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)

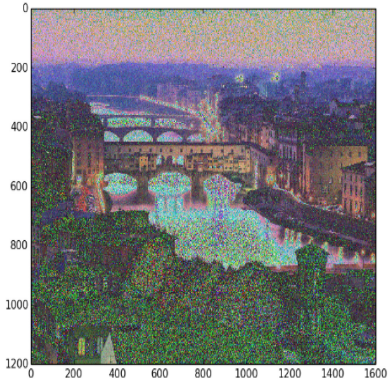
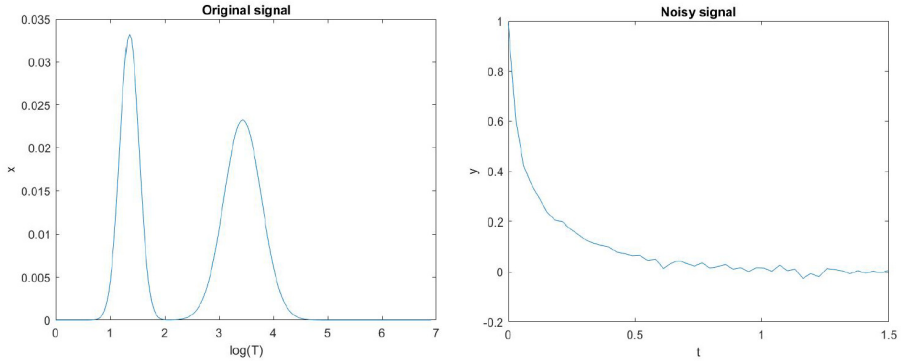


Image denoising



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 Nicolas SALVY (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-1pm, in CentraleSupélec campus (17/10,24/10,07/11,14/11,12/12,19/12,09/01)

Evaluation:

- 2 labs reports (Python notebooks)
- Exam (2 hours) on the 16th of January

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

Detailed schedule

1. 17/10/2024 – 9h45-13h - Amphi I, Eiffel - **Lecture**
2. 24/10/2024 – 9h45-13h15 - EE.004 - EE.005, Eiffel - **Exercises**
3. 07/11/2024 – 9h45-13h15 - TBA - **Lecture**
4. 14/11/2024 – 9h45-13h15 - h.201 - h.202, Bouygues - **Lab**
5. 12/12/2024 – 9h45-13h15 - TBA - **Lecture** + **Lab**
6. 19/12/2024 – 9h45-13h15 - TBA - **Lecture**
7. 09/01/2024 – 10h-13h15 - TBA - **Lab**
8. 11/01/2025 – 10h-12h - TBA - **Exam**