Groupe de contact FNRS

ONDELETTES ET APPLICATIONS / WAVELETS AND APPLICATIONS

in honor of Prof. Christine De Mol, former president of the contact group

Friday, November 22, 2019

Université libre de Bruxelles

(campus Plaine, building NO, 9th floor, salle des professeurs 2.NO.9.06)

09.15-09.45 Welcome coffee/tea

09.45-10.00 Welcome address

10.00-11.00 Jean-Christophe Pesquet (CentraleSupelec - University Paris-Saclay): "Forward-backward steps and variations."

Abstract TBA

11.00-12.00 Lorenzo Rosasco (MIT): "Implicit bias and regularization in machine learning and inverse problems"

Abstract TBA

12.00-13.30 Lunch at the local cafeteria

13.30-14.00 Christophe Kervazo (University of Mons): Mini-batch optimization for large-scale sparse blind source separation

Sparse Blind source separation (sparse BSS) is an unsupervised matrix factorization method that has now become one of the major tools to analyze and extract information for multi/hyperspectral data. With the ever growing size of datasets in fields like remote sensing and astrophysics, it is essential to design scalable but still efficient and reliable BSS methods. We here introduce such a scalable sparse BSS algorithm, which combines a robust projected alternate least-squares method with mini-batches. The originality lies in the use of manifold-based aggregation from asynchronously estimated mixing matrices. This approach is showed to maintain high performances, which are similar to the ones of non-parallelized algorithms in most cases. Remarkably, it can further outperform them when the sources have highly sparse distributions. Numerical experiments are carried out on synthetic data as well as realistic simulations of spectroscopic data.

14.00-14.30 Maarten Jansen (ULB): Multiscale local polynomials for unequispaced data processing

On nonequispaced data, the lifting scheme provides a framework for the construction multiscale analyses. In the construction, there are basically two options. The first option is to develop a multiscale decomposition from basis functions that are known to be refinable, meaning that they can be defined on (nested) grids of knots. B-spline functions are a typical example of this approach. The second option, which will be highlighted in this talk, is to build a multiscale analysis from a uniscale filtering or smoothing technique. As multiscale local polynomials are a popular local regression method in statistics (along with spline methods), we investigate the use of this smoothing technique in the construction of a multiscale decomposition. For reasons of continuity, a critically downsample wavelet scheme is not possible, motivating the use of a slightly redundant scheme, provided by the Laplacian pyramid. Further issues include the role of the kernel bandwidth as a continuous scale parameter, the smoothness of the reconstruction, the basis functions.

14.30-15.00 Nelly Pustelnik (CNRS, Laboratoire de Physique de l'ENS de Lyon): Semi-Linearized Proximal Alternating Minimization for a Discrete Mumford–Shah Model

The Mumford–Shah model is a standard model in image segmentation and many approximations have been proposed in order to approximate it. The major interest of this functional is to be able to perform jointly image restoration and contour detection. In this work, we propose a general formulation of the discrete counterpart of the Mumford–Shah functional, adapted to nonsmooth penalizations, fitting the assumptions required by the Proximal Alternating Linearized Minimization (PALM), with convergence guarantees. A second contribution aims to relax

some assumptions on the involved functionals and derive a novel Semi-Linearized Proximal Alternated Minimization (SL-PAM) algorithm, with proved convergence. We com- pare the performances of the algorithm with several nonsmooth penalizations, for Gaussian and Poisson denoising, image restoration and RGB-color denoising. We compare the results with state-of-the-art convex relaxations of the Mumford–Shah functional, and a discrete version of the Ambrosio–Tortorelli functional. We show that the SL-PAM algorithm is faster than the original PALM algorithm, and leads to competitive denoising, restoration and segmentation results.

15.00-15.30 Vincent Schellekens (UCLouvain):
Generative models as data-driven priors: how to learn them efficiently?

”Generative models are the new sparsity” is a statement that appears more and more frequently. In this talk, I will first give an overview of what generative models are, and explain how (and when) they should be used as a data-driven prior in general inverse problems. I will then explain why generative networks are notoriously hard to train, and propose a compressive learning-based method to simplify this training. Compressive learning in a recent framework where models are trained not from the full dataset but from a heavily compressed sketch that summarizes only the required information, allowing in this case to train the generative model without explicit and repeated access to the whole database.

15.30-16.00 Tea/Coffee break

16.00-17.00 Ingrid Daubechies (Duke University):
“Phase retrieval for the magnitudes of frame coefficients in infinite dimension”

Abstract TBA

17.00 Closing words and drink

How to reach the workshop

The workshop will take place at Université libre de Bruxelles (ULB), campus Plaine, building NO, floor 9, room 2.NO.9.06 (“salle des professeurs”) in Brussels, Belgium.

Campus Plaine can be reached by metro (line 5, stop “DELTA”,) or by train (station “Etterbeek” or station “Delta”). Building NO is a 5-10 minute walk from Delta or Etterbeek.