

ROBERT KRONE

rckrone@gmail.com
(647) 657 9846
<http://www.rckr.one>

EMPLOYMENT

2017–2020 Krener Assistant Professor, **University of California - Davis**
2015–2017 Postdoctoral Fellow, **Queen’s University**

EDUCATION

2020–2020 Fellowship program in Data Science, **The Data Incubator**
2010–2015 Ph.D. in Mathematics, **Georgia Institute of Technology**
Advisor: Anton Leykin
Thesis: “Symmetric ideals and numerical primary decomposition”
Minor: Computer Science
2004–2008 B.A. in Mathematics, **Princeton University**
Certificate in Computer Science

RESEARCH INTERESTS

Applied algebraic geometry: using algebraic geometry tools to solve applied problems, and developing computational tools such as software packages for solving algebraic problems.

PAPERS

Mareike Dressler and Robert Krone. Multiple typical ranks in matrix completion, *preprint* arXiv:2010.09777 (2020).
Justin Chen, Marc Härkönen, Robert Krone, Anton Leykin. Noetherian operators and primary decomposition, *preprint* arXiv:2006.13881 (2020).
Robert Krone and Kaie Kubjas. Uniqueness of nonnegative matrix factorizations by rigidity theory, accepted to *SIAM Journal on Matrix Analysis and Applications* (2020).
Daniel Irving Bernstein and Robert Krone. The tropical Cayley-Menger variety, *SIAM Journal on Discrete Mathematics* 33.3: pages 1725-1742. (2019).
Jesús A. De Loera, Serkan Hoşten, Robert Krone, Lily Silverstein. Average Behavior of Minimal Free Resolutions of Monomial Ideals, *Proceedings of the American Mathematical Society*, pages 3239-3257 (2019).
Hector Baños, Nathaniel Bushek, Ruth Davidson, Elizabeth Gross, Pamela E Harris, Robert Krone, Colby Long, Allen Stewart and Robert Walker. Dimensions of Group-based Phylogenetic Mixtures, *Bulletin of Mathematical Biology* 1522-9602, pages 1-21 (2018).

- Madeline Brandt, DJ Bruce, Taylor Brysiewicz, Robert Krone and Elina Robeva. The degree of $SO(n)$, *Combinatorial Algebraic Geometry* (book), pages 229-246 (2016).
- Hector Baños, Nathaniel Bushek, Ruth Davidson, Elizabeth Gross, Pamela E Harris, Robert Krone, Colby Long, Allen Stewart and Robert Walker. Phylogenetic Trees, accepted to *Journal of Software for Algebra and Geometry* (2019).
- Chris Hillar, Robert Krone and Anton Leykin. Equivariant Gröbner bases, *The 50th Anniversary of Gröbner Bases* (book), pages 129-154 (2018).
- Robert Krone, Anton Leykin and Andrew Snowden. Hilbert series of symmetric ideals in infinite polynomial rings via formal languages, *Journal of Algebra* 485, pages 353-362 (2016).
- Robert Krone. Equivariant Gröbner bases of symmetric toric ideals, *In Proceedings of the 41th International Symposium on Symbolic and Algebraic Computation, ISSAC '16*, pages 311-318 (2016).
- Robert Krone and Anton Leykin. Numerical algorithms for detecting embedded components, *Journal of Symbolic Computation* 82, pages 1-18 (2017).
- Robert Krone and Anton Leykin. Eliminating dual spaces, *Journal of Symbolic Computation* 79, pages 609-622 (2017).
- Thomas Kahle, Robert Krone, Anton Leykin. Equivariant lattice generators and markov bases, *In Proceedings of the 39th International Symposium on Symbolic and Algebraic Computation, ISSAC '14*, pages 264-271 (2014).
- Jan Draisma, Rob Eggermont, Robert Krone, Anton Leykin. Noetherianity for infinite-dimensional toric varieties, *Algebra & Number Theory* 9-8, pages 1857-1880 (2015).
- Robert Krone. Numerical algorithms for dual bases of positive-dimensional ideals, *Journal of Algebra and Its Applications* 12.06 (2013).

SOFTWARE

- `PhylogeneticTrees` package for Macaulay2 computer algebra system for computing invariants of statistical models for evolutionary phylogenetic trees.
- `RegularLanguages/OIModules` a package for Macaulay2 computer algebra system for working with regular languages and finite state automata, used for equivariant Hilbert series computation.
- `NoetherianOperators` package for Macaulay2 computer algebra system for using differential operators to represent the multiplicity structure of primary components of schemes, and numerically computing local Hilbert functions.
- `EquivariantGB` package for Macaulay2 computer algebra system for computing equivariant Gröbner bases of algebraic systems with symmetric group symmetry.

