# ELINA ROBEVA

http://math.ubc.ca/~erobeva/

erobeva@math.ubc.ca, 650-353-0437

| Positions | | |
|---|---|---|
| | **University of British Columbia,** *Assistant Professor* Department of Mathematics | Vancouver, BC July 2019 - present |
| | **Massachusetts Institute of Technology,** *Statistics Instructor and NSF Postdoctoral Fellow* Department of Mathematics | Cambridge, MA Sept 2016 - Jun 2019 |
| **Education** | **University of California at Berkeley**, *Mathematics Ph.D.* Advisor: Bernd Sturmfels | Berkeley, CA Sept 2012 - May 2016 |
| | **Harvard University,** *Master of Arts in Mathematics* | Cambridge, MA Sept 2011 - June 2012 GPA 4.00 |
| | **Stanford University,** *B.S in Mathematics with Honors and Distinctions; Minor: Computer Science* | Stanford, CA Sept 2007 – June 2011 GPA 4.00 |
| | **Sofia High School of Mathematics**, *Graduated with recognition for outstanding achievements in the area of mathematics* *National diploma for outstanding achievements from the Minister of Education of Bulgaria* | Sofia, Bulgaria June 2007 GPA 6.00/6.00 |

| Awards & Honors | | |
|---|---|---|
| **CAIMS/PIMS Early Career Research Award** 2022 | | Kelowna, BC |
| **UBC/PIMS Mathematical Sciences Young Faculty Award** 2020 | | Vancouver, BC |
| **SIAM Algebraic Geometry Early Career Prize** 2019 | | Bern, Switzerland |
| **Bernard Friedman Memorial Prize in Applied Mathematics** (thesis award) 2016 | | Berkeley, CA |
| **Outstanding Graduate Student Instructor Award** (teaching award) 2016 | | Berkeley, CA |
| **MIT Rising Stars workshop participant** 2015 | | Cambridge, MA |
| **Berkeley Fellowship for outstanding doctoral applicants** 2012 | | Berkeley, CA |
| **Pierce Fellowship for incoming Harvard graduate students** 2011 | | Cambridge, MA |
| **Honorable Mention for the Morgan Prize for Outstanding Research in Mathematics** 2011 | | Stanford, CA |
| **Undergraduate Research Award in Mathematics** 2011 | | Stanford, CA |
| **Dean's Award for Academic Accomplishment** 2011 | | Stanford, CA |
| **J.E.Wallace Sterling Award for Scholastic Achievement** 2011 | | Stanford, CA |
| **Honorable Mention** – top 75 in the Putnam Mathematical Competition 2010 | | Stanford, CA |
| **Highbridge Award for Mathematical Problem Solving** 2008, 2009 | | Stanford, CA |
| **Silver Medal** – International Mathematical Olympiad 2007 | | Hanoi, Vietnam |
| **Silver Medal** – International Mathematical Olympiad 2006 | | Ljubljana, Slovenia |
| **Gold Medal** – Balkan Mathematical Olympiad 2007 | | Rhodes, Greece |
| **Gold Medal** – 2nd Young International Mathematical Convention 2006 | | Lucknow, India |

| Research Interests | |
|---|---|
| | Mathematical statistics, causality, graphical models, hidden variable models, tensor decompositions, algebraic statistics, applied algebraic geometry, total positivity, optimization |

| Preprints | |
|---|---|
| | ***Log-concave Density Estimation in Undirected Graphical Models,*** with Kaie Kubjas, Olga Kuznetsova, Pardis Semnani, and Luca Sodomaco, *arXiv:2206.05227* |
| | ***Third-order Moment Varieties for Non-Gaussian Graphical Models,*** with Carlos Améndola, Mathias Drton, Alex Grosdos, and Roser Homs, *arXiv:2112.10875* |

| Publications | |
|---|---|
| | ***Robust Eigenvectors of Symmetric Tensors,*** with Tommi Muller and Konstantin Usevich, *to appear in SIAM Journal of Matrix Analysis and Applications, arXiv:2111.06880* |
| | ***Kernel Density Estimation for Totally Positive Random Vectors***, with Ali Zartash, *to appear in Algebraic Statistics, 2022* |
| | ***The Set of Orthogonal Tensor Trains,*** with Pardis Semnani, *to appear in Vietnam Journal of Mathematics, Special Issue in Honor of Bernd Sturmfels' 60th Birthday, 2022* |

