

Carlos Llosa

Statistician, AI researcher, Computational Scientist

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Research Program and Leadership

- Statistical Methods:** Develop statistical methods for tensor-valued and other high-dimensional data, as motivated by applications in imaging reconstruction, remote sensing, cyber security, cryptography, and other mission-relevant settings where matrix-based modeling quickly becomes impractical.
- Statistical Theory:** Study the statistical foundations of existing methods, including identifiability, Fisher information, error bounds, and asymptotic behavior, to understand when structured models are reliable and how they can be used more rigorously in applied and high-consequence settings.
- Artificial Intelligence:** Extend tensor and information-theoretic ideas to foundation language and image models through Fisher-information analysis and low-rank tensor parameterizations. Reduce model size to accelerate training and inference while improving interpretability, uncertainty characterization, reliability, and AI credibility in high-consequence applications.
- Leadership:** Build collaborative research efforts across statistics, machine learning, and scientific computing through proposal development, student/staff mentoring, software development, and partnerships between Sandia researchers and external academic collaborators.

Leadership and Mentoring

Led research efforts involving up to 8 students, staff, and external collaborators across overlapping projects.

- Proposals Funded**
- *Tocosh: Developing Theoretical Underpinnings for Miniaturizing Large Language Models Using the Fisher Information Matrix.* Laboratory Directed Research and Development. Co-Principal Investigator, 2027-2029.
 - *GMLMs: Generalized Multilinear Models for Effectively Leveraging Complex Structure in Remote Sensing and Cybersecurity Regression and Prediction Mission Problems.* Laboratory Directed Research and Development. Principal Investigator, 2025-2027.
 - *Robust and Unrolled GMLMs for Efficient Remote Sensing Applications (subcontract with University of Illinois Urbana-Champaign)* Laboratory Directed Research and Development. Principal Investigator, 2025-2027.
- Student Supervision**
- Georgios Avdis (graduate), University of Illinois Urbana-Champaign Dept of Statistics, 2026-present
 - John Hood (graduate), University of Chicago Department of Statistics, 2026-present
 - Kyle Ritscher (graduate), University of California Los Angeles Department of Statistics, 2025-present
 - Kimmie Harding (undergraduate), New Jersey Institute of Technology, 2025-present
 - Nick Bampton (graduate), University of Illinois Urbana-Champaign Department of Electrical Engineering, 2024-present
- Mentored staff**
- Olivia Beck, Sandia National Laboratories, 2025-2026
 - Jeremy Myers, Sandia National Laboratories (currently at Qualcomm), 2024-2025

Software Development

- pyttb** A Sandia-developed Python package for sparse and structured tensor operations. Contribute optimized tensor operations and tensor classes for large-scale multilinear computation.
- totr** A R package for tensor-on-tensor regression under Gaussian responses and multiple low-rank parameterizations. Lead developer and maintainer.
- gtotr** A Sandia-developed Python package for tensor-on-tensor regression under low-rank CP parameterization, and general response distributions. Co-lead developer and maintainer.
- ptotr** A Sandia-developed Python package for tensor-on-tensor regression of ultra-sparse Poisson responses. Co-lead developer and maintainer. Under review for open-source release.

Education

- 2016 - 2022 **PhD in Statistics**, *Iowa State University*, Ames, IA
Thesis: Statistical methods for tensor-valued data
Advisor: Ranjan Maitra
- 2016 - 2022 **MS in Statistics**, *Iowa State University*, Ames, IA
Thesis: Tensor on tensor regression with tensor normal errors and tensor network states
Advisor: Ranjan Maitra
- 2011 - 2015 **BS in Mathematics and Chemistry**, *The University of Arizona*, Tucson, AZ

Employment History

- 2022–now **Senior Member of Technical Staff**,
Department of Statistical Sciences, Sandia National Laboratories
- Develop statistical methods for high-dimensional data, with emphasis on low-rank tensor models, tensor regression, covariance modeling, identifiability, Fisher-information-based analysis, and scalable inference, motivated by mission applications in sensing, imaging, and networked systems.
 - Build efficient algorithms for factored and sparse tensor computations, especially in settings where dense representations are computationally infeasible or cannot be stored explicitly in memory.
 - Lead proposal development and contribute to proposal strategy, including Laboratory Directed Research and Development and related research efforts; maintain active collaborations with internal and external researchers in statistics, machine learning, signal processing, and scientific computing; and mentor graduate students and early-career staff.
 - Serve the research community as an associate editor for a statistics journal and as a reviewer in statistics, machine learning, signal processing, and scientific computing journals.
- 2019–2022 **Research Assistant**, *Department of Statistics*, Iowa State University
- Developed novel statistical methodology for quantitative forensic fracture-surface matching using 3D microscopy, spectral analysis, and matrix-variate classification models.
 - Designed and analyzed matrix-response gauge R&R methods to assess repeatability, reproducibility, and operator effects in forensic fracture measurement systems.
- 2016–2019 **Teaching Assistant**, *Department of Statistics*, Iowa State University
- Led weekly laboratory sections for introductory statistics (STAT 101) with approximately 40 students, providing instruction, student support, and grading.
 - Instructed business statistics (STAT 226) over two academic years (four semesters), teaching biweekly classes to approximately 70 students, and contributing to grading and exam writing.

