Rebecca Morrison

Department of Computer Science
University of Colorado Boulder
1111 Engineering Drive
UCB 430, ECOT 820
Boulder, CO 80309

rebeccam@colorado.edu
CU Boulder
Personal
Github
Google Scholar

Positions

Assistant Professor, Dept. of Computer Science, University of Colorado Boulder, 2018 – present
Affiliate Faculty Member, Robotics Program

Postdoc, Dept. of Aeronautics and Astronautics, Massachusetts Institute of Technology, 2016 – 2018

Intern, Sandia National Laboratories, Albuquerque, NM, 2012

Student Researcher, International Research Experience for Students (IRES), Federal University of Ceará, Fortaleza, Brazil, 2008

Undergraduate Researcher, REU, University of California Davis, 2007

Undergraduate Researcher, Joint Science Department of the Claremont Colleges, 2005

Education

Ph.D. in Computational Science, Engineering, and Mathematics, The University of Texas at Austin, 2016

M.S. in Computational and Applied Mathematics, The University of Texas at Austin, 2012

B.A. in Physics, Scripps College, Awarded Magna cum Laude, Phi Beta Kappa, 2008

Honors & Awards

Computational and Applied Mathematics Fellowship, UT Austin, 2009 – 2013

Rudmose Department Fellowship, UT Austin, Physics Department, 2008

Dart/Merritt Award for the Outstanding Student in Engineering or Physics, Joint Science Department of the Claremont Colleges, 2008

Grants

NSF Formal Methods in the Field: *Verified Probabilistic Programming for Hybrid Systems* (Co-PI), with Dr. Sriram Sankaranarayanan (PI) and Dr. Gowtham Kaki (Co-PI) $875,000, 2024 – 2028

NASA Space Weather with Quantified Uncertainties: *Ensemble Learning for Accurate and Reliable Uncertainty Quantification* (Co-PI), with Dr. Enrico Camporeale (PI) and Dr. Thomas Berger (Co-PI) $2,891,954 (My portion: $469,299), 2020 – 2023

Johnson & Johnson Women in STEM2D Award: *Discovering Dynamic Structure from Data* (PI), $150,000, 2019 – 2022

Association for Women in Mathematics/NSF Travel Grant, $600, 2017

Publications

† (Co-)first author, otherwise listed first; * Graduate student, ** Undergraduate student

Journal Articles

1. R. Morrison, E. Basor. Exact mean and covariance formulas after diagonal transformations of a multivariate normal. (In review)

2. T. Price-Broncucia*, A. Baker, D. Hammerling, M. Duda, R. Morrison. The Ensemble Consistency Test: From CESM to MPAS and Beyond. (In review)

3. P. W. Marcy, R. Morrison. "Stochastic Inverse Problems" and Changes-of-Variables. arxiv.org/abs/2211.15730 (In review)

4. S. Leventhal*, S. Edie, R. Morrison, C. Simpson. Origin of division of labor is decoupled from polymorphism in colonial animals. *PNAS Nexus,* 2024, p476.

5. E. Basor, R. Morrison†. Analytic solutions to nonlinear ODEs via spectral power series. *Linear Algebra and its Applications.* 697, 561-582 (2024).

6. R. Baptista*†, R. E. Morrison†, O. Zahm, Y. Marzouk. Learning non-Gaussian graphical models via Hessian scores and triangular transport. *Journal of Machine Learning Research* 25(85):1-46, 2024.

7. R. Bandy*, R. Morrison. Stochastic model corrections for reduced Lotka-Volterra models exhibiting mutual, competitive, and predatory interactions. *Chaos* 34, 013116 (2024).

8. R. E. Morrison, R. Baptista*, E. Basor. Diagonal nonlinear transformations preserve structure in covariance and precision matrices. *Journal of Multivariate Analysis*, 104983 (2022).

9. M. Tosin, E. Dantas, A. Cunha, R. E. Morrison. ARBO: Arbovirus Modeling and Uncertainty Quantification Toolbox. *Software Impacts* 12, 100252 (2022).

10. R. E. Morrison. Exact reduction of the generalized Lotka-Volterra equations via integral and algebraic substitutions. *Computation* 2021 (9)5, 49.

11. R. E. Morrison. Data-driven corrections of partial Lotka-Volterra models. *Entropy* 2020 (22)11, 1313.

12. R. E. Morrison, A. Cunha. Embedded discrepancy operators: A case study of Zika modeling. *Chaos* 30(5):051103 (2020).

13. R. E. Morrison, T. A. Oliver, R. D. Moser. Representing model inadequacy: A stochastic operator approach. *ASA/SIAM Journal on Uncertainty Quantification* 6 (2), 457-496 (2018).