***Bimonotone Subdivisions of Point Configurations in the Plane,*** with Melinda Sun, *Algebraic Statistics,* 12:2 (2021) pp.125-138

***Learning Linear Non-Gaussian Graphical Models with Multidirected Edges,*** with Yiheng Liu and Huanqing Wang, *Journal of Causal Inference,* 9:1 (2021) pp. 250-263

***Orthogonal Decomposition of Tensor Trains,*** with Karim Halaseh and Tommi Muller, *Linear and Multilinear Algebra, 2021*

***Multi-trek Separation in Linear Structural Equation Models,*** with Jean-Baptiste Seby, *SIAM Journal on Applied Algebra and Geometry,* 5:2 (2021) pp. 278-303

***Optimal Rates for Estimation of Two-Dimensional Totally Positive Distributions,*** with Jan-Christian Hüter, Cheng Mao, and Philippe Rigollet, *Electronic Journal of Statistics*, 14:2 (2020) pp. 2600-2652

***Estimation of Monge Matrices***, with Jan-Christian Hüter, Cheng Mao, and Philippe Rigollet, *Bernoulli,* 26:4 (2020) pp. 3051-3080

***Maximum Likelihood Estimation of Totally Positive and Log-concave Densities,*** with B. Sturmfels, Ngoc Tran, and C. Uhler, *Scandinavian Journal of Statistics,* 48:3 (2020) 817-844

***Nested Covariance Determinants and Restricted Trek Separation in Gaussian Graphical Models***, with M. Drton and L. Weihs, *Bernoulli* 26:4 (2020) pp. 2503-2540

***Geometry of Log-Concave Density Estimation,*** with B. Sturmfels and C. Uhler, *Discrete and Computational Geometry* 61 (2019) pp.136-160

***Duality of Graphical Models and Tensor Networks,*** with A. Seigal, *Information and Inference: A Journal of the IMA,* 8:2 (2019) pp. 273-288

***Positive Semidefinite Rank and Nested Spectrahedra,*** with Kaie Kubjas and Richard Robinson, *Linear and Multilinear Algebra, (2017/10/4), pp.1-23*

***Determinantal Generalizations of Instrumental Variables,*** with L. Weihs, B. Robinson, E. Dufrense, J. Kenkel, K. Kubjas, R. McGee II, N. Nguyen, and M. Drton, *Journal of Causal Inference*, **6:1** (2017) ISSN (Online) 2193-3685, https://doi.org/10.1515/jci-2017-0009

***The Degree of SO(n)***, with Madeline Brandt, DJ Bruce, Taylor Brysiewicz, and Robert Krone, *Combinatorial Algebraic Geometry, Fields Institute Communications, 80, Springer, New York, 2017. Editors: Gregory Smith and Bernd Sturmfels*

***Super-Resolution without Separation***, with Geoffrey Schiebinger and Benjamin Recht: *Information and Inference: A Journal of the IMA, iax006, https://doi.org/10.1093/imaiai/iax006*

***Singular Vectors of Orthogonally Decomposable Tensors,*** with Anna Seigal, *Linear and Multilinear Algebra,* 65:12 (2017), pp. 2457-2471

***Orthogonal and Unitary Tensor Decomposition from an Algebraic Perspective***, with Ada Boralevi, Jan Draisma and Emil Horobet, *Israel Journal of Mathematics,* 222:1 (2017), pp 223–260

***Decomposing Tensors into Frames,*** with Luke Oeding and Bernd Sturmfels: *Advances in Applied Mathematics,* 73 (2016), pp. 125-153

***Orthogonal Decomposition of Symmetric Tensors***: *SIAM Journal on Matrix Analysis and Applications, 37 (2016), pp. 86-102*

***Fixed Points of the EM Algorithm and Nonnegative Rank Boundaries,*** with Kaie Kubjas and Bernd Sturmfels: *Annals of Statistics,* 43:1 (2015), pp. 422-461

