

LARA KASSAB

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EDUCATION

Doctorate of Philosophy in Mathematics Dec. 2021
Colorado State University Fort Collins, CO, USA
Advisor: Henry Adams
Thesis: *Iterative Matrix Completion and Topic Modeling Using Matrix and Tensor Factorizations*

Master of Science in Mathematics May 2019
Colorado State University Fort Collins, CO, USA
Advisor: Henry Adams
Thesis: *Multidimensional Scaling: Infinite Metric Measure Spaces*

Bachelor of Science in Mathematics May 2017
Lebanese American University, with high distinction Beirut, Lebanon

EMPLOYMENT

Assistant Adjunct Professor July 2022 – Present
University of California, Los Angeles, CA

Post Doctorate Research Associate Jan.-June 2022
Pacific Northwest National Lab, Seattle, WA

Graduate Teaching Assistant Aug.2017-Dec. 2021
Colorado State University, Fort Collins, CO

Data Science 4 All/Women Fellow Sept.-Oct. 2021
Correlation One (Remote)

Applied Science Intern May-Aug. 2021
Amazon Research Tübingen, Germany (Remote)

TEACHING EXPERIENCE

Colorado State University, Fort Collins, CO

- Instructor of Record for
MATH 255 – Calculus for Biological Scientists II Fall 2019 – Fall 2021
MATH 261 – Calculus for Physical Scientists III Spring 2019
MATH 155 – Calculus for Biological Scientists I Spring 2018, Fall 2018
- Calculus Center Tutor
MATH 161 – Calculus for Physical Scientists II Fall 2017
- Graduate Teaching Assistant Mentor
Graduate teaching assistant mentor for incoming 2020 graduate students 2020-21
- Co-taught a mini-course on *A visual introduction to geometric data analysis* with Henry Adams at the workshop Geometry: Education, Art, and Research (Online), Banff International Research Station, Feb 19-21, 2021.

RESEARCH EXPERIENCE

I am interested in many aspects of machine learning and most of my research focuses on mathematical methods for machine learning and data analysis.

Preprints

- *Weakly-Supervised Object Localization using Semi-Supervised Non-Negative Matrix Factorization* by E. Sizikova, J. Vendrow, R. Grotheer, J. Haddock, L. Kassab, A. Kryshchenko, T. Merkh, M. Rajapaksha, H. V. Vo, C. Wang, K. Leonard, D. Needell. Submitted, 2021.
- *Detecting Short-Lasting Topics using Nonnegative Tensor Decomposition* by L. Kassab, A. Kryshchenko, H. Lyu, D. Molitor, D. Needell, E. Rebrova. Submitted, 2021. Available at arXiv: 2010.01600.

Publications

- *TopTemp: Parsing Precipitate Structure from Temper Topology* by L. Kassab, S. Howland, H. Kvinge, K. Sahithi Kappagantula, T. Emerson. To appear in the 2022 ICLR Workshop on Geometric and Topological Representation Learning.
- *Semi-supervised NMF Models for Topic Modeling in Learning Tasks* by J. Haddock, L. Kassab, S. Li, A. Kryshchenko, R. Grotheer, E. Sizikova, C. Wang, T. Merkh, R. W. M. A. Madushani, M. Ahn, D. Needell, K. Leonard. Proc. 55th Asilomar Conf. on Signals, Systems, and Computers, Pacific Grove, CA, Nov. 2021. Extended version available at arXiv: 2010.07956. PyPI package `ssnmf`.
- *On Large-Scale Dynamic Topic Modeling with Nonnegative CP Tensor Decomposition* by M. Ahn, N. Eikmeier, J. Haddock, L. Kassab, A. Kryshchenko, K. Leonard, D. Needell, R. W. M. A. Madushani, E. Sizikova, C. Wang. Proc. Women in Data Science and Mathematics, Advances in Data Science, AWM-Springer series, 2020.
- *An Adaptation for Iterative Structured Matrix Completion* by H. Adams, L. Kassab, D. Needell. Journal version published in Foundations of Data Science 3:769–791, 2021. Conference version published in Proc. 54th Asilomar Conf. on Signals, Systems and Computers, Pacific Grove, CA, Nov. 2020.
- *On Nonnegative CP Tensor Decomposition Robustness to Noise* by J. Haddock, L. Kassab, A. Kryshchenko, and D. Needell. Proc. Information Theory and Applications (ITA), San Diego, CA, February 2020.
- *A torus model for optical flow* by H. Adams, J. Bush, B. Carr, L. Kassab, J. Mirth. Journal version published in Pattern Recognition Letters 129: 304-310, 2020. Conference version *On the nonlinear statistics of optical flow* published in Proceedings of Computational Topology in Image Context, LNCS volume 11382:151-165, 2019.
- *Multidimensional Scaling on Metric Measure Spaces* by H. Adams, M. Blumstein, L. Kassab. Rocky Mountain Journal of Mathematics 50:397-413, 2020.
- *Understanding the Center of 2×2 Linear Iterative Systems* by L. Kassab. Pi Mu Epsilon Journal, 14(8), 515-522, 2018 *.

Research Talks

- *TopTemp: Parsing Precipitate Structure from Temper Topology*, ICLR Workshop on Geometric and Topological Representation Learning, April 2022.
- *Multidimensional Scaling on Metric Measure Spaces*, AMS Special Session on Geometry in the Mathematics of Data Science, Joint Math Meetings, April 2022.
- *Detecting short-lasting topics using Nonnegative Tensor Decomposition*, Pacific Northwest Seminar on Topology, Algebra, and Geometry in Data Science, University of Washington, November 2021.
- *Detecting short-lasting topics using Nonnegative Tensor Decomposition*, Greenslopes Seminar, CSU, September 2021.
- *Semi-supervised Non-negative Matrix Factorization for Learning Tasks*, Data Science Seminar, CSU, September 2021.

