Alexey Bochkarev

Researcher in Mathematical Optimization / Operations Research
PhD in Industrial Engineering from Clemson University

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Research interests

Mathematical optimization, theory and applications, especially:

- Combinatorial optimization,
- Network optimization and interdiction,
- Decision diagrams and dynamic programming,
- Applications of reinforcement learning techniques.

Applications: So far my research has been driven more by methodological questions, but I do have some experience of implementing applied models in industry. Also, due to my background I have a special interest in optimization related to electricity markets: pricing / OPF / economic dispatch / infrastructure planning, etc.

Research experience / current projects

(more)

- **Align-BDD:** seeking to obtain computational benefits and sensitivity information by representing a combinatorial problem as a collection of Binary Decision Diagrams (BDDs). The project involves creating a heuristic to enforce a certain structural property for a pair of BDDs and building a related "computational pipeline" for a specific, hard optimization problem: a variant of the facility location.
- **DSPI:** applying game-playing and reinforcement learning techniques to the Dynamic Shortest-path Interdiction problem, in a framework of a Monte-Carlo Search Tree based algorithm.

Both projects involve design and implementation of an algorithm and the related computational experiments.

Dissertation: "Selected Topics in Network Optimization: Aligning Binary Decision Diagrams for a Facility Location Problem and a Search Method for Dynamic Shortest Path Interdiction."
(Online: https://tigerprints.clemson.edu/all_dissertations/2915.)

Research supervisor: Dr. J. Cole Smith.

Working papers

- A. A. Bochkarev, J.C. Smith, On Aligning Non-Order-Associated Binary Decision Diagrams, under review in *INFORMS Journal on Computing*. Preprint: https://optimization-online.org/2022/08/on-aligning-non-order-associated-binary-decision-diagrams/
- A. A. Bochkarev, J.C. Smith, A Monte Carlo Tree Search for Dynamic Shortest-Path Interdiction, under review in *Networks*.

Talks

- On Aligning Non-Order-Associated Binary Decision Diagrams, *INFORMS Annual Meeting, 2020* (virtual), BDD section.
- A Monte Carlo Tree Search for Dynamic Shortest-Path Interdiction, *International Network Optimization Conference, 2022*, Aachen, Germany (INOC-2022).

Grants and awards

- Clemson University Doctoral Disseration Completion grant (support for Fall 2021)
- The Seth Bonder Foundation grant (to participate in INFORMS Annual Meeting 2021)
- International Teaching Fellowship from Clemson University (partial support in 2020, training in teaching)

Education

PhD Industrial Engineering (2018–2021)
Clemson University, US
Operations Research track

MSc/BSc Appl. Math and Physics (2004–2010)
Moscow Institute of Physics
and Technology, Russia

M.A. Economics (2008–2010)
New Economic School, Russia

(Human) Languages

English (fluent), Russian (native), German (∼ A1).

Technical skills (more)

Main programming stack:

- Python (gurobi, CBC, numpy/pandas, etc.)
- R (ggplot, dplyr, tidyverse),
- Julia (JuMP/gurobi, LightGraphs),
- C++ (gurobi, armadillo/BLAS, boost).

Basic knowledge: PyTorch, Java, Matlab/Octave.

Other technical skills: PBS (comp cluster), GNU/Linux, bash; make, git, LaTeX, Emacs, basic GIS (QGIS), Inkscape, beamer / PPT / reveal.js, Jupyter.

Teaching experience (more)

- Designed and delivered three 4-days mini-courses aimed at gifted high-school students and early undergrads for School for Molecular and Theoretical Biology (SMTB) and Puschino Winter School (ZPSh), mostly in English (sometimes in Russian as well):
  - "Practical Introduction to Probability Theory," ZPSh-2021, SMTB-2021
  - "A Glimpse into Algorithms," SMTB-2020 (workshop); SMTB-2021, SMTB-2022 (course)
  - "How to teach machines: simple examples on ML," SMTB-2022 (course)
- TA in "Intro probability" undergrad course at Clemson University (IE3600), Summer 2021

Service and volunteering / Community

Besides teaching at summer and winter schools (above), I have been doing some work under the umbrella of Clemson University INFORMS Student Chapter:

- serving on the Executive Board: as a Secretary (2020) and President (2021),
- organized a "Journal club on Network optimization and interdiction" (2021),
- designed and delivered "OR Tech Seminar" – a series of four workshops on "research toolbox" (2021).

Industry experience

Electric energy / The Federal Grid (FGC UES) (2013–2017)
Electricity transmission. Moscow, Russia

Role: Team deputy head → head; modeling and analytics
Focus: Performance benchmarking (branches), operational efficiency improvement. Internal and external regulations / KPI, strategy, analytics / modeling, and presentations.

Roland Berger Strategy Consultants GmbH (2010–2013)
Strategic consulting. Moscow, Russia

Role: Intern → Junior Consultant → Consultant
Focus: Infrastructure and construction. Strategy and performance: market entry, supply/demand modeling, growth strategy, efficiency improvement. Internal knowledge sharing, modeling, presentations.