Bistra Dilkina, Ph.D.
Assistant Professor
School of Computational Science and Engineering
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INTERESTS

Computational Sustainability; Artificial Intelligence; Optimization; Constraints.

Achieving sustainability requires balancing economic, environmental and social needs, and hence decision and optimization problems are at the heart of many sustainability issues. My research focus is on advancing the state of the art in combinatorial optimization techniques for solving real-world large-scale problems, particularly ones that arise in sustainability areas such as conservation planning. My work spans discrete optimization, network design, stochastic optimization, satisfiability, and game theory.

EDUCATION

Cornell University, Ithaca, NY, USA   **2005-2011**
Doctor of Philosophy (Ph.D), Computer Science (Minor in Operations Research)
- Thesis Advisor: Carla Gomes
- Committee Members: David Shmoys and Dexter Kozen
- Thesis Title: *Exploiting Structure in Combinatorial Problems with Applications in Computational Sustainability*

Simon Fraser University, Burnaby, BC, Canada   **1999-2004**
Bachelor of Science (B.Sc.), Computer Science
- Research Advisor: William S. Havens
- *Highest Honors*

United World College of the Adriatic, Trieste, Italy   **1997-1999**
International Baccalaureate (IB)

AWARDS

Best paper award, INFORMS Annual Meeting   **2011**
- *Cost-effective Conservation Planning for Improving Landscape Connectivity*
- ENRE Sessions in Forestry

NSERC Postgraduate Scholarship   **2008-2010**
- Award based on academic excellence, research ability, and communication skills
- CAD$21,000 per year

Graduate Teaching Assistant Award,Computer Science, Cornell University   **2008**

Nominated for Best paper Award, AAAI: Conference on Artificial Intelligence   **2007**

Google Anita Borg Scholarship   **2007**
- Award based on academic background, and demonstration of leadership
- USD$10,000

Dean of Applied Sciences Convocation Medal, Simon Fraser University   **2004**

CRA Outstanding Undergraduate Researcher Award   **2003**
- Recognition for research potential to one female student in North America

B.C. Sugar Achievement Award **2003**
- Granted to students that bring distinction to the University and B.C.
- CAD$4,000

International Gordon M. Shrum Scholarship **1999-2004**
- Full scholarship to study at Simon Fraser University
- CAD$40,000 stipend over 8 semesters

United World College Scholarship **1997-1999**
- Full scholarship for a 2-year program towards an International Baccalaureate Diploma

PEER-REVIEWED
PUBLICATIONS

Improving Your Chances: Boosting Citizen Science Discovery
Y. Xue, *B. Dilkina*, T. Damoulas, D. Fink, C. P. Gomes and S. Kelling
HCOMP-13: *AAAI Conference on Human Computation and CrowdSourcing*, 2013

Robust Network Design for Multispecies Conservation
R. Le Bras, *B. Dilkina*, Y. Xue, C. P. Gomes, K. S. McKelvey, C. Montgomery and M. K. Schwartz
AAAI-13: *AAAI Conference on Artificial Intelligence*, pp. 1305-1312, 2013

Large Landscape Conservation - Synthetic and Real-World Datasets
B. Dilkina, K. Lai, R. Le Bras, Y. Xue, C. P. Gomes, A. Sabharwal, J. Suter, K. S. McKelvey, M. K. Schwartz and C. Montgomery
AAAI-13: *AAAI Conference on Artificial Intelligence*, pp. 1369-1372, 2013

Upgrading Shortest Paths in Networks
B. Dilkina, K. Lai, C. P. Gomes
CPAIOR-11: *Intl. Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problem*, pp. 79-91, 2011

An Empirical Study of Optimization for Maximizing Diffusion in Networks
K. Ahmadizadeh, *B. Dilkina*, C. P. Gomes, A. Sabharwal
CP-10 : *Intl. Conference on Principles and Practice of Constraint Programming*, pp. 514-521, 2010

Maximizing Spread of Cascades Using Network Design
D. Sheldon, *B. Dilkina*, A. Elmachtoub, R. Finseth, A. Sabharwal, J. Conrad, C. P. Gomes, D. Shmoys, W. Allen, O. Amundsen, B. Vaughan
UAI-10: *Conference in Uncertainty in Artificial Intelligence*, pp. 517-526, 2010