***Robust Toric Ideals,*** with Adam Boocher: *Journal of Symbolic Computation*, 68 (2015), pp. 254-264

***A Tropical Proof of the Brill-Noether Theorem***, with Philip Cools, Jan Darisma and Sam Payne: *Advances in Mathematics* 230 (2012), pp. 759-776

***Artificial Intelligence for Bidding Hex***, with Sam Payne: *Games of No Chance,* edited by Richard Nowakowski. Mathematical Sciences Research Institute Publications, 63. Cambridge University Press, Cambridge (2015), pp. 207-214

*An Extensive Survey of Graceful Trees*, Undergraduate Honors Thesis, Stanford University 2011

**Work Experience**

**Google, Inc.**                                                                                              Mountain View, CA
*Software Engineering Intern in Research*                                                          May 2013 – Aug 2013
Worked on identifying users' online behavior and grouping together different online tasks.

**Facebook, Inc.**                                                                                                      Palo Alto, CA
*Software Engineering Intern*                                                                          June 2010 – Sept 2010
Developed new ways of analyzing incoming data in order to surface fake accounts.

**Invited Talks**

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| *Log-Concave Graphical Models,* Combinatorial, Computational, and Applied Algebraic Geometry | Seattle, WA<br>June, 2022 |
| *Orthogonal and Incoherent Tensor Decompositions,* CAIMS Annual Meeting Award Talk | Kelowna, BC<br>June, 2022 |
| *Log-Concave Graphical Models,* Algebraic Statistics Conference | Honolulu, HI<br>May, 2022 |
| *Log-Concave Graphical Models,* Algebra, Combinatorics, and Geometry Seminar, SFSU | Online Seminar<br>Nov, 2021 |
| *Orthogonal and Incoherent Tensor Decompositions,* University of Idaho Mathematics Colloquium | Online Colloquium<br>Nov, 2021 |
| *Hidden Variables in Linear Causal Models,* AMS Fall Western Sectional Meeting | Online Conference<br>Oct, 2021 |
| *Log-Concave Graphical Models,* SIAM Conference on Applied Algebra and Geometry | Online Conference<br>Aug, 2021 |
| *Orthogonal and Incoherent Tensor Decompositions,* International Conference on Large Scale Computation | Online Conference<br>Jun, 2021 |
| *Orthogonal and Incoherent Tensor Decomposition,* SIAM Conference on Applied Linear Algebra | Online Conference<br>May, 2021 |
| *Orthogonal Tensor Decomposition,* First Annual Meeting of Young Bulgarian Mathematicians | Online Conference<br>May, 2021 |
| *Learning Totally Positive Densities,* High-dimensional Covariance Matrices, Networks and Inequalities | Online Workshop<br>May, 2021 |
| *Orthogonal and Incoherent Tensor Decomposition,* Codes and Expansions Seminar | Online Seminar<br>May, 2021 |
| *Hidden Variables in Non-Gaussian Linear Causal Models,* IPAM Workshop on Tensor Algorithms | Online Workshop<br>May, 2021 |
| *Density Estimation under Total Positivity and Conditional Independence,* UBC/PIMS Colloquium | Vancouver, BC<br>Apr, 2021 |
| *Hidden Variables in Linear Causal Models,* Number Theory and Algebraic Geometry Seminar, Simon Fraser | Online Seminar<br>Apr, 2021 |
| *Estimating Totally Positive Densities,* SIAM Conference on Computational Science and Engineering | Online Conference<br>Mar, 2021 |
| *Hidden Variables in Linear Causal Models,* Algebra in Statistics and Computation Seminar, UW Madison | Online Seminar<br>Feb, 2021 |
| *Orthogonal Decomposition of Tensor Trains,* Working Geometry Seminar, Texas A&M | Online Seminar<br>Feb, 2021 |
| *Orthogonal Decomposition of Tensor Trains,* Nonlinear Algebra Seminar Online | Online Seminar<br>Nov, 2020 |
| *Hidden Variables in Linear Causal Models,* UBC IAM Colloquium | Online Colloquium<br>Nov, 2020 |
| *Orthogonal Tensor Decomposition,* St Andrews University Pure Mathematics Colloquium | Online Colloquium<br>Oct, 2020 |
| *Duality between Graphical Models and Tensor Networks,* Joint Statistical Meetings 2020 | Online Workshop<br>Aug, 2020 |
| *Superresolution Imaging and Total Positivity,* Algebraic Statistics 2020 | Online Workshop<br>Jun, 2020 |
| *Statistical Estimation under Total Positivity*, Boise State Mathematics Colloquium | Boise, ID<br>Mar, 2020 |
| *Nonparametric Density Estimation of Totally Positive Distributionsi,* MIFODS Workshop, MIT | Cambridge, MA<br>Jan, 2020 |
| *Orthogonal Tensor Decomposition,* Seminar on Alg. Geom., Simon Fraser University | Vancouver, BC<br>Oct, 2019 |
| *Duality of Graphical Models and Tensor Networks,* AI and Tensor Factorizations Workshop | Santa Fe, NM<br>Sep, 2019 |

