


IPParis Optimization Meeting

17th september 2021

Program (short version)

Program (extended version)

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9.50	*Introduction*
10.00	Grégoire Allaire [X-CMAP] *Panorama de quelques résultats récents en optimisation de formes*
10.35	*Coffee break*
10.50	Zacharie Ales [ENSTA-UMA-CEDRIC] *Solution robustness*
11.25	Guillaume Lecué [ENSAE-CREST] *Optimization problems and algorithms in robust statistics*
12.00	*Lunch* 🍽
14.00	Stéphane Gaubert [X-CMAP] *Convexité tropicale, programmation linéaire et jeux avec paiement moyen*
14.35	Walid Ben-Ameur [TSP-SAMOVAR] *To meet, or not to meet*
15.10	Andrea Simonetto [ENSTA-UMA] *Optimization and quantum computing*
15.45	*Coffee break*
16.00	Discussion
17.30	

Program (extended version)

9.15 Introduction

9.30 Grégoire Allaire [X-CMAP]

Panorama de quelques résultats récents en optimisation de formes

Dans cet exposé je présenterai quelques résultats récents, obtenus au CMAP en collaboration avec des partenaires académiques et industriels, en optimisation géométrique et topologique de structures gouvernées par des équations aux dérivées partielles. Je soulignerai plus particulièrement les aspects multi-échelles, multi-physiques, et leurs conséquences en terme d'algorithme d'optimisation.

10.05 Olivier Fercoq [TP-LTCI]

Quadratic error bound of the smoothed gap and the restarted averaged primal-dual hybrid gradient

We study the linear convergence of the primal-dual hybrid gradient method. After a review of current analyses, we show that they do not explain properly the behavior of the algorithm, even on the most simple problems. We thus introduce the quadratic error bound of the smoothed gap, a new regularity assumption that holds for a wide class of optimization problems. Equipped with this tool, we manage to prove tighter convergence rates.
Then, we show that averaging and restarting the primal-dual hybrid gradient allows us to leverage better the regularity constant. Numerical experiments on linear and quadratic programs, ridge regression and image denoising illustrate the findings of the paper.

11.00 Zacharie Ales [ENSTA-UMA-CEDRIC]

Solution robustness

Most robust optimization approaches focus on the quality robustness and only evaluate the relevance of their solutions through the objective function value of the nominal problem. However, it can be more important to optimize the solution robustness and, once the uncertainty is revealed, find an alternative feasible solution which is as similar as possible to the robust solution. This for example occurs when the robust solution is implemented on a regular basis or when the uncertainty is revealed late.
We propose a framework which minimizes the solution robustness over a discrete set of scenarios while ensuring the optimality of the nominal objective. We study the complexity of several problems in this context.

We highlight the benefits of solution robustness in a case study on a railroad planning problem in which we compare our approach to the anchored and the k-distance approaches.

11.35 Guillaume Lecué [ENSAE-CREST]

Optimization problems and algorithms in robust statistics

Joint works with Jules Depersin.
We consider the problem of robust (to heavy-tailed data and adversarial contamination) mean estimation with respect to any (pseudo-)norm of the form $x \in \mathbb{R}^d \to \|x\|_S = sup_{v\in S}\langle v, x\rangle$ *where S is any symmetric subset of* $\mathbb{R}^d$*. We obtain the deviation-optimal minimax subgaussian rate for confidence* $1-\delta$ *and show how to construct a robust gradient descent scheme which achieves this rate when* $S = B_2^d$ *that is for the estimation w.r.t. the* ℓ_2^d *(euclidean)-norm.*
In the general case, we show that the optimal rate can be achieved by a solution to a convex optimization problem which is the minimum of some Fenchel-Legendre transforms constructed using the Median-of-means principle. We design an algorithm out of this principle however the study of its convergence is still open.

12.10 Lunch at the restaurant offered to all participants

14.00 Stéphane Gaubert [X-CMAP]

Convexité tropicale, programmation linéaire et jeux avec paiement moyen

On fera un tour d'horizon de résultats de convexité tropicale:
- lien de celle-ci avec la théorie des jeux avec paiement moyen,
- application à la complexité des méthodes de points intérieurs,
- programmation semi-définie non-archimédienne.

14.35 Walid Ben-Ameur [TSP-SAMOVAR]

To meet, or not to meet

Given a digraph and a subset of vertices representing initial positions, we study the existence problem of infinitely long walks, one starting from each initial position, that never meet. We show that the subsets for which this is possible constitute the independent sets of a matroid. We prove that the independence oracle is polynomial- time. We also provide a more efficient algorithm to compute the size of a basis. Then we focus on the orientation problem of the undirected edges of a mixed graph to either maximize or minimize the rank of a subset. Some NP-hardness results and inapproximability results are proved in the general case. Polynomial-time algorithms are described for subsets of size 1. Some extensions and related applications are also discussed.

15.10 Andrea Simonetto [ENSTA-UMA]

Optimization and quantum computing

Quantum computers are here. I will introduce some key concepts and how (classical) optimization can help and benefit from this new computing paradigm.

16.00 Discussion

Following to the presentations, the purpose of this slot is to discuss about future actions we could take together to better emphasize the research activities at IPParis in optimization (such as regular meetings for researchers and doctoral students, etc.).