Solving Connected Subgraph Problems in Wildlife Conservation
B. Dilkina, C. P. Gomes
CPAIOR-10: *Intl. Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems*, pp. 102-116, 2010

Backdoors in the Context of Learning
B. Dilkina, C. P. Gomes
SAT-09: *Intl. Conference on Theory and Applications of Satisfiability Testing*, pp. 73-79, 2009

Backdoors to Combinatorial Optimization: Feasibility and Optimality
B. Dilkina, C. P. Gomes, Y. Malitsky, A. Sabharwal, M. Sellmann
CPAIOR-09: *Intl. Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems*, pp. 56-70, 2009

Tradeoffs in the Complexity of Backdoor Detection
B. Dilkina, C. P. Gomes, A. Sabharwal
CP-07: *Intl. Conference on Principles and Practice of Constraint Programming*, pp. 256-270, 2007

The Impact of Network Topology on Pure Nash Equilibria in Graphical Games
B. Dilkina, C. P. Gomes, A. Sabharwal
AAAI-07: *Conference on Artificial Intelligence*, pp. 42-49, 2007
Nominated BEST PAPER AWARD

Extending Systematic Local Search for Job Shop Scheduling Problems
B. Dilkina, L. Duan and W. S. Havens
CP-05: *Intl. Conference on Principles and Practice of Constraint Programming*, 2005

Scheduling the National Football League Season
B. Dilkina, and W. S. Havens
IAAI-04: *Innovative Applications in Artificial Intelligence*, 2004 **A Hybrid Schema**

for Systematic Local Search
W. S. Havens and *B. Dilkina*
AI-04: *Canadian Conference on Artificial Intelligence*, 2004

Robust Network Design for Multispecies Conservation
B. Dilkina, K. Lai, R. Le Bras, Y. Xue, C. P. Gomes
INFORMS Annual Meeting, Phoenix, AZ, 2012

Computer Science helps Conservation Planning
B. Dilkina and C. P. Gomes
4th International EcoSummit on Ecological Sustainability, Columbus, OH, 2012

Incorporating Computational Sustainability into AI Education through a Freely-Available, Collectively-Composed Supplementary Lab Text
D. H. Fisher, *B. Dilkina*, E. Eaton, C. P. Gomes (Extended Abstract)
EAAI: AAAI Symposium on Educational Advances in Artificial Intelligence, 2012

Optimal Cost-effective Conservation Planning for Landscape Connectivity
B. Dilkina
International Conference on Computational Sustainability, Denmark, 2012

AL2: Learning for Active Learning
B. Dilkina, T. Damoulas, C. P. Gomes, D. Fink
NIPS Workshop: Machine Learning for Sustainability, Vancouver, BC, 2011

Cost-effective Conservation Planning for Improving Landscape Connectivity
B. Dilkina, K. Lai, C. P. Gomes
INFORMS Annual Meeting, Charlotte, NC, 2011
AWARD: 2011 ENRE Best Paper Award in Forestry Sponsored Sessions

Optimal Layout of Wind Farms
B. Dilkina, J. Kalagnanam
INFORMS Optimization Society Conference on Energy, Sustainability and Climate Change, Gainesville, FL, 2010

Backdoors to Combinatorial Optimization: Feasibility and Optimality
B. Dilkina, C. P. Gomes, Y. Malitsky, A. Sabharwal, M. Sellmann
CORS-INFORMS Joint International Meeting, Toronto, ON, 2009

Hidden Structure in Constraint Reasoning Problems
B. Dilkina, C. P. Gomes, A. Sabharwal
INFORMS Annual Meeting, Washington, DC, 2008

A Framework for Designing and Evaluating Mixed-Initiative Optimization Systems
A. E. Kirkpatrick, *B. Dilkina*, and W. S. Havens

Workshop on Mixed-Initiative and Planning at ICAPS, 2005

PATENTS AND COPYRIGHT	*Flexible Constraint Propagation Engine for Combinatorial Optimization Problems*, **US Patent 7606776** W. S. Havens and *B. Dilkina*. Granted Oct 20, 2009. Assignee: Actenum Corp.

Flexible Constraint Propagation Engine for Combinatorial Optimization Problems,
US Patent 7606776
W. S. Havens and *B. Dilkina*. Granted Oct 20, 2009. Assignee: Actenum Corp.