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| *Orthogonal Tensor Decomposition,* SIAM AG Conference, Early Career Prize Lecture | Bern, Switzerland <br> Jul, 2019 |
| *Nested Covariance Determinants in Gaussian Graphical Models,* SIAM AG Conference | Bern, Switzerland <br> Jul, 2019 |
| *Maximum Likelihood Estimation under Total Positivity,* Northeastern Pick My Brain Seminar | Boston, MA <br> Mar, 2019 |
| *Statistical Estimation under Algebraic Constraints*, UW Madison Machine Learning Seminar | Madison, WI <br> Mar, 2019 |
| *Statistical Estimation under Algebraic Constraints*, UNC Statistics and Optimization Colloquium | Chapel Hill, NC <br> Feb, 2019 |
| *Algebraic Structure in Hidden Variable Models,* Duke Statistics Colloquium | Durham, NC <br> Feb, 2019 |
| *Statistical Estimation under Algebraic Constraints,* Stanford Statistics Colloquium | Stanford, CA <br> Jan, 2019 |
| *Statistical Estimation under Algebraic Constraints,* UBC Mathematics Colloquium | Vancouver, BC <br> Jan, 2019 |
| *Maximum Likelihood Estimation under Total Positivity,* UBC Mathematics of Information Seminar | Vancouver, BC <br> Jan, 2019 |
| *Statistical Estimation under Algebraic Constraints,* UC Irvine Mathematics | Irvine, CA <br> Jan, 2019 |
| *Statistical Estimation under Algebraic Constraints,* Caltech CMS Frontiers | Pasadena, CA <br> Jan 2019 |
| *Maximum Likelihood Estimation under Total Positivity,* U of Utah Stochastics Seminar | Salt Lake City, UT <br> Dec, 2018 |
| *Orthogonal Tensor Decomposition,* U of Utah Mathematics Colloquium | Salt Lake City, UT <br> Dec, 2018 |
| *Maximum Likelihood Estimation under Total Positivity,* WORDS Workshop, Fuqua School of Business | Durham, NC <br> Dec, 2018 |
| *Orthogonal Tensor Decomposition,* Duke Applied Math Seminar | Durham, NC <br> Nov, 2018 |
| *Maximum Likelihood Estimation under Total Positivity,* CU Boulder Applied Math Seminar | Boulder, CO <br> Nov, 2018 |
| *Graphical Models from the Perspective of Algebra and Geometry, ICERM Nonlinear Algebra Bootcamp* | Providence, RI <br> Sep, 2018 |
| *Maximum Likelihood Estimation under Total Positivity,* SIAM Annual meeting minisymposium | Portland, OR <br> July, 2018 |
| *Maximum Likelihood Estimation under Total Positivity,* Brandeis University | Waltham, MA <br> Mar, 2018 |
| *Maximum Likelihood Estimation under Total Positivity,* UMass Amherst | Amherst, MA <br> Feb, 2018 |
| *Maximum Likelihood Estimation under Total Positivity,* Applied Math Seminar at Johns Hopkins University | Baltimore, MD <br> Feb, 2018 |
| *Maximum Likelihood Estimation under Total Positivity,* Applied Math Seminar at Duke | Durham, NC <br> Jan, 2018 |
| *Maximum Likelihood Estimation under Total Positivity,* CAM Seminar at University of Chicago | Chicago, IL <br> Jan, 2018 |
| *Maximum Likelihood Estimation under Total Positivity,* Microsoft Research | Redmond, WA <br> Nov, 2017 |
| *Maximum Likelihood Estimation under Total Positivity*, CMO Oaxaca, Beyond Convexity workshop | Oaxaca, Mexico <br> Oct, 2017 |
| *Decomposing Tensors into Frames,* SIAM-AG | Atlanta, GA <br> Aug, 2017 |
| *Orthogonal Tensor Decomposition*, CBMS workshop on Tensors | Auburn, AL <br> Jul, 2017 |
| *Geometry of Log-Concave Density Estimation,* Oberwolfach MFO Algebraic Statistics Meeting | Oberwolfach,Germany <br> Apr, 2017 |
| *Geometry of Log-Concave Density Estimation,* Joint Math Meetings | Atlanta, GA <br> Jan, 2017 |
| *Superresolution without Separation,* MIT LIDS Seminar | Cambridge, MA <br> Sep, 2016 |
| *The Geometry of Positive Semidefinite Rank,* AMS Special Session | Salt Lake City, UT <br> Apr, 2016 |
| *Orthogonal Tensor Decomposition,* ETH Zürich | Zürich, Switzerland <br> Nov, 2015 |
| *Superresolution without Separation,* SIAM AG 2015 | Daejeon, South Korea <br> Aug, 2015 |
| *Orthogonal Tensor Decomposition, SIAM AG 2015* | Daejeon, South Korea <br> Aug, 2015 |

