

Yuen-Lam Voronin (née Cheung)

yuen-lam.voronin@colorado.edu

Research interests

- Semidefinite optimization and its applications in NP hard problems
- Algorithm design and implementation for convex optimization
- Mathematical modeling
- Numerical linear algebra and analysis

Education

Ph.D. in Combinatorics and Optimization, *September 2009 – December 2013*
University of Waterloo, Waterloo, Ontario, Canada
Thesis topic: *Preprocessing and Reduction for Semidefinite Programming via Facial Reduction: Theory and Practice*
Thesis advisor: Prof. Henry Wolkowicz

M.Math. in Continuous Optimization, *September 2008 – August 2009*
University of Waterloo, Waterloo, Ontario, Canada
Research project topic: *Portfolio Optimization via Downside-Risk Aversion Model*
Advisor: Prof. Michael J. Best

B.Sc. in Mathematics (minor in Economics, 2nd upper) *September 2003 – May 2007*
Chinese University of Hong Kong, Hong Kong

Research experience

Efficient use of semidefinite programming for the selection of rotamers in protein conformations
(with Prof. Forbes Burkowski and Prof. Henry Wolkowicz, University of Waterloo, Canada)

- We study a doubly nonnegative semidefinite programming (SDP) relaxation of the NP-hard sidechain positioning problem, and show that strict feasibility fails for the SDP relaxation. Using facial reduction, we arrive at a smaller equivalent problem that can be solved in a more stable manner and in much shorter time in practice. Using a cutting plane technique, we obtain an exact optimal solution for the original discrete problem with proteins of up to 900 rotamers.

Preprocessing and regularization of degenerate semidefinite programs
(with Dr. Simon Schurr and Prof. Henry Wolkowicz, University of Waterloo, Canada)

- We provide a backward stable preprocessing procedure for regularizing semidefinite programs (SDP) that (nearly) fails strict feasibility, based on Borwein-Wolkowicz facial reduction. By repeatedly solving an auxiliary semidefinite optimization problem and performing rank-revealing rotation for finitely many times, we arrive at a smaller, well-posed, nearby problem that satisfies strict feasibility and can be solved by standard SDP solvers.

Portfolio optimization via downside-risk aversion model
(with Prof. Michael J. Best, University of Waterloo, Canada)

- We study the portfolio optimization problem based on an expected-utility model that incorporates the notion of downside risk aversion via an S-shaped utility function. This results in a maximization problem with a piecewise quadratic objective and linear inequality constraints. We study different methods for solving the nonsmooth optimization problems: active set method (for the case where the objective is piecewise linear) and interior point method together with smoothing and crossover techniques.

Publications

- Yuen-Lam Cheung, Dmitriy Drusvyatskiy, Nathan Krislock, and Henry Wolkowicz, Noisy sensor network localization: robust facial reduction and the Pareto frontier. (Submitted in October 2014.)
- Y.-L. Cheung, D. Drusvyatskiy, C.-K. Li, D.C. Pelejo, H. Wolkowicz, Projection methods in quantum information science. (Submitted in July 2014.)
- Y.-L. Cheung, H. Wolkowicz, Sensitivity analysis of semidefinite programs without strong duality. (Submitted in June 2014.)
- F. Burkowski, Y.-L. Cheung, H. Wolkowicz, Efficient use of semidefinite programming for selection of rotamers in protein conformations, *INFORMS Journal on Computing* 26 (2014), no. 4, 748-766.
- Y.-L. Cheung, S. Schurr, H. Wolkowicz, Preprocessing and regularization of degenerate semidefinite programs. In: D. Bailey, H. H. Bauschke, P. Borwein, F. Garvan, M. Théra, J. Vanderwerff, and H. Wolkowicz (Editors), *Computational and Analytical Mathematics*, Springer Proceedings in Mathematics & Statistics, Vol. 50. Springer, New York, 2013.

Articles in Preparation

- Y.-L. Cheung, M.A. Saunders, H. Wolkowicz, Efficient and accurate solutions for linear programs with bound constraints.

Yuen-Lam Voronin (née Cheung)

yuen-lam.voronin@colorado.edu

Work experience

January — April 2014

Postdoctoral research assistant at University of Waterloo, Canada

January – April 2012

Sessional lecturer at University of Waterloo, Canada

Course: CO466/666 *Continuous Optimization* (undergraduate/graduate level)

January 2009 – December 2012

Teaching assistant at University of Waterloo, Canada

Courses:

- o ACTSC 973/CO 372: *Portfolio Optimization* (graduate level, undergraduate level)
- o CO671: *Semidefinite Optimization* (graduate level)
- o CO250/CO350: *Linear Optimization* (undergraduate level)
- o CO355: *Mathematical Optimization* (undergraduate level)
- o CO365: *Nonlinear Optimization* (undergraduate level)

February – August 2008

Program coordinator of Enrichment Program for Young Mathematics Talents, Chinese University of Hong Kong, Hong Kong (Reference: Professor Thomas Kwok-Keung Au)

Conference presentations

- *On the sensitivity of semidefinite programs*. SIAM Conference on Optimization, San Diego, USA. May 2014
- *Efficient use of semidefinite programming for the selection of rotamers in protein conformations*. Retrospective Workshop on Discrete Geometry, Optimization, and Symmetry, Fields Institute, Toronto, ON, Canada. November 2013.
- *Facial reduction for semidefinite programming: theory and practice*. 15th Midwest Optimization Meeting, University of Western Ontario, London, ON, Canada. October 2013.
- *Sensitivity Analysis for Semidefinite Programs*. Optimization Days, HEC Montreal, Montreal, QC, Canada. May 2013.
- *Preprocessing and reduction for degenerate semidefinite programs*.
 - 7th Intl. Congress on Industrial and Applied Mathematics, Vancouver, BC, Canada. July 2011.
 - 13th Midwest Optimization Meeting, Fields Institute, Toronto, ON, Canada. October 2011.
 - INFORMS Annual meeting, Phoenix, AZ, USA. October 2012.
- *Structure based drug design problem: solving a class of quadratically constrained SDP problems*. Intl. Symposium on Mathematical Programming, Berlin, Germany. August 2012.
- *Strong duality in semidefinite programming and facial reduction with applications to sensor network localization and molecular conformation*. Computational and Analytical Mathematics Conference in honour of Jonathan Borwein's 60th Birthday, IRMACS Center, Simon Fraser University, Vancouver, BC, Canada. May 2011.
- *Robust optimization: applications in portfolio selection problems*. Research meeting at Tata Consultancy Services, Hyderabad, India. October 2009.

Scholarships and Awards

- Cotton Family Women in Mathematics Graduate Scholarship
- AIMMS/MOPTA Modeling Competition 2010: Honorable mention
Competition theme: Tax-aware Portfolio Optimization

Activities

Committee member of Women In Mathematics,
University of Waterloo, Canada

September 2010 –
December 2012

Organizer of Continuous Optimization Seminar,
University of Waterloo, Canada

March 2009 –
August 2012

Representative of Faculty of Mathematics, University of Waterloo visiting
Tata Consultancy Services, India

October 2009

Editing the book *Portfolio Optimization*
(By Michael J. Best. Taylor and Francis, May 2010)

January 2009 –
August 2009

Computer skills Linux, Matlab, Python

Last updated: December 2, 2014