Method for designing the layout of turbines in a windfarm,
US Patent Application 20110208483
B. Dilkina, J. Kalagnanam, E. Novakovskaia. Submitted 2010. Assignee: IBM Corp.

TEACHING EXPERIENCE

Tutorial Presenter   2012
Master class at International Conference on Computational Sustainability
Copenhagen, Denmark.

Guest Lecturer   2011
Graduate course *Topics in Computational Sustainability*
Cornell University, Ithaca, NY

Teaching Assistant   2010
Topics in Computational Sustainability, taught by Carla Gomes
Graduate course in Computer Science and Information Science
Cornell University, Ithaca, NY
Helped design course content and projects for this brand new course

Teaching Assistant   2008
Networks, taught by David Easley and Jon Kleinberg
Undergraduate course in Computer Science, Economics, Sociology, Information Science
Cornell University, Ithaca, NY
Outstanding Graduate Teaching Assistant Award

Mentor   2010-12
Humale Khan, Undergraduate Computer Science, Cornell
Independent Study Project, Fall 2012: "GIS python toolbox for Wildlife Corridors"

Karan Kurani and Jason Marcel, M.Eng. 2011, Cornell
"Social Network Discovery", Winners of the BOOM 2011, EMC Big Data Award

Kiyan Ahmadizadeh, M.S. Computer Science 2010, Cornell
"Optimization for Maximizing Diffusion in Networks using Cloud Computing"

PROFESSIONAL SERVICE

Publicity chair
- CPAIOR 2013

Program Committee Co-chair
- NESCAI: North East Student Colloquium on Artificial Intelligence 2008
- CROCS: International Workshop on Constraint Reasoning and Optimization for Computational Sustainability 2012

Program Committee member
- AAAI 2013/2012/2011: AAAI Conference on Artificial Intelligence
- IJCAI 2013/2011/2009: International Joint Conference on Artificial Intelligence
- CPAIOR 2013: Intl. Conference on Integration of AI and OR Techniques in Constraint Programming
- CompSust 2012: International Conference on Computational Sustainability

Reviewer
- *Conferences*: AAAI'06/07, IJCAI'07, SAT'12, UAI'12, CP'07/12, ECAI '10, SODA'09, AAMAS'08, CPAIOR'06/07/08, STACS'07
- *Journals*: INFORMS Journal of Computing, Annals of Mathematics and AI, IEEE

Transactions on Computers
Workshop coordinator/participant
- EYH: Expanding Your Horizons (for middle school girls) 2008/2009/2010

Mentor
- ChicTech Competition (for high school girls), Simon Fraser University, Spring 2005

RESEARCH AND DEVELOPMENT EXPERIENCE

Institute for Computational Sustainability, Ithaca, NY   **2008-2013**
- Title: *Postdoctoral Associate*   Aug 2011 - Jul 2013
- Title: *Research Assistant*   2008-2011
- Worked under the supervision of Carla Gomes.
- Optimization and network design with applications in Sustainability. Conservation Planning: stochastic optimization under species dispersal models; reserve network design under connectivity constraints; Resource allocation for poverty alleviation.

IBM Research T.J. Watson, Yorktown Heights, NY   **Sept 2009-Aug 2010**
- Title: *Graduate intern* (Mentors: Jayant Kalagnanam and Andrew Conn)
- Wind farm turbine layout optimization (MIP and MINLP techniques).

IBM Research T.J. Watson, Yorktown Heights, NY   **June 2009-Aug 2009**
- Title: *Graduate intern* (Mentors: Jayant Kalagnanam and Andrew Davenport)
- Steel production scheduling with campaign constraints (using IBM ILOG OPL).

Intelligent Information Systems Institute, Ithaca, NY   **2005-2008**
- Title: *Research Assistant*
- Worked under the supervision of Carla Gomes.
- Study of structural properties of real-world combinatorial problems that lead to efficient algorithm (in the context of Satisfiability and Mixed-Integer Programming)
- Analysis of the distribution of Nash Equilibria in different classes of graphical games.

Actenum Corporation, Vancouver, BC   **2005-2006**
- Title: *Full time Senior Research Scientist*
- R&D in modeling and search methods for Resource-Constrained Scheduling and oversubscribed scheduling problems.

Constraint Works Inc., Vancouver, BC   **2002**
- Title: *COOP/Intern*
- R&D for a prototype National Football League (NFL) scheduling system.