LSE Mathematics

Operations Research Seminar Series in 2016

Seminars are listed in reverse chronological order, most recent first.

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16 March - Thomas Dueholm Hansen (Aarhus)
An improved version of the Random-Facet pivoting rule for the simplex algorithm

The Random-Facet pivoting rule of Kalai and of Matousek, Sharir, and Welzl is an elegant, randomized pivoting rule for the simplex algorithm, the classical combinatorial algorithm for solving linear programs. The expected running time of the simplex algorithm when using this rule is subexponential in the combinatorial size--the number of variables and inequalities--of the linear program. This is currently the best known combinatorial bound for solving general linear programs. Other polynomial time algorithms are known, but their running time depends also on the number of bits in the representation of the linear program.

We present a slightly improved version of the Random-Facet pivoting rule, thus obtaining the fastest known combinatorial algorithm for solving linear programs, the first improvement in over 20 years. Our results apply not only to linear programs, but also to more general, abstract LP-type problems. In particular we also obtain the fastest known algorithm for solving two-player turn-based stochastic games.

Joint work with Uri Zwick.

17 February - Daan Wierstra (Google DeepMind)
How to Build an Artificial General Intelligence

At Google DeepMind, we focus on developing general learning algorithms to push the frontier of artificial general intelligence (AGI) research. Endeavouring to eventually construct a full AGI, agent architecture design and the non-trivial matter of `how to put it all together' figures prominently in our mission. As such, DeepMind operates at the crossroads between neuroscience, machine learning and engineering. The first part of this talk will provide an overview of some of our recent research, ranging from advances in (deep) reinforcement learning and advanced game play to (deep) variational inference methods and (deep) memory techniques. In the second part of this talk, I will elaborate on some of our general design philosophy, confront some of the profound dilemmas inherited from disparate fields such as machine learning and computational neuroscience, and explain why a great deal of work is sure to still be ahead of us.

11 February - Christoph Dürr (Paris)
Online Algorithms for Multi-Level Aggregation

Online algorithms receive their input in form of request sequences and need to make irrevocable decisions at each request. A classical example is the paging problem. We introduce standard techniques used to design online algorithms and their analysis, for the ski rental problem, the cow path problem and load balancing. Finally we talk about a personal work on the multi-level aggregation problem.

This is a joint work with Marcin Bienkowski, Martin Böhm, Jaroslaw Byrka, Marek Chrobak, Lukáš Folwarczný, Łukasz Jeż, Jiří Sgall, Nguyen Kim Thang, Pavel Veselý.

20 January - Ruth Misener (Imperial)
Implementing algorithmic advances in mixed-integer nonlinear optimisation

ANTIGONE (Algorithms for coNTinuous / Integer Global Optimisation of Nonlinear Equations), is a computational framework for the deterministic global optimisation of mixed-integer nonlinear programs (nonconvex MINLP).

This presentation highlights how ANTIGONE integrates algorithmic advances in: reformulating expression graphs, finding high-dimensional vertex polyhedral cuts, and detecting convexity. We also discuss new directions in finding special structure via pattern matching.

13 January - Giacomo Zambelli (LSE)
Rescaled coordinate descent methods for Linear Programming

Simple coordinate descent methods such as von Neumann's algorithm or Perceptron, both developed in the 50s, can be used to solve linear programming feasibility problems. Their convergence rate depends on the condition measure of the problem at hand, and is typically not polynomial. Recent work of Chubanov (2012, 2014), related to prior work of Betke (2004), has gathered renewed interest in the application of these methods in order to obtain polynomial time algorithms for linear programming. We present two algorithms that fit into this line of research. Both our algorithms alternate between coordinate descent steps and rescaling steps, so that either the descent step leads to a substantial improvement in terms of the convergence, or we can infer that the problem is ill conditioned and rescale in order to improve the condition measure. In particular, both algorithms are based on the analysis of a geometrical invariant of the LP problem, used as a proxy for the condition measure, that appears to be novel in the literature.

This is joint work with Daniel Dadush (CWI) and László Végh (LSE).