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| *The Geometry of Positive Semidefinite Rank, SIAM AG 2015* | | Daejeon, South Korea<br>Aug, 2015 |
| *The Geometry of Positive Semidefinite Rank,* GOAL workshop | | Berkeley, CA<br>May 2015 |
| *Super-Resolution Imaging and Tchebychev Systems,* Seminar in Computational Algebraic Geometry | | Berkeley, CA<br>Mar 2015 |
| *Orthogonal Tensor Decomposition,* Tensors in Computer Science and Geometry | | Berkeley, CA<br>Nov 2014 |
| *Orthogonal Tensor Decomposition,* Computational Algebraic Geometry Seminar | | Berkeley, CA<br>Oct 2014 |
| *Orthogonal Tensor Decomposition,* Benjamin Recht's Group Meeting | | Berkeley, CA<br>Oct 2014 |
| *Robust Toric Ideals,* Western Fall Sectional AMS Meeting | | San Francisco, CA<br>Oct 2014 |
| *Orthogonal Tensor Decomposition,* Western Fall Sectional AMS Meeting | | San Francisco, CA<br>Oct 2014 |
| *Orthogonal Tensor Decomposition,* AMS Meeting Eau-Claire | | Eau-Claire, WI<br>Sep 2014 |
| *Orthogonally Decomposable Tensors,* Workshop on the Method of Moments and Spectral Learning, ICML 2014 | | Beijing, China<br>Jun 2014 |
| *Orthogonally Decomposable Tensors,* Optimization and Algebraic Geometry | | Daejeon, South Korea<br>Jun 2014 |
| *Fixed Points of the EM Algorithm and Nonnegative Rank Boundaries,* Computer Science Seminar, U Washington | | Seattle, WA<br>May, 2014 |
| *Fixed Points of the EM Algorithm and Nonnegative Rank Boundaries,* Applications of Real Algebraic Geometry | | Helsinki, Finland<br>Mar 2014 |
| *A Tropical Proof of the Brill-Noether Theorem,* Joint Mathematical Meeting | | Boston, MA<br>Jan 2012 |
| *How to win in Bidding Hex.* Stanford Undergraduate Math Organization speaker series | | Stanford, CA<br>May 2011 |