14. R. E. Morrison, C. M. Bryant, G. Terejanu, S. Prudhomme, K. Miki. Data partition methodology for validation of predictive models. *Computers and Mathematics with Applications*, 66 (10), 2114-2125 (2013).

15. R. E. Morrison, A. S. Landsberg, E. J. Friedman. Combinatorial games with a pass: A geometric approach. *Chaos* 21, 043108 (2011).

Peer-Reviewed Conference Papers

1. R. Bandy, R. Washington*, R. Morrison, T. Portone. Isolating and Quantifying Uncertainties in the Vibration Isolation Round-Robin Challenge. (Submitted)

2. S. Liaw**, R. Morrison, Y. Marzouk, R. Baptista. Learning local neighborhoods of non-Gaussian graphical models. (In review)

3. T. Price-Broncucia*, S. Amorese**, R. Baptista, R. Morrison. A probabilistic graphical model approach to interpret, verify, and decouple multi-physics systems. *Proceedings of 16th World Congress in Computational Mechanics*, 2024.

4. R. Bandy*, T. Portone, R. Morrison. Stochastic Model Correction for the Adaptive Vibration Isolation Round-Robin Challenge. *Proceedings of IMAC-XLI Conference and Exposition 2024.*

5. T. Price-Broncucia*, R. Morrison. Ultra-short time batching and unscented Kalman inversion for calibration of expensive chaotic models. *United States National Congress on Computation Mechanics 2023*, Albuquerque, NM. **UQ Student Paper Competition Semi-Finalist.** (No proceedings recorded.)

6. T. Price-Broncucia*, R. Morrison. Multi-time unscented Kalman inversion for calibration of expensive chaotic models. *14th International Conference on Applications of Statistics and Probability in Civil Engineering 2023*, Dublin, Ireland. **2023 CERRA Student Recognition Award.**

7. R. Bandy*, R. Morrison. Quantifying model form uncertainty in spring-mass-damper systems. In *Society for Experimental Mechanics Annual Conference and Exposition*, p9-19. Springer Nature Switzerland, 2023. **Best Paper Award.**

8. R. E. Morrison, R. Baptista, Y. Marzouk. Beyond normality: Learning sparse probabilistic models in the non-Gaussian setting. *Advances in Neural Information Processing Systems 30 (NeurIPS 2017)*, 11 pages. (Acceptance rate: 21%)

9. R. E. Morrison, C. M. Bryant, G. Terejanu, K. Miki, S. Prudhomme. Optimal data split methodology for model validation. *Proceedings of the World Congress on Engineering and Computer Science 2011*, p1038-1043. (Acceptance rate: 53%) **Best Student Paper Award.**

Theses

1. PhD Dissertation: *On the representation of model inadequacy: A stochastic operator approach*, Advisor: Prof. Robert Moser, UT Austin, 2016

2. Honors Senior Thesis: *From geometry to perturbation theory in combinatorial games: A case study of the game of Nim with a pass*, Advisor: Prof. Adam Landsberg, Scripps College, 2008

Software

1. Nonparanormal covariance (examples). R. Morrison.

2. TransportMaps. D. Bigoni, A. Spantini, R. Baptista, R. Morrison.

3. ARBO: Arbovirus Modeling and Uncertainty Quantification Toolbox. M. Tosin, E. Dantas, A. Cunha, R. Morrison.

4. Zika. R. Morrison, A. Cunha.

5. Enriched-GLV. R. Morrison.

In the News

Group profile by Grace Wilson CU Boulder, CS Department 5/4/24

Interview with Jessie Finocchiaro CU Boulder CS Neural Network, 4/23/21

Covid models show how to avoid future lockdowns Scientific American, 11/24/20

Covid-19: Why most virus models are wrong Westword, 05/12/20

Scientists develop tool to improve disease model accuracy CU Boulder Today, 05/05/20

Presentations & Other Workshops

Colloquia & Invited Talks

MD Anderson, Image-Driven Biology-Informed Therapy Program Seminar Series, (Virtual) 4/29/24

Space Weather Workshop, Boulder, CO, 4/18/24

IU Bloomington, IMAG (Interagency Modeling and Analysis Group)/ MSM (Multiscale Modeling) Viral Pandemics Seminar, (Virtual) 4/4/24

Two Sigma Academic Seminar, New York City, NY, 3/14/24

CU Boulder, Data Buffs (Student Chapter of the American Statistical Society) Meeting, Boulder, CO, 11/6/23

Santa Fe Institute, NSF Workshop: Crosscutting Needs for Digital Twins, Santa Fe, NM, 10/12/23