VISITING PROGRAMS

- Sep–Dec 2018 ICERM Semester Program - Nonlinear Algebra (Brown University)
- Aug–Sep 2016 Fields Institute Program - Combinatorial Algebraic Geometry apprenticeship weeks (University of Toronto)
- Oct–Dec 2015 Fields Institute Program - Computer Algebra (University of Toronto)

Oct–Nov 2014	Simons Institute Program - Algorithms and Complexity in Algebraic Geometry (UC Berkeley)
Jul 2014	IMA PI Summer Program - Modern Applications of Representation Theory (University of Chicago)
Mar–Jun 2013	Research visit with Jan Draisma (TU Eindhoven)
Jun–Jul 2012	IMA PI Summer Program - Algebraic Geometry for Applications (Georgia Tech)

HONORS AND AWARDS

2016	Best Thesis Award, Georgia Institute of Technology - School of Mathematics
2015	Top Graduate Student Award, Georgia Institute of Technology - School of Mathematics
2014 Spring	Algorithms & Randomness Center Student Fellowship, Georgia Institute of Technology
2010–2014	President’s Fellowship, Georgia Institute of Technology

SERVICE

Spring 2020	Bay Area Discrete Math Day - co-organizer
Apr 2020	AMS Western Sectional mini-symposium on Algebraic Geometry in Statistics and Machine Learning - co-organizer
Winter 2018	UC Davis Mathematics for Data Science and Decision Making seminar - organizer
Fall 2018	ICERM Nonlinear Algebra postdoc seminar - co-organizer
Jul 2017	SIAM Conference on Applied Algebraic Geometry mini-symposium on Theory of Numerical Algebraic Geometry - co-organizer
Jan 2017	AMS Joint Meeting mini-symposium on Numerical Algebraic Geometry - co-organizer
2012–2013	Georgia Tech Research Horizons seminar - co-organizer
2010–2014	Georgia Tech High School Math Competition - problem writer and grader

INVITED TALKS AND POSTERS

Sep 2019	AMS Central Sectional Meeting (University of Wisconsin) Talk: “Typical coranks”
Sep 2019	San Francisco State University - Algebra Seminar Talk: “Matrices on the nonnegative rank boundary”
Jul 2019	SIAM Conference on Applied Algebraic Geometry (Bern University) Talk: “FI-algebras: examples and counterexamples”
Jul 2019	Summer School on Randomness and Learning in Non-Linear Algebra (MPI Leipzig) Talk: “Predictions and learning with random monomial ideals”
Sep 2018	Conference on Core Computational Methods in Nonlinear Algebra (ICERM) Talk: “Computational tools for FI-algebras”
Aug 2018	Representation Stability Week (University of Michigan) Talk: “Computational tools for FI-algebras”
Jul 2018	SIAM 2018 Annual Meeting (Portland, OR) Talk: “Dimensions of group-based phylogenetic mixtures”
Apr 2018	University of Kentucky - Algebra Seminar Talk: “FI-algebras”
Aug 2017	SIAM Conference on Applied Algebraic Geometry (Georgia Tech) Talk: “Modules over FI-algebras”
Jul 2017	Applied Macaulay2 Tutorials (Georgia Tech) Talk: “Degree of $SO(n)$ ”

