Maksim Ekin Eren

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National Science Foundation (NSF) CyberCorps: Scholarship for Service (SFS) Alumnus
LANL Center for National Security and International Studies (CNSIS) Fellow

Education

- **University of Maryland, Baltimore County** — Baltimore, Maryland
  Doctor of Philosophy in Computer Science — *Aug. 2024*
- **University of Maryland, Baltimore County** — Baltimore, Maryland
  Master of Science in Computer Science; GPA: 4.00 — *May 2022*
- **University of Maryland, Baltimore County** — Baltimore, Maryland
  Bachelor of Science in Computer Science; Summa Cum Laude; GPA: 4.00 — *Dec. 2020*

Employment

- **Los Alamos National Laboratory** — Los Alamos, NM
  Scientist — *Nov. 2022 - Present*
  - Conduct cutting-edge research in machine learning (ML), specializing in tensor decomposition methods, with applications across cybersecurity, text mining, natural language processing (NLP), pattern extraction, data privacy, biology, and high-performance computing.
  - Perform advanced artificial intelligence (AI) research in domains such as large language models (LLMs), knowledge graphs, AI reasoning, and link prediction.
  - Design and optimize scalable ML and data analysis pipelines to efficiently process, analyze, and extract insights from extra-large datasets.
  - Lead for Cyber Science Research Program, an internship program where students apply ML to solve cyber-security problems. https://cyberfire.energy.gov/school/
  - Organize and host an invited speaker series, bringing industry and academic experts to discuss advancements in AI and cybersecurity.
- **Los Alamos National Laboratory** — Los Alamos, NM
  Graduate Research Assistant/Undergraduate Research Assistant — *Jun. 2020 - Oct. 2022*
  - Conducted research in data analysis and ML, focusing on tensor decomposition methods for anomaly detection, NLP, and high-performance computing.
  - Designed and developed efficient pipelines and tools for ML and NLP applications.
  - Engineered state-of-the-art solutions for cyber anomaly detection, malware analysis, and large-scale data processing.
- **University of Maryland, Baltimore County** — Baltimore, MD
  Graduate Research Assistant/Undergraduate Teaching Fellow — *Aug. 2020 - May 2022*
  - Conducted research in data analysis and ML, specializing in tensor decomposition methods for malware analysis and data privacy.
  - Collaborated with a team to develop and deliver instructional materials for an active cyber defense course.
  - Presented Linux hardening and ML concepts to an audience of 80 students, enhancing their understanding of cybersecurity best practices and advanced analytics.
- **Cyber Pack Ventures** — Columbia, MD
  Undergraduate Research Assistant — *Nov. 2019 - May 2020*
  - Researched advanced techniques for detecting malicious code in large-scale systems.
  - Developed and implemented a data-driven approach to large-scale malware analysis, leveraging data science and ML techniques.
- **Montgomery County Government EISO** — Rockville, MD
  Information Security Intern — *Jan. 2018 – Oct. 2019*
  - Leveraged the central threat console, SIEM, OSINT, asset and vulnerability management systems, and help desk tools to detect, investigate, and mitigate malicious incidents.
  - Designed and developed a real-time cyber threat map, along with incident response and vulnerability management dashboards, to enhance Security Operations Center (SOC) monitoring and decision-making.

U.S. Patents

- **Eren, M.E.**, Bhattarai, M., Nicholas, C., Rasmussen K., and Alexandrov, B. (2023), Data Identification and Classification Method, Apparatus, and System, US, Provisional Patent 63/472,188.

Publications

Conferences & Workshops

- Barron, R., **Eren, M.E.**, Serafimova, O.M., Matuszek, C., and Alexandrov, B.. Bridging Legal Knowledge and AI: Retrieval-Augmented Generation with Vector Stores, Knowledge Graphs, and Hierarchical Non-negative Matrix Factorization. *In ICAIL '25: 20th International Conference on Artificial Intelligence and Law*, Jun. 16-20, 2025, Chicago, Illinois, USA. 10 pages.

- Bhattarai, M., Barron, R., **Eren, M.E.**, Vu, M., Grantcharov, V., Boureima, I., Stanev, V., Matuszek, C., Valtchinov, V., Rasmussen, K. and Alexandrov, B.. HEAL: Hierarchical Embedding Alignment Loss for Improved Retrieval and Representation Learning. *In ICLR '25 SSI-FM Workshop: 13th International Conference on Learning Representations, Workshop on Scaling Self-Improving Foundation Models without Human Supervision*, Apr. 21, 2025, Singapore. 10 pages.