CU Boulder, Computer Science Colloquium, Boulder, CO, 9/7/23

Emory University, Mathematics Colloquium, Atlanta, GA, 8/31/23

Institute for Computational and Experimental Research in Mathematics (ICERM), Workshop on Optimal Transport in Data Science, Providence, RI, 5/11/23

Colorado School of Mines, Applied Mathematics and Statistics Colloquium, Golden, CO, 5/5/23

USACM TTA (Technical Thrust Area) on UQ and Probabilistic Modeling Seminar, **First talk of new seminar series**, (Virtual) 2/10/21

Rio de Janeiro State University, Computer Science Colloquium, (Virtual) 8/25/21

Caltech CMX (Computational Mathematics + X) Colloquium, (Virtual) 12/9/20

Potsdam Institute for Climate Impact Research, Workshop on Uncertainties in Data Analysis **Keynote**, (Virtual) 10/1/20

Computing Research Association (CRA) 2020 Virtual Conference Lightning Talk, **Contest winner** (Selected to appear on CRA website)

Argonne National Laboratory, Laboratory for Applied Mathematics, Numerical Software, and Statistics (LANS) Seminar, (Virtual) 5/20/20

CU Boulder, Applied Math Colloquium, Boulder, CO, 9/27/19

Statistical and Applied Mathematical Sciences Institute (SAMSI), Workshop on Statistical Perspectives on Uncertainty Quantification, Research Triangle Park, NC, 5/17/19

Johnson & Johnson Women in STEM2D Scholars Award Symposium, New Brunswick, NJ, 4/24/19

Banff International Research Station, Workshop on Computational Uncertainty Quantification, Banff, Canada, 10/9/17

Stanford, Institute for Computational Mathematics and Engineering, *Talks Seminar, Palo Alto, CA, 5/1/17

CU Boulder, Computer Science Colloquium, Boulder, CO, 4/13/17

MIT, Aerospace Computational Design Laboratory Seminar, Cambridge, MA, 2/26/16

UT Austin, Babuška Forum Seminar Series at The Oden Institute, Austin, TX, 9/28/12

Sandia National Laboratories, Org. 1544 (Validation and UQ) Seminar, Albuquerque, NM, 8/15/12

Conference Talks

SIAM Conference on Uncertainty Quantification, Trieste, Italy, 2/27/24

SIAM Conference on Mathematics of Data Science, San Diego, CA, 9/29/22

SIAM Conference on Uncertainty Quantification, (Virtual) 4/15/22

International Conference of the Engineering Mechanics Institute, (Virtual) 3/24/21

2nd Symposium on Machine Learning and Dynamical Systems, The Fields Institute, (Virtual) 9/21/20

SIAM Conference on Dynamical Systems, Snowbird, UT, 5/20/19

SIAM Conference on Computational Science & Engineering, Spokane, WA, 3/01/19

World Congress on Computational Mechanics, New York City, NY, 7/24/18

SIAM Conference on Uncertainty Quantification, Lausanne, Switzerland, 4/18/18

SIAM Conference on Computational Science & Engineering, Atlanta, GA, 3/01/17

Probabilistic Mechanics and Reliability Conference, Nashville, TN, 5/24/16

SIAM Conference on Uncertainty Quantification, Lausanne, Switzerland, 4/07/16

APS Division of Fluid Dynamics Annual Meeting, Boston, MA, 11/24/15

13th US National Congress on Computational Mechanics, San Diego, CA, 7/27/15

SIAM Workshop Celebrating Diversity, Salt Lake City, UT, 3/16/15

SIAM Conference on Computational Science & Engineering, Salt Lake City, UT, 3/14/15

APS Division of Fluid Dynamics Annual Meeting, San Francisco, CA, 11/25/14

SIAM Conference on Uncertainty Quantification, Savannah, GA, 4/01/14

SIAM Conference on Uncertainty Quantification, Raleigh, NC, 4/05/12

The World Congress on Engineering and Computer Science 2011, Berkeley, CA, 10/20/11

SIAM Conference on Dynamical Systems, Snowbird, UT, 5/19/09

Posters

Reducing Dimensions and Cost for UQ in Complex Systems Workshop, Newton Institute, Cambridge, England, 3/5/18

Neural Information Processing Systems (NeuRIPs), Long Beach, CA, 12/4/17

Uncertainty Quantification Workshop, ICERM, Providence, RI, 10/10/12

Uncertainty Quantification Summer School, The University of Southern California, Los Angeles, CA, 8/23/12

Predictive Science Academic Alliance Program (PSAAP) Meeting, University of Michigan, Ann Arbor, MI, 8/9/12

Large-Scale Inverse Problems and Quantification of Uncertainty Workshop, Institute for Mathematics and its Applications (IMA), Minneapolis, MN, 6/8/11

Uncertainty Quantification for Multiphysics and Multiscale Systems Workshop, The University of Southern California, Los Angeles, CA, 3/7/11

Other Workshops, etc.

