Eric M. Evert

Contact Information

Department of Mathematics
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Research Interests

Functional Analysis, Matrix Convex Sets, Extreme Points, Free Spectrahedra, Noncommutative Polynomials, Tensors, Multilinear Algebra, Low Rank Approximation

Education

University of California, San Diego, La Jolla, CA

Ph.D., Mathematics, September 2018

Dissertation Topic: *Extreme Points of Matrix Convex Sets*
Advisor: J. William Helton, Ph.D

Virginia Tech, Blacksburg, VA

B.S., Mathematics, May 2013

Summa Cum Laude
Honors Scholar

Honors Societies

Phi Beta Kappa
Pi Mu Epsilon

Research Experience

Assistant Professor — September 2022 to August 2024
Department of Mathematics,
University of Florida

Shaw Family CS+X Postdoctoral Fellow — September 2022 to August 2024
Department of Computer Science,
Northwestern University
Supervisor: Aravindan Vijayaraghavan, Ph.D

Postdoctoral Researcher — August 2018 to August 2022
Group Science, Engineering and Technology,
KU Leuven, Kulak
Supervisor: Lieven De Lathauwer, Ph.D

Research Assistant — June 2013 to August 2018
Department of Mathematics,
UC San Diego
Supervisor: J. William Helton, Ph.D

REU — Summer 2012
Department of Mathematics,
Central Michigan University
Supervisor: Sivaram K. Narayan, Ph.D

Refereed Journal Publications

1. A. Epperly, **E. Evert**, J.W. Helton, I. Klep: *Matrix extreme points and free extreme points of free spectrahedra*, published online in Optim. Methods Softw. (2024). https://doi.org/10.1080/10556788.2024.2339221

2. Domanov I., Vervliet N., **E. Evert**, L. De Lathauwer: *Decomposition of a tensor into multilinear rank-$(M_r, N_r, \cdot)$ terms*, SIAM J. Matrix Anal. Appl. **45** (2024) 1310–1334. https://doi.org/10.1137/23M1557246.

3. **E. Evert**, L. De Lathauwer: *On best low rank approximation of positive definite tensors* , SIAM J. Matrix Anal. & Appl. **44** (2023) 867–893. https://doi.org/10.1137/22M1494178

4. **E. Evert**, S. McCullough, T. Štrekelj, A. Vershynina: *Convexity of a certain operator trace functional*, Linear Algebra Appl. **643** (2022) 218–234. https://doi.org/10.1016/j.laa.2022.02.033

5. **E. Evert**, M. Vandecappelle, L. De Lathauwer: *Canonical polyadic decomposition via the generalized Schur decomposition*, IEEE Signal Process. Lett. **29** (2022) 937–941. https://doi.org/10.1109/LSP.2022.3156870

6. **E. Evert**, M. Vandecappelle, L. De Lathauwer: *A recursive eigenspace computation for the canonical polyadic decomposition*, SIAM J. Matrix Anal. Appl. **43** (2022) 274–300. https://doi.org/10.1137/21M1423026

7. **E. Evert**, L. De Lathauwer: *Guarantees for existence of a best canonical polyadic approximation of a noisy low-rank tensor*, SIAM J. Matrix Anal. Appl. **43** (2022) 328–369. https://doi.org/10.1137/20M1381046

8. **E. Evert**, Y. Fu, J.W. Helton, J. Yin: *Empirical properties of optima in free semidefinite programs*, published online in Experimental Mathematics (2021). https://doi.org/10.1080/10586458.2021.1980457

9. **E. Evert**: *The Arveson boundary of a free quadrilateral is given by a noncommutative variety*, Operators and Matrices. **15** (2021) 1351–1378. https://dx.doi.org/10.7153/oam-2021-15-85

10. **E. Evert**, J.W. Helton, S. Huang, J. Nie: *Efficient evaluation of noncommutative polynomials using tensor and noncommutative Waring decompositions*, Numer. Funct. Anal. Optim. **42** (2021) 39–68. https://doi.org/10.1080/01630563.2020.1859530

11. **E. Evert**, J.W. Helton: *Arveson extreme points span free spectrahedra*, Math. Ann. **375** (2019) 629–653. https://doi.org/10.1007/s00208-019-01858-9

12. **E. Evert**: *Matrix convex sets without absolute extreme points*, Linear Algebra Appl. **537** (2018) 287–301. https://doi.org/10.1016/j.laa.2017.09.033

13. **E. Evert**, J.W. Helton, I. Klep, S. McCullough: *Extreme points of matrix convex sets, free spectrahedra and dilation theory*, J. of Geom. Anal. **28** (2018) 1373–1498. https://doi.org/10.1007/s12220-017-9866-4

14. **E. Evert**, J.W. Helton, I. Klep, S. McCullough: *Circular free spectrahedra*, J. Math. Anal. Appl. 445 (2017) 1047–1070. https://doi.org/10.1016/j.jmaa.2016.07.011

15. K. Berry, M.S. Copenhaver, **E. Evert**, Y.H. Kim, T. Klingler, S.K. Narayan, S.T. Nghiem: *Factor posets of frames and dual frames in finite dimensions*, Involve 9 (2017) 237–248 http://dx.doi.org/10.2140/involve.2016.9.237

Accepted Articles

16. **E. Evert**, B. Passer, T. Štrekelj: *Extreme points of matrix convex sets and their spanning properties*, Accepted to the Springer reference work "Operator Theory" volume 2. https://arxiv.org/abs/2405.07924

Preprints

17. **E. Evert**: *Free extreme points span generalized free spectrahedra given by compact coefficients*, preprint https://arxiv.org/abs/2302.07382

Conference Papers

18. A. Bhaskara, **E. Evert**, V. Srinivas, A. Vijayaraghavan: *New Tools for Smoothed Analysis: Least Singular Value Bounds for Random Matrices with Dependent Entries*, To Appear in Annual ACM Symposium on Theory of Computing 2024.