Jan 2017 AMS Joint Mathematics Meeting (Atlanta)
 Talk: "The degree of the special orthogonal group"
 Nov 2016 AMS Southern Sectional Meeting (North Carolina State University)
 Talk: "Hilbert series of infinite symmetric ideals"
 Jul 2016 ISSAC 2016 (Wilfrid Laurier University)
 Talk: "Equivariant Gröbner Bases of Symmetric Toric Ideals"
 Jul 2016 SIAM 2016 Annual Meeting (Boston, MA)
 Talk: "Hilbert series of invariant ideals"
 Jun 2016 Georgia Tech - Algebra Seminar
 Talk: "Macaulay dual spaces and local Hilbert functions"
 Apr 2016 Free Resolutions, Representations, and Asymptotic Algebra workshop (BIRS)
 Talk: "Equivariant Gröbner bases"
 Feb 2016 York University - Applied algebra seminar
 Talk: "Noetherianity for infinite-dimensional symmetric toric varieties"
 Nov 2015 McMaster University - Algebra seminar
 Talk: "Numerical Primary Decomposition"
 Oct 2015 Route 81 Conference (Queen's University)
 Talk: "Equivariant Gröbner bases"
 Oct 2015 AMS Central Sectional Meeting (Loyola University)
 Talk: "Equivariant Gröbner bases of toric ideals"
 Sep 2015 CUNY - Symbolic-Numeric Computing seminar
 Talk: "Numerical primary decomposition"
 Apr 2015 Meeting on Algebraic Geometry and Applications (Georgia Tech)
 Talk: "Equivariant Gröbner basis algorithms"
 Nov 2014 San Jose State University - Combinatorics seminar
 Talk: "Finite generation of symmetric toric ideals"
 Oct 2014 UC Berkeley - Computational Algebraic Geometry seminar
 Talk: "Numerically detecting embedded components"
 Oct 2014 AMS Western Sectional Meeting (San Francisco State)
 Talk: "Finite generation of symmetric toric ideals"
 Talk: "Equivariant lattice generators and Markov bases"
 Oct 2014 UC Davis - CACAO seminar
 Talk: "Finite generation of symmetric toric ideals"
 Sep 2014 University of Georgia - Algebraic Geometry seminar
 Talk: "Finite generation of symmetric toric ideals"
 Jul 2014 ISSAC 2014 (Kobe University)
 Talk: "Equivariant lattice generators and Markov bases"
 Jul 2014 Workshop on applications of algebraic geometry and algebraic analysis (Kobe University)
 Talk: "Finite generation of symmetric toric ideals"
 Jun 2014 Computational Nonlinear Algebra conference (ICERM)
 Poster: "Numerical Primary Decomposition"
 Apr 2014 North Carolina State University - Symbolic Computation seminar
 Talk: "Noetherianity for infinite-dimensional toric ideals"
 Jan 2014 Macaulay2 Workshop (MSRI - UC Berkeley)
 Talk: "Equivariant Gröbner Bases"
 Aug 2013 SIAM Conference on Applied Algebraic Geometry (Colorado State)
 Talk: "Macaulay Dual Space and Numerical Primary Decomposition"
 Jun 2013 Effective Methods in Algebraic Geometry 2013 (Goethe-Universität)
 Talk: "Algorithms for equivariant Gröbner Bases"
 Jun 2013 DIAMANT Symposium 2013 (Heeze, Netherlands)
 Talk: "Noetherianity for infinite-dimensional toric varieties"
 Mar 2013 Technical University of Eindhoven - Discrete Mathematics seminar
 Talk: "Computing Equivariant Gröbner Bases"
 Oct 2012 RTG Workshop: Tensors and their Geometry in High Dimensions (UC Berkeley)

Apr 2012 Talk: "Algorithms for symmetric Gröbner bases"
 Texas Algebraic Geometry Symposium 2012 (Texas A&M)
 Oct 2011 Poster: "Numerical algorithms for dual bases of positive-dimensional ideals"
 SIAM Conference on Applied Algebraic Geometry (North Carolina State)
 Talk: "Numerical algorithms for dual bases of positive-dimensional ideals"

TEACHING

2020 Winter MATH 150A: Modern Algebra A
 2020 Winter MATH 22A: Linear Algebra
 2019 Fall MATH 108: Intro to Abstract Math
 2019 Spring MATH 16A: Short Calculus A
 2019 Winter MATH 108: Intro to Abstract Math
 2018 Winter MATH 16B: Short Calculus B
 2017 Fall MATH 67: Modern Linear Algebra
 2017 Fall MATH 16B: Short Calculus B
 2017 Winter MATH 228: Complex Analysis
 2016 Fall MATH 221: Vector Calculus
 2016 Spring APSC 172: Calculus II
 2016 Winter APSC 171: Calculus I
 2013 Fall Lead Instructor - MATH 1522: Linear Algebra
 2012 Fall Recitation TA - MATH 1512: Honors Calculus II
 2012 Spring Recitation TA - MATH 2605: Linear and Discrete Mathematics
 2011 Fall Recitation TA - MATH 2605: Calculus III for Computer Science
 2011 Spring Recitation TA - MATH 2602: Linear and Discrete Mathematics
 2010 Fall Recitation TA - MATH 2602: Linear and Discrete Mathematics
 2009–2010 Private Tutor - high school math and science