Rigorous and Reproducible Scientific Reasoning (R2SR) NSF Workshop, CU Boulder, CO, 11/(13–14)/23

50th Anniversary Workshop, The Oden Institute for Computational Engineering & Sciences, UT Austin, 9/21/23

US National Congress on Computational Mechanics, Albuquerque, NM, 7/(23–27)/23

Scientific Machine Learning Workshop, Banff International Research Station, Banff, Canada, 6/(19–23)/23

Space Weather with Quantification of Uncertainty Workshop, MIT, Cambridge, MA, 3/(9–10)/23

Climate Informatics Workshop, National Center for Atmospheric Research, Boulder, CO, 9/(20–21)/18

MIT Statistics and Data Science Center Day (SDSCon 2017), Cambridge, MA, 4/21/17

Uncertainty Quantification and Data-driven Modeling Workshop, Sandia/The Oden Institute, UT Austin, TX, 3/(23–24)/17

Integrated Analysis for Agricultural Management Strategies Workshop, American Institute of Mathematics (AIM), San Jose, CA, 5/(4–8)/15

Large-Scale Inverse Problems and Quantification of Uncertainty: Big Data Meets Big Models Workshop, Santa Fe, NM, 5/(22–24)/13

Association for Women in Mathematics (AWM) Research Symposium, Santa Clara University, CA, 3/(16–17)/13

Uncertainty Quantification School taught by Tony O'Hagan, UT Austin, TX, 10/(3–4)/11

SAMSI/Sandia Summer School on Uncertainty Quantification, Albuquerque, NM, 6/(20–24)/11

Women in Theory Workshop, Princeton, NJ, 6/(19–23)/10

Student Advising

PhD

Ujas Shah, 2024 – present

Noah Peterson, 2023 – present

Teo Price-Broncucia, 2019 – present

Rileigh Bandy, 2019 – 2024

Thesis: *Uncertainty Representations in White- and Black-Box Models: Quantifying Model-Form and Measurement Errors in Computational Science* (defended 5/8/24)

Next/current position: Postdoc at Sandia National Lab

Master's

Rachel Washington (Summer intern), 2024

Undergraduate

Sienna Amorese (Applied Math), Senior Thesis, 2024 – present

Daniel Crook, Discovery Learning Apprenticeship (DLA), 2020 – 2021

Michael Donovan, DLA, 2020 – 2021

As Committee Member

(Only most recent exam listed, if multiple)

Phd Thesis:

Mike McCabe (CS) 4/2/24; Basu Parmar (AERO) 7/17/23; Jingwei Li (CS) 4/10/23; Chou Yi (CS) 7/9/21; Sebastian Laudenschlager (CS) 5/27/21; Felix Newberry (AERO) 4/2/21; Zhiyuan Liu (CS) 4/1/21; Tristan Konolige (CS) 4/2/20; Paul Diaz (AERO) 2/25/20; Eric Peters (AERO) 5/3/19

PhD Area/Comprehensive Exam:

Leila Ghaffari (CS) 5/15/23; Ren Stengel (CS) 11/17/22; Sarah Gage (CS) 11/8/19

Senior Thesis:

Saurabh Totey (PHYS) 5/4/23

Courses Taught & Developed

Course number: Title; Semester (Enrollment)

CSCI 2820: Linear Algebra with Computer Science Applications; S19 (73) Redesign, F19 (77), F22 (78)

CSCI 4802/5802: Data Science Team; F20 (20), S21 (41)

CSCI 5646: Numerical Linear Algebra; F23 (35)

CSCI 5822: Probabilistic Models of Human and Machine Intelligence; S21 (42), S23 (26)

CSCI 6110: Graduate Writing Workshop; F21 (24) New Course, F23 (13)

CSCI 6166: Validation and Uncertainty Quantification for Computational Models; F18 (3) New Course, S20 (5)

CSCI 7000: Research & Reading Group UPSCALE (**U**ncertainty, **P**robability, **S**cientific **C**omputing **A**nd **LE**earning); S24 (13)

Faculty Founder and Sponsor F19 – present, About 10–15 students & postdocs

Independent Study; F18 (1), F19 (1), S21 (1), F23 (1), S24 (2)

