Applications in Super-Resolution Microscopy

*Laure Blanc-Féraud*

I3S laboratory

Université Côte d'Azur, CNRS, Sophia Antipolis, France

Sparse L0 optimization arise in many signal and image processing techniques. The L0 term is non-continuous non-convex and leads to NP-hard problems. We review some approaches to tackle the L2-L0 optimization problem both in the penalization and in the constrained form. Among examples of inverse problems, we focus on fluorescent super-resolution microscopy by Single Molecule Localisation Microscopy and MA-TIRF (Multi-Angle Total Internal Reflection Fluorescence) reconstruction. We finally show how acquisition of a sequence of images allows to leverage fluctuations of molecules for super resolution by sparse optimization and how these data can be used in a generative adversarial network built to solve the inverse reconstruction problem with a data term, which considers the statistics of the observations, learned by the network.

### Short Bio



Laure Blanc-Féraud is CNRS Research Director at I3S lab (Université Côte d'Azur, CNRS), in the Morpheme team, shared with INRIA and the Institute of Biology Valrose (IBV) in Sophia Antipolis, France. Her research topic concerns image processing, mainly inverse problems, using PDE and calculus of variation, under smooth, non-smooth and l0-sparse constraints. She studies minimization problems using duality, convex and non-convex optimization, Gamma-convergence. She is also developing Bayesian modeling for model parameter estimation. Since 2011, she focuses her activity on 3D

microscopy imaging in biology, mainly in super-resolution technics and extra cellular matrix characterization.



She has been associate editor of the journals SIAM Imaging Science (13-18) and is currently area editor of IEEE Signal Processing Magazine (21-24). She was General chair of IEEE ISBI 2021 and TPC od ISBI 2014. She headed (in 12-18) the French National Research group on Information, Signal Image and Vision (GDR ISIS of CNRS: more than 120 laboratories and 20 industrial partners), she has been member of the Scientific Council of the INS2I CNRS (10-14), member of steering committees of French National Research Agency. She was awarded of the Price Montpetit of the French Academy of Sciences in 2013, she is knight of the French Legion of Honor in 2015 and has a chair of the French national Artificial Intelligence Interdisciplinary Institute (3IA), 2019.