Professional Service

- Professional Memberships
- American Statistical Association (ASA)
 - Society for Industrial and Applied Mathematics (SIAM)
 - Association for Computing Machinery (ACM)
- Society Leadership
- President of the Iowa Chapter of the ASA (2021-2022)
 - Vice-president of the Iowa Chapter of the ASA (2020-2021)
- Editorial Work
- Associate editor (2025-2027) for [Sankhya B – The Indian Journal of Statistics](#).
I oversee peer review and editorial decisions for submitted manuscripts.
- Peer-Review
- I have reviewed manuscripts for the following journals:
- IEEE Transactions on Pattern Analysis and Machine Intelligence (ongoing)
 - IEEE Transactions on Signal Processing (two times)
 - Annals of Statistics
 - Pattern Recognition (two times)
 - Statistical Analysis and Data Mining: An ASA Data Science Journal
 - Communications in Statistics - Simulation and Computation
 - Sankhya B – The Indian Journal of Statistics (three times)
 - Statistics Surveys (two times)
- Sessions Chaired
- Contributed Sessions Chair at the Joint Statistical Meetings (JSM) for years 2023-4.
 - I am a co-organizer of the Minisymposium *Statistical Modeling Meets Tensor Modeling*, at the upcoming SIAM Conference on Mathematics of Data Science (MDS26, 12 invited speakers).

Awards

- Up & Coming Innovator. *14th Annual Innovation Celebration*. Sandia National Laboratories. 2023.
- Research Excellence Award. *Department of Statistics*. Iowa State University. 2022.
- Runner-up for best paper award titled *Tensor-variate Elliptically Contoured distributions with Application to Image Learning*. Statistical Methods in Imaging Student Paper Competition. American Statistical Association. 2022.
- First Place for best paper award titled *Reduced-Rank Tensor-on-Tensor Regression and Tensor-variate Analysis of Variance*. JSM Section on Imaging Statistics Student Paper Competition. American Statistical Association. 2022.
- Spósito Statistical Computing Award. *Department of Statistics*. Iowa State University. 2021.
- People's Choice Award. *2021 Three Minute Thesis (3MT) Competition*. Iowa State University. 2021.
- Teaching Excellence Award. *Department of Statistics*. Iowa State University. 2020.

Peer-Reviewed Publications

- 2026 **C.Llosa-Vite** and D.M.Dunlavy, *Poisson-response Tensor-on-Tensor Regression and Applications*. (Under Review) [arXiv:2604.07377](https://arxiv.org/abs/2604.07377)
- 2025 **C.Llosa-Vite**, D.M.Dunlavy, R.B.Lehoucq, O.López, A.Prasadan, *A Latent-Variable Formulation of the Poisson CP Tensor Model: Maximum Likelihood Estimation and Fisher Information*. (Under Review) [arXiv:2511.05352](https://arxiv.org/abs/2511.05352)
- 2025 O.López, A.Prasadan, **C.Llosa-Vite**, R.B.Lehoucq, D.M.Dunlavy, *Near-Efficient and Non-Asymptotic Multiway Inference*. (Under Review) [arXiv:2511.05368](https://arxiv.org/abs/2511.05368)
- 2024 **C.Llosa-Vite**, R.Maitra, *Elliptically-Contoured Tensor-variate Distributions with Application to Image Learning*. ACM Transactions on Probabilistic Machine Learning, 1.1. [DOI:10.1145/3675161](https://doi.org/10.1145/3675161)
- 2024 J.Adams, B.Berman, T.Buchheit, **C.Llosa-Vite**, S.Reza, *Recent Advances in Functional Data Analysis for Electronic Device Data*. 2024 8th IEEE Electron Devices Technology & Manufacturing Conference (EDTM). [DOI:10.1109/EDTM58488](https://doi.org/10.1109/EDTM58488)
- 2022 **C.Llosa-Vite**, R.Maitra, *Reduced-rank tensor-on-tensor regression and tensor-variate analysis of variance*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 45.2. [DOI:10.1109/TPAMI.2022.3164836](https://doi.org/10.1109/TPAMI.2022.3164836)
- 2022 B.Dawood, **C.Llosa-Vite**, G.Z.Thompson, B.K.Lograsso, L.K.Claytor, J.Vanderkolk, W.Q.Meeker, R.Maitra, A.Bastawros *Quantitative matching of forensic evidence fragments utilizing 3D microscopy analysis of fracture surface replicas*. Journal of Forensic Sciences, 67.3, [DOI:10.1111/1556-4029.15012](https://doi.org/10.1111/1556-4029.15012)