Teaching & Professional Development

Fall 2020 Diversity and Inclusion Summit, CU Boulder, 11/10/20

"What's Your Plan? A Symposium on Education for Fall 2020," College of Engineering and Applied Science, CU Boulder, 7/27/20

2020 Career Mentoring Workshop, Computing Research Association (CRA), Washington DC, 2/(27–28)/20

Introductory Leadership Training Workshop, Leadership Education for Advancement & Promotion (LEAP), CU Boulder, 1/(8–9)/20

New Assistant Professor Program Certificate, Faculty Teaching Excellence Program (FTEP), CU Boulder, 2018-19

Kaufman Teaching Certificate Program (Intensive 2-Week Course), MIT, 5/29 – 6/15/18

NSF CISE CAREER Proposal Writing Workshop, Washington, DC, 4/(9–10)/18

Professional Service

Member of the SIAM Committee for the Joint Math Meetings (JMM), 2024 – 2026

Program Director for SIAM Data Science Activity Group, 2024 – 2025

Member of the SIAM Annual 2025 Organizing Committee (Representative from SIAG/DATA)

Mentor for the Computational Mechanics Student Mentorship Program (CMSMP), USACM Student Chapter, 2024 – present

Mentor for the Johnson & Johnson Women in STEM2D Program, 2024 – present

NSF Reviewer, 2024 (x2)

Co-Organizer for Minisymposium at SIAM UQ 2024

Reviewer for NCWIT Award for Aspirations in Computing 2024

NSF Reviewer, 2023

Faculty Mentor with Peak to Peak Charter School (Lafayette, CO), 2023

Reviewer for NCWIT Award for Aspirations in Computing 2023

"Lunch Mentor" at USNCCM17 Mentoring Event, Albuquerque, NM, 7/24/23

Secretary for SIAM UQ Activity Group, 2021 – 2022

Co-Organizer for Minisymposium at ECCOMAS 2022

Co-Organizer for Minisymposium at SIAM UQ 2022

Poster Judge at SIAM Mathematics of Data Science, San Diego, CA, 9/28/22

Reviewer for NCWIT Award for Aspirations in Computing 2021

Co-Organizer for Minisymposium at USNCCM 2021

Organizer for Workshop Celebrating Diversity at SIAM Annual 2020

Reviewer for NCWIT Award for Aspirations in Computing 2020

Organizer for Workshop Celebrating Diversity at SIAM CSE 2019

"Breakfast Mentor" at Rocky Mountain Celebration of Women in Computing, 11/2/18

Volunteer Tutor for 8th grade math, with Austin Partners in Education (APIE), 2013 – 2014

Reviewer for (Journals, Proceedings, & Books):
Advances in Neural Information Processing Systems (NeurIPS), Chaos, Computational Science and Engineering, Computer Methods in Applied Mechanics and Engineering, Discrete Applied Mathematics, Entropy, Games of No Chance, IEEE/ACM Transactions on Networking, International Conference on Machine Learning (ICML), International Journal of Uncertainty Quantification, Machine Learning: Science and Technology, Mathematical Reviews, Mathematics, The MIT Press, Nature Computational Science, Nonlinear Dynamics, Pattern Recognition Letters, Physica D, SIAM Journal on Scientific Computing, SIAM/ASA Journal on Uncertainty Quantification, Space Weather

University Service

CEAS NSF GRFP Introductory Workshop, 7/18/24

CS Executive Committee Member, 08/2023 – present

CS Faculty Search Committee Member, 2023 – 2024

CEAS NSF GRFP Introductory Workshop, 7/10/23

CS Faculty Search Committee Member, 2022 – 2023

AB Nexus Reviewer, 2023

Representative for the CS Junior Faculty Assembly, 2022

CS Graduate Curriculum Committee Member, 01/2020 – 12/2021

ECEE Faculty Search Committee Member, 2020 – 2021

Reviewer for Johnson&Johnson WiSTEM2D Award (Internal review), 2021

Faculty Mentor for the BOLD Center RedShirt S-STEM Program, 2019 – 2020

Covid-19 CEAS Working Group Member, Summer 2020

Reviewer for Johnson&Johnson WiSTEM2D Award (Internal review), 2020

CS Undergraduate Curriculum Committee Member, 08/2018 – 12/2019

School of Computing Task Force Member, Spring 2019

Organizer for Babuška Forum Series (UT Austin), with Professor Ivo Babuška, 2013 – 2014

Membership

Association for Women in Mathematics (AWM)

Mathematical Association of America (MAA)

Society for Industrial and Applied Mathematics (SIAM)

United States Association for Computational Mechanics (USACM)