

CS/MVA

Large Scale and Distributed Optimization Presentation

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Optimization ?

Whatever people do, at some point they get a craving to organize things in a best possible way. This intention, converted in a mathematical form, turns out to be an optimization problem of certain type.
(Yurii Nesterov)



Goal of this course

- ▶ Introduce the theoretical background to develop efficient algorithms to successfully address large scale optimization problems by taking advantage of modern multicore or distributed computing architectures.

Outline:

1. Background on convex analysis
Convexity / Conjugate function / Subdifferential / Proximity operator
2. Parallel and distributed proximal splitting methods
Fixed point algorithms / Primal-dual methods / Distributed optimization
3. Parallelization through Majorization-Minimization approaches
MM methods / Variable metric and subspace acceleration / Parallel algorithms

Lab sessions (in Python environment)

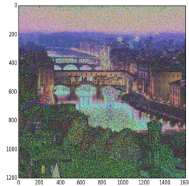
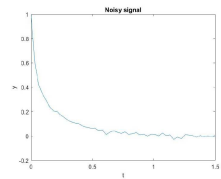
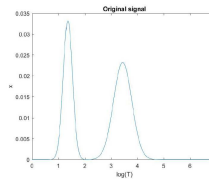


Image denoising



Biochemical signal restoration

$$A = \begin{bmatrix} 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{bmatrix} \quad b = \begin{bmatrix} 0.2114 \\ 0.6331 \\ 0.6312 \\ 0.5182 \\ 0.9337 \\ 0.0035 \end{bmatrix}$$

Database request processing



Medical imaging

Course schedule and evaluation

Instructors: Emilie CHOUZENOUX and Samy FERRAT (TA), from CVN, CentraleSupélec and Inria Saclay.

Schedule:

- ▶ The course consists of seven sessions (3h each) combining lectures and labs (in Python environment).
- ▶ 9.45am-1.15pm, in CentraleSupélec campus

Evaluation:

- ▶ 2 labs reports (Python notebooks)
- ▶ Exam (2 hours) in January

<https://pages.saclay.inria.fr/emilie.chouzenoux>

Detailed schedule

1. 17/10/2025 – 9h45-13h - sd.201 - sd.203, Bouygues - **Lecture**
2. 24/10/2025 – 9h45-13h15 - MF.101, Eiffel - **Exercises**
3. 07/11/2025 – 9h45-13h15 - sd.201 - sd.203, Bouygues - **Lecture**
4. 14/11/2025 – 9h45-13h15 - sd.201 - sd.203, Bouygues - **Lecture + Lab**
5. 05/12/2025 – 9h45-13h15 - TBA, Bouygues - **Lab**
6. 12/12/2025 – 9h45-13h15 - TBA - **Lecture**
7. 19/12/2025 – 10h-13h15 - TBA - **Lab**
8. 09/01/2026 – 9h45-11h45 - TBA - **Exam**