Technical Reports

- 2025 - 09 Daniel M. Dunlavy, Richard B. Lehoucq, **Carlos Llosa-Vite**, Oscar F. Lopez, Arvind Prasad, LDRD Final Report: Probabilistic Error Bounds for Low-Rank Tensor Decompositions Used in Large-Scale Data Analysis Applications, *Technical Report Number SAND2025-11681R* [\[URL\]](#)

Recent Presentations (2022-present)

- 2026 – 08 (upcoming invited talk) GToTR: The Generalized Tensor-on-Tensor Regression Model, *The 27th International Conference on Computational Statistics (COMPSTAT)*
- 2026 – 08 (upcoming contributed talk) Poisson-response Tensor-on-Tensor Regression and Applications, *2026 Joint Statistical Meetings (JSM)*
- 2026 – 05 (invited talk) GToTR: The Generalized Tensor-on-Tensor Regression Model, *UCLA Department of Statistics, Department Seminar*
- 2026 – 03 (invited talk) GToTR: The Generalized Tensor-on-Tensor Regression Model, *University of Illinois Urbana-Champaign, Signals, Inference, and Networks Seminar*
- 2026 – 02 (invited talk) GToTR: The Generalized Tensor-on-Tensor Regression Model, *Purdue University Department of Statistics, Department Seminar*
- 2025 – 12 (invited talk) The Generalized Multilinear Model, *19th International Conference on Computational and Methodological Statistics (CMStats)*
- 2025 – 05 (contributed poster) The Generalized Multilinear Model, *IMSI workshop on Statistics Meets Tensors: Methodology, Theory, and Applications*

- 2025 – 02 (invited talk) Poisson-response Tensor-on-Tensor Regression and Applications, *ASA Statistics in Imaging Virtual Working Group Colloquium*
- 2025 – 02 (contributed poster) On a Latent-Variable Formulation of the Poisson CP Tensor Model, *2025 Conference on Data Analysis (CoDA)*
- 2024 – 12 (contributed talk) Elliptically-Contoured Tensor-Variate Distributions, *2024 IMS International Conference on Statistics and Data Science (ICSIDS)*
- 2024 – 12 (invited talk) Elliptically-Contoured Tensor-Variate Distributions, *18th International Conference on Computational and Methodological Statistics (CMStats)*
- 2024 – 10 (contributed poster) On a Latent-Variable Formulation of the Poisson CP Tensor Model, *SIAM Conference on Mathematics of Data Science (MDS)*
- 2024 – 09 (invited talk) Probabilistic Guarantees for Low-Rank Tensor Decompositions, *The 2024 Sandia Machine Learning and Deep Learning Workshop (MLDL)*
- 2024 – 08 (contributed talk) On a Latent-Variable Formulation of the Poisson CP Tensor Model, *2024 Joint Statistical Meetings (JSM)*
- 2023 – 12 (invited talk) On a Latent-Variable Formulation of the Poisson CP Tensor Model, *16th International Conference on Computational and Methodological Statistics (CMStats)*
- 2023 – 10 (invited talk) Poisson-response Tensor-on-Tensor Regression and Applications, *Iowa State University Department of Statistics 75th Anniversary Research Conference*
- 2023 – 08 (contributed talk) Poisson-response Tensor-on-Tensor Regression and Applications, *2023 Joint Statistical Meetings (JSM)*
- 2023 – 07 (invited talk) Poisson-response Tensor-on-Tensor Regression and Applications, *The 2023 Sandia Machine Learning and Deep Learning Workshop (MLDL)*
- 2023 – 03 (contributed poster) Poisson-response Tensor-on-Tensor Regression and Applications, *2023 Conference on Data Analysis (CoDA)*
- 2022 – 08 (invited talk, **first place in ASA student paper competition**) Reduced-Rank Tensor-on-Tensor Regression and Tensor-Variate ANOVA, *2022 Joint Statistical Meetings (JSM)*
- 2022 – 05 (invited talk, **runner-up in ASA student paper competition**) Tensor-variate elliptically contoured distributions with application to image learning, *Statistical Methods in Imaging (SMI)*
- 2022 – 02 (invited talk) Reduced-Rank Tensor-on-Tensor Regression and Tensor-Variate ANOVA, *Iowa State University Department of Statistics, Department Seminar*

Contributions to Presentations (†=Speaker)

- 2025 – 08 J.M.Myers[†], D.M.Dunlavy, **C.Llosa-Vite**, R.B.Lehoucq, T.Ma, The Generalized Multilinear Model (GMLM), *Sandia Machine Learning and Deep Learning Workshop*
- 2025 – 06 D.M.Dunlavy[†], **C.Llosa-Vite**, J.M.Myers, R.B.Lehoucq, T.Ma, Generalized Multilinear Models for Tensor-on-Tensor Regression, *TRICAP 2025*