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| **Teaching Experience** | **Instructor and course design**<br>*UBC Math 605D Graphical Models and Causal Inference* | Vancouver, BC<br>Spring, 2022 |
| | **Instructor and course design**<br>*UBC Math 605D Tensor Decompositions and Their Applications; a graduate student topics course* | Vancouver, BC<br>Fall, 2020 |
| | **Instructor**<br>*UBC Math 307 Applied Linear Algebra; Math 303 Introduction to Stochastic Processes* | Vancouver, BC<br>2019-2022 |
| | **Instructor**<br>*MIT IDS.136 / 6.244 Graphical Models: A Combinatorial, Algebraic and Geometric Perspective*<br>Co-taught together with Caroline Uhler | Cambridge, MA<br>Spring, 2019 |
| | **Instructor and course design**<br>*MIT IDS.S21 / 6.248 Graphical Models: A Combinatorial, Algebraic and Geometric Perspective*<br>Developed and co-taught a new class together with Caroline Uhler | Cambridge, MA<br>Spring, 2016 |
| | **Teaching Assistant**<br>*MIT 18.03 Introduction to Differential Equations* | Cambridge, MA<br>Fall 2016 |
| | **Graduate Student Instructor**<br>*Math 10B Methods of Mathematics: Calculus, Statistics, and Combinatorics*<br>Teaching discussion for two sections of 25 students each. Course instructor: Bernd Sturmfels. | Berkeley, CA<br>Spring 2015 |
| | **Math Circle Lecturer**<br>Semesterly lectures to advanced math high-school students at UC Berkeley and UBC | 2012 - 2021 |
| | **Center for Teaching and Learning – Stanford University**<br>*Appointment Tutor for Academic Years 2008-2011*<br>Meeting students in individual appointments and helping them in Mathematics and Computer Science. | Stanford, CA<br>Apr 2008 – June 2011 |
| | **Stanford Math Department**<br>*Grader*<br>Grading homework for various mathematics classes: Math 42, 51H, 52H, 108, 121. | Stanford, CA<br>Jan 2008 – June 2011 |

**Advanced Math Group in High School**
*Group leader*
Organized and taught a series of lectures in advanced mathematics to prepare younger students for Mathematical Olympiads. A few of them participated successfully at the IMO.

Sofia, Bulgaria
Sept 2006 – May 2007

## Academic Service

**IMSI Semester Long Program Organizer**
*Algebraic Statistics in Our Changing World*

Chicago, IL
Sep - Dec, 2023

**BIRS Oaxaca Workshop Organizer**
*Computations and Data in Algebraic Statistics*

Oaxaca, Mexico
May, 2023

**IPAM Semester Long Program Organizer**
*Tensor Methods and Emerging Applications to the Physical and Data Sciences*

Los Angeles, CA
Mar - Jun, 2021

**Minisymposium Organization**
- ❑ **SIAM AG Meeting:** *Theory and Methods for Tensor Decomposition*, — Bern, Switzerland Jul 2019
- ❑ **SIAM AG Meeting:** *Graphical Models* — Bern, Switzerland Jul 2019
- ❑ **Joint Statistical Meetings:** *Algebraic Methods in Statistics* — Vancouver, BC Jul 2018
- ❑ **SIAM Annual Meeting:** *Theoretical Challenges in Tensor Decomposition* — Portland, OR Jul 2018

**Seminar Organization**
- ❑ **Algebraic Statistics Online Seminar:** A worldwide virtual seminar series — Online seminar Jun 2020 – present
- ❑ **MIT Seminar on Applied Algebra and Geometry:** organizer and founder — Cambridge, MA 2017 – 2018

## Students and Postdocs

**Graduate Students**
- ❑ **Pardis Semnani (UBC)**
- ❑ **Reza Sadoughian (UBC)**
- ❑ **Mateusz Faltyn (UBC)**
- ❑ **Bakytzhan Kurmanbek (UBC)**
- ❑ **Damara Gagnier (UBC)**
- ❑ **Jean-Baptiste Seby (MIT)**

**Undergraduate Students**
- ❑ **Chrisian Campbell (UBC)**
- ❑ **Niko Nikov (UBC)**
- ❑ **Alex Dong (UBC)**
- ❑ **Jai Grewal (UToronto)**
- ❑ **Tommi Muller (UBC)**
- ❑ **Karim Halaseh (UBC)**
- ❑ **Yiheng Liu (UBC)**
- ❑ **Huanqing Wang (UBC)**
- ❑ **Ali Zartash (MIT)**
- ❑ **Melinda Sun (MIT)**

**Postdocs**
- ❑ **Marina Garrote-López (UBC)**