- Barron, R., Grantcharov, V., Wanna, S., **Eren, M.E.**, Bhattarai, M., Solovyev, S., Tompkins, G., Nicholas, C., Rasmussen, K., Matuszek, C., and Alexandrov, B.. Domain-Specific Retrieval-Augmented Generation Using Vector Stores, Knowledge Graphs, and Tensor Factorization. *In ICMLA '24: 23rd IEEE Conference on Machine Learning and Applications, Special Session on Machine Learning for Natural Language Processing*, Dec. 18-20, 2024, Miami, Florida, USA. 8 pages. DOI: 10.1109/ICMLA61862.2024.00258

- Anjum, A., **Eren, M.E.**, Boureima, I., Eren, M.E., Alexandrov, B., and Bhattarai, M.. Tensor Train Low-rank Approximation (TT-LoRA): Democratizing AI with Accelerated LLMs. *In ICMLA '24: 23rd IEEE International Conference on Machine Learning and Applications*, **Best Paper Award**, Dec. 18-20, 2024, Miami, Florida, USA. 8 pages. DOI: 10.1109/ICMLA61862.2024.00085

- Barron, R., **Eren, M.E.**, Solovyev, N., Bhattarai, M., Boureima, I., Matuszek, C., and Alexandrov, B.. Binary Bleed: Fast Distributed and Parallel Method for Automatic Model Selection. *In HPEC '24: 28th IEEE High Performance Extreme Computing Conference*, Sept. 23-27, 2024, Virtual Event, New England. 8 pages. DOI: 10.1109/HPEC62836.2024.10938517

- Wanna, S., Solovyev, N., Barron, R., **Eren, M.E.**, Bhattarai, M., Rasmussen, K., Nicholas, C., and Alexandrov, B.. TopicTag: Automatic Annotation of NMF Topic Models Using Chain of Thought and Prompt Tuning with LLMs. *In DocEng '24: 24th ACM Symposium on Document Engineering*, Aug. 20-23, 2024, Adobe, San Jose, CA, USA. 4 pages. DOI: 10.1145/3685650.3685667

- Barron, R., **Eren, M.E.**, Bhattarai, M., Wanna, S., Solovyev, N., Rasmussen, K., Alexandrov, B., Nicholas, C., and Matuszek, C.. Cyber-Security Knowledge Graph Generation by Hierarchical Nonnegative Matrix Factorization. *In ISDFS '24: 12th IEEE International Symposium on Digital Forensics and Security (ISDFS)*, Apr. 29-30, 2024, San Antonio, Texas USA. 6 pages. DOI: 10.1109/ISDFS60797.2024.10527237

- **Eren, M.E.**, Barron, R., Bhattarai, M., Wanna, S., Solovyev, N., Rasmussen, K., Alexandrov, B., and Nicholas, C.. Catch'em all: Classification of Rare, Prominent, and Novel Malware Families. *In ISDFS '24: 12th IEEE International Symposium on Digital Forensics and Security (ISDFS)*, Apr. 29-30, 2024, San Antonio, Texas USA. 6 pages. DOI: 10.1109/ISDFS60797.2024.10527250

- Most, A., **Eren, M.E.**, Alexandrov, B., and Lawrence, N.. Electrical Grid Anomaly Detection via Tensor Decomposition. *In MILCOM '23: IEEE Military Communications Conference, Artificial Intelligence for Cyber Workshop*, Oct. 30 - Nov. 3, 2023, Boston, Massachusetts, USA. 7 pages. DOI: 10.1109/MILCOM58377.2023.10356348

- Solovyev, N., Barron, R., Bhattarai, M., **Eren, M.E.**, Rasmussen, K.O., and Alexandrov, B.. Interactive Distillation of Large Single-Topic Corpora of Scientific Papers. *In ICMLA '23: 22st IEEE International Conference on Machine Learning and Applications*, Dec. 15-17, 2023, Jacksonville Riverfront, Florida, USA. 6 pages. DOI: 10.1109/ICMLA58977.2023.00148

- **Eren, M.E.**, Bhattarai, M., Rasmussen, K., Alexandrov, B., and Nicholas, C.. MalwareDNA: Simultaneous Classification of Malware, Malware Families, and Novel Malware. *In ISI '23: 20th Annual IEEE International Conference on Intelligence and Security Informatics*, Oct. 2-3, 2023, Charlotte, North Carolina USA. 3 pages. DOI: 10.1109/ISI58743.2023.10297217