19. **E. Evert**, M. Vandecappelle, L. De Lathauwer: *CPD computation via recursive eigenspace decompositions*, IEEE International Conference on Acoustics, Speech, and Signal Processing, May 2022. https://doi.org/10.1109/ICASSP43922.2022.9747288

20. **E. Evert**, Vervliet N., Domanov I., L. De Lathauwer: *Uniqueness result and algebraic algorithm for decomposition into multilinear rank-$(M_r, N_r, \cdot)$ terms and joint block diagonalization*, To appear at IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing, December 2023. https://ftp.esat.kuleuven.be/pub/stadius/nvervliet/evert2023uniquenessresult.pdf

Programming

E. Evert, M. de Oliveira, J. Yin, and J.W. Helton: NCSE 2.3: An NCAlgebra package for optimization over free spectrahedra, Feb. 2021. Available online. https://github.com/NCAlgebra/UserNCNotebooks/tree/master/NCSpectrahedronExtreme

Science communication

E. Evert, L. De Lathauwer: *Tensors and multilinear algebra: what and why*, Leuven.AI Stories, 2023. https://ai.kuleuven.be/stories/post/2023-01-10-tensorlab/

Presentations

Invited Conference Talks

Canadian Mathematical Society Winter Meeting	December 2023
IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing	December 2023
Conference of the International Linear Algebra Society	June 2023
SIAM Conference on Optimization	May 2023
Amer. Math Soc. Annual Meeting (JMM)	January 2023
International Symposium on Mathematical Theory of Networks and Systems	September 2022
Conference of the International Linear Algebra Society	June 2022
IEEE International Conference on Austics, Speech, and Signal Processing	May 2022
Operator theory talks for early researchers meeting	January 2022
Matrix Equations and Tensor Techniques IX	September 2021
International Workshop on Operator Theory and its Applications	August 2021
SIAM Conference on Applied Linear Algebra	May 2021
2TART Online Conference	June 2020
The International Council for Industrial and Applied Mathematics	July 2019
International Workshop on Operator Theory and its Applications	July 2018
Amer. Math Soc. Annual Meeting (JMM)	January 2018
Mathematics, Signal Processing and Linear Systems: New Problems and Directions	November 2017
International Workshop on Operator Theory and its Applications	July 2016

Contributed Conference Talks

International Workshop on Operator Theory and its Applications	July 2019
Great Plains Operator Theory Symposium	May 2018
Great Plains Operator Theory Symposium	May 2017

Other Talks

Structured Low-Rank Matrix/Tensor Approximation seminars at KU Leuven — July 2021, October 2019

Seminar at Tensor Methods and Emerging Applications to the Physical and Data Sciences long program hosted by Institute for Pure & Applied Mathematics — April 2021

Talks in Seminars at UC, San Diego

Research Programs

Noncommutative Inequalities, hosted by American Institute of Mathematics — June 2021

Tensor Methods and Emerging Applications to the Physical and Data Sciences, hosted by Institute for Pure & Applied Mathematics — March-June 2021

Schools

Summer School in Algebraic Statistics, hosted by The Arctic University of Norway — September 2018

EURASIP Summer School on Tensor-Based Signal Processing, hosted by KU Leuven — August 2018

Teaching Experience

University of Florida (Instructor) — Fall 2024 to Present

- MAA 6406: Complex Analysis — Fall 2024

Northwestern (Instructor) — Fall 2022 to Spring 2023

- CS 496: Mathematical and Computational Foundations of Tensors and Applications — Spring 2023
- CS 212: Mathematical Foundations of Computer Science — Fall, Winter 2023; Fall 2022

UC San Diego (Teaching Assistant) — Fall 2013 to June 2018

- Math 152: Applicable Math and Computing — Winter 2018
- Math 202A: Applied Algebra — Fall 2017
- Math 245C: Convex Analysis and Optimization — Spring 2017
- Math 202B: Applied Algebra II — Winter 2017
- Math 18: Linear Algebra — Fall 2016
- Math 10C: Calculus III — Winter 2015
- Math 20C: Calculus and Analytic Geometry for Science and Engineering — Fall 2013, Spring 2014
- Math 20D: Introduction to Differential Equations — Fall 2014, Winter 2016
- Math 20B: Calculus for Science and Engineering — Winter 2014, Fall 2015

Computational Experience

Computer Programming:

- Mathematica
  - Noncommutative Computer Algebra
  - Lead author of NCSE package for NCAlgebra
- Matlab
  - Tensorlab

Semidefinite and Linear Programming

Awards

UC San Diego, Department of Mathematics
Powell Dissertation Fellowship — December 2017

Virgina Tech, Department of Mathematics
Department of Mathematics Outstanding Senior — May 2013

Professional Memberships

American Mathematical Society
International Linear Algebra Society
Society for Industrial and Applied Mathematics