*Undergraduate Paper

- *Multidimensional Scaling on Metric Measure Spaces*, Rainwater Seminar, Department of Mathematics, University of Washington, June 2021.
- *Semi-supervised Non-negative Matrix Factorization for Learning Tasks*, SIAM Front Range Applied Mathematics Student Conference, March 2021.
- *An Adaptation for Iterative Structured Matrix Completion*, Asilomar Conference on Signals, Systems, and Computers, November 2020
- *An Adaptation for Iterative Structured Matrix Completion*, AMS Virtual Fall Western Sectional Meeting, Contributed Paper Session, October 2020
- *Nonnegative CP Tensor Decomposition for Dynamic Topic Modeling*, AMS Virtual Fall Southeastern Sectional Meeting, Contributed Paper Session, October 2020
- *Analyzing COVID-19 Twitter Dynamics Using Nonnegative Matrix and Tensor Decompositions*, Invited talk at the Graduate Student Seminar, California State University, Channel Islands, September 2020
- *Analyzing COVID-19 Twitter Dynamics Using Nonnegative Matrix and Tensor Decompositions*, Data Science Seminar, CSU, September 2020
- *An Iterative Method for Structured Matrix Completion*, SIAM Front Range Applied Mathematics Student Conference, March 2020
- *Matrix Completion for Structured Observations Using Iteratively Reweighted Algorithms*, AMS Special Session on Iterative Methods for Large-Scale Data Analysis, Joint Math Meetings, January 2020
- *On Infinite Multidimensional Scaling*, Solving Problems in Applied Math Lab, CSU, February 2019
- *Understanding the Center of 2×2 Linear Iterative Systems*, MAA MathFest, Student Paper Session, August 2016

Poster Presentations

- *TopTemp: Parsing Precipitate Structure from Temper Topology*, ICLR Workshop on Geometric and Topological Representation Learning, April 2022.
- *Detecting short-lasting topics using Nonnegative Tensor Decomposition*, Joint Math Meetings, AWM Workshop Poster Session, April 2022
- *An Iterative Method for Structured Matrix Completion*, IPAM Workshop Poster Session, February 2020
- *On Infinite Multidimensional Scaling*, AWM Research Symposium, April 2019
- *Multidimensional Scaling: Infinite Metric Measure Spaces:*
 - Joint Math Meetings, AWM Workshop Poster Session, January 2019
 - Rocky Mountain Celebration of Women in Computing, November 2018
 - TRIPODS Summer Bootcamp on Topology and Machine Learning at ICERM, August 2018

Departmental Expository Talks

- *A Visual Introduction to Geometric Data Analysis*, Data Science Seminar, CSU, February 2021.
- *An Introduction to Compressive Sensing*, Solving Problems in Applied Math Lab, CSU, November 2019
- *Matrix Completion: Motivation and Intuitive Approaches to Algorithms*, Data Science Seminar, CSU, September 2019
- *Multidimensional Scaling: From Finite to Infinite Spaces*, Greenslopes Seminar, CSU, December 2018

WORKSHOPS ATTENDED

Workshops Attended

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|---|------------------------|
| · IPAM Workshop on Who Counts? Sex and Gender Bias in Data
Los Angeles, CA | Jul. 18-20, 2022 |
| · IPAM Graduate Summer School on Algorithmic Fairness
Los Angeles, CA | Jul. 11-15, 2022 |
| · ICERM Interdisciplinary Network Analysis Methods for Analyzing Social Systems
Providence, RI (Virtual) | Jun. 27 - Jul. 1, 2022 |
| · IPAM Workshop on Intersections between Control, Learning and Optimization
Los Angeles, CA | Feb. 24-28, 2020 |
| · WiSDM [†] Research Collaboration Workshop at ICERM
Providence, RI | Jul. 29 - Aug. 2, 2019 |

[†]Women in Data Science and Mathematics

- TRIPODS [‡] Summer Bootcamp on Topology and Machine Learning at ICERM Providence, RI Aug. 6-10, 2018
- MSRI [§] Summer Graduate School, Representations of High Dimensional Data, Berkeley, CA Jul. 9-20, 2018

ACADEMIC ACHIEVEMENTS AND AWARDS

Colorado State University, Fort Collins, CO

- Outstanding Graduate Teaching Assistant Award, Department of Mathematics, 2019-20
- Dr. Frank DeMeyer Fellowship in Mathematics, CSU, 2019-20
- Govan Travel Award, CSU, Spring 2019

Lebanese American University, Beirut, Lebanon

- Recipient of the Richard V. Andree Award 2018 for the journal article, *Understanding the Center of 2×2 Linear Iterative Systems*.
- Dean's Distinguished List from Fall 2014 to Spring 2017.
- Academic Scholarship from Fall 2014 to Spring 2017.

TECHNICAL SKILLS AND LANGUAGES

Computation

- Programming languages and tools: Python, MATLAB, R, Git, Jupyter Notebooks.
- Packages: Scikit-learn, PyTorch, Keras, Pandas, Matplotlib, Numpy, Scipy, Gensim, Spacy.

Languages

- Arabic - Native proficiency
- English - Full professional proficiency
- French - Professional working proficiency

Organization/Memberships

- Co-started and co-organized the Data Science Seminar at CSU Mathematics Department, Fall 2019 - Spring 2021
- CSU Student Chapter member of (2017-2021):
 - American Mathematical Society (AMS)
 - Society for Industrial and Applied Mathematics (SIAM)
 - Association for Women in Mathematics (AWM)

[‡]Transdisciplinary Research In Principles Of Data Science

[§]Mathematical Sciences Research Institute