- **Eren, M.E.**, Bhattarai, M., Solovyev, N., Richards, L., Yus, R., Nicholas, C., and Alexandrov, B.. One-Shot Federated Group Collaborative Filtering. *In ICMLA '22: 21st IEEE International Conference on Machine Learning and Applications*, Dec. 12-15, 2022, Nassau, The Bahamas. 6 pages. **Awarded Best M.S. Research at 2023 UMBC CSEE Research Day**. DOI: 10.1109/ICMLA55696.2022.00107
- Boureima, I., Bhattarai, M., **Eren, M.E.**, Solovyev, N., Djidjev, H., and Alexandrov, B.. Distributed Out-of-Memory SVD on CPU/GPU Architectures. *In HPEC '22: 26th IEEE High Performance Extreme Computing Conference*, **Outstanding Paper Award**, Sept. 19-23, 2022, Virtual Event, New England. 8 pages. DOI: 10.1109/HPEC55821.2022.9926288
- **Eren, M.E.**, Solovyev, N., Bhattarai, M., Rasmussen, K., Nicholas, C., and Alexandrov, B.. SeNMFk-SPLIT: Large Corpora Topic Modeling by Semantic Non-negative Matrix Factorization with Automatic Model Selection. *In DocEng '22: 22th ACM Symposium on Document Engineering*, Sept. 20-23, 2022, Virtual Event, San Jose, CA, USA. 4 pages. DOI: 10.1145/3558100.3563844
- **Eren, M.E.**, Solovyev, N., Hamer, C., McDonald, R., Alexandrov, B., and Nicholas, C.. COVID-19 Multidimensional Kaggle Literature Organization. *In DocEng '21: 21th ACM Symposium on Document Engineering*, Aug. 24–27, 2021, Virtual Event, Limerick, Ireland. 4 pages. DOI: 10.1145/3469096.3474927
- **Eren, M.E.**, Moore, J.S., and Boian, A.S.. Multi-Dimensional Anomalous Entity Detection via Poisson Tensor Factorization. *In ISI '20: Proceedings of the 13th IEEE International Conference on Intelligence and Security Informatics*, Nov. 9-10, 2020, Virtual Event, USA., 6 pages. DOI: 10.1109/ISI49825.2020.9280524
- **Eren, M.E.**, Solovyev, N., Raff, E., Nicholas, C., and Johnson, B.. COVID-19 Kaggle Literature Organization. *In DocEng '20: 20th ACM Symposium on Document Engineering*, Sep. 29 - Oct. 2, 2020, Virtual Event, CA, USA. ACM, New York, NY, USA, 4 pages. DOI: 10.1145/3395027.3419591

Journals

- **Eren, M.E.**, Bhattarai, M., Joyce, R.J., Raff, E., Nicholas, C. and Alexandrov, B.. 2023. Semi-supervised Classification of Malware Families Under Extreme Class Imbalance via Hierarchical Non-Negative Matrix Factorization with Automatic Model Selection. TOPS: ACM Transactions on Privacy and Security, 26 pages. DOI: 10.1145/3624567
- Bhattarai, M., Boureima, I., **Eren, M.E.**, Skau, E., Romero, P., Eidenbenz, S., and Alexandrov, B.. 2023. Distributed Out-of-Memory NMF on CPU/GPU Architectures. The Journal of Supercomputing. DOI: 10.1007/s11227-023-05587-4
- **Eren, M.E.**, Moore, J.S., Skau, E.W., Bhattarai, M., Moore, E.A, and Alexandrov, B.. 2022. General-Purpose Unsupervised Cyber Anomaly Detection via Non-Negative Tensor Factorization. Digital Threats: Research and Practice, 28 pages. DOI: 10.1145/3519602
- Golaszewski, E., Sherman , A.T., [et al, including **Eren, M.E.**]. 2020. Project-based learning continues to inspire cybersecurity students: the 2018–2019 SFS research studies at UMBC. *Association for Computing Machinery.* ACM, New York, NY, USA, 9 pages. DOI: 10.1145/3386363

Book Chapters

- **Eren, M.E.**, Alexandrov, B.S., Nicholas, C. (2025). Classifying Malware Using Tensor Decomposition. In: Gritzalis, D., Choo, KK.R., Patsakis, C. (eds) Malware. Advances in Information Security, vol 91. Springer, Cham. DOI: 10.1007/978-3-031-66245-4_1

