Title: Optimal barriers on convex cones

MSIAM, Master of Science in Industrial and Applied Mathematics
Master Thesis Proposal 2018-2019
Research project

Supervisor: Roland Hildebrand (Roland.Hildebrand@univ-grenoble-alpes.fr, 0457421743)
Team: DAO-LJK
Funding: LJK
Internship gratuity: ~550 Euros / month

Description: Self-concordant barriers are at the heart of interior-point methods for convex conic programming [1]. Whether a conic program can be solved efficiently depends on the availability of a self-concordant barrier. The convergence speed of an interior-point method depends on the parameter of the barrier. A lower parameter results in faster convergence. It is therefore of interest to have barriers with a parameter as low as possible. For a generic cone with C^2 boundary the question on the lowest possible value of the parameter is an open question. An upper bound on the optimal value is given by the dimension of the cone, while a lower bound has been constructed in [2].
The **objective** of the internship is to implement and test methods to construct better lower bounds on the optimal barrier parameter, which rely on a sophistication of the construction in [2]. The more developed of these methods are expected to yield an approximation of an optimal barrier. In particular, the focus will be on the transcendental p-norm and power cones, for which at the moment only barriers with a parameter far from the optimal value are available.
The internship requires material taught at the “Efficient Methods of Optimization” course.

The Master thesis will take place at Laboratoire Jean Kuntzmann (LJK), and may be followed by a PhD thesis on the subject.

References

[1] Nesterov Y., Nemirovski A. *Interior-point Polynomial Algorithms in Convex Programming.* SIAM, Philadelphia, 1994.
[2] Hildebrand R. A lower bound on the barrier parameter of barriers for convex cones. *Mathematical Programming Series A*, 142(1):311-329, 2013.