Posters & Abstracts

- Barron, R., **Eren, M.E.**, Truong, D., Matuszek, C., Wendelberger, J., Dorn, M.F., and Alexandrov, B.S.. Matrix Factorization for Inferring Associations and Missing Links. *CoDA '25: Conference on Data Analysis*, February 25-28, 2025, Santa Fe, New Mexico, USA.
- **Eren, M.E.**, Rasmussen, K.O., Nicholas, C., and Alexandrov, B.S.. Tensor Decomposition Methods for Cybersecurity. *MTEM '24: Malware Technical Exchange Meeting*, July 16-18, 2024, MITRE Corporation, McLean, Virginia, USA.
- **Eren, M.E.**, Rasmussen, K.O., Nicholas, C., and Alexandrov, B.S.. Malware-DNA: Machine Learning for Malware Analysis that Treats Malware as Mutations in the Software Genome. *MTEM '23: Malware Technical Exchange Meeting*, July 25-27, 2023, Lawrence Livermore National Laboratory, Livermore, California, USA.
- **Eren, M.E.**, Nicholas, S., Barron, R., Bhattarai, M., Boureima, I.D., Rasmussen, K.O., and Alexandrov, B.. Sub-topic and Semantic Sub-structure Extraction via SPLIT: Joint Nonnegative Matrix Factorization (NMF) with Automatic Model Selection. *CoDA '23: Conference on Data Analysis*, March 7-9, 2023, Santa Fe, New Mexico, USA.

- Bhandary, P., Adetunji, I., Kiendrebeogo, A., Vieson, C., Joyce, R.J., **Eren, M.E.**, and Nicholas, C.. Malware Antivirus Scan Pattern Mining via Tensor Decomposition. *MTEM '22: Malware Technical Exchange Meeting*, July 26-28, 2021, MIT Lincoln Laboratories, Cambridge, MA, USA.
- Liu, R., **Eren, M.E.**, and Nicholas, C.. Can Feature Selection Help Quantum Machine Learning for Malware Detection?. *MTEM '22: Malware Technical Exchange Meeting*, July 26-28, 2021, MIT Lincoln Laboratories, Cambridge, MA, USA.
- **Eren, M.E.**, Nicholas, C., McDonald, R., and Hamer, C.. Random Forest of Tensors. *MTEM '21: Malware Technical Exchange Meeting*, July 13-15, 2021, Sandia National Laboratories, Virtual Event, USA.
- Boutsikas, J., **Eren, M.E.**, Varga, C., Raff, E., Matuszek, M., and Nicholas, C.. Evading Malware Classifiers via Monte Carlo Mutant Feature Discovery. *MTEM '21: Malware Technical Exchange Meeting*, July 13-15, 2021, Sandia National Laboratories, Virtual Event, USA.

Dissertation & Thesis

- **Eren, M. E.**. Advanced Semi-supervised Tensor Decomposition Methods for Malware Characterization. Ph.D. Dissertation in Computer Science at the University of Maryland, Baltimore County Department of Computer Science and Electrical Engineering. 2024.
- **Eren, M. E.**. Random Forest of Tensors (RFoT). Master's Thesis in Computer Science at the University of Maryland, Baltimore County Department of Computer Science and Electrical Engineering. 2022.

Presentations

- **Invited Speaker**: Tensor Decomposition for AI: Applications in Cyber-security, Data Privacy, Model Compression, and Hallucination Reduction. *University of Maryland Baltimore County, Department of Computer Science and Electrical Engineering, Research Day.* Virtual Event, May 2, 2025.
- **Invited Speaker**: Tensor Decomposition Methods for Data Privacy - Federated Learning. *University of Maryland Baltimore County, Data Privacy Class by Dr. Roberto Yus.* Virtual Event, April 17, 2024.
- **Invited Speaker**: Tensor Decomposition Methods for Cybersecurity. *University of Maryland Baltimore County, Cyber Defense Lab (CDL).* Virtual Event, March 29, 2024.
- **Invited Speaker**: Tensor Decomposition Methods for Cybersecurity. *Auburn University, AI for security (AI4Sec).* Virtual Event, March 12, 2024.
- **Invited Speaker**: Scientific Leadership Identification and Characterization: Interactive Distillation of Large Single-Topic Corpora of Scientific Papers. *Love Data Week: Los Alamos National Laboratory Data Lightning Talks.* Virtual Event, Feb. 14, 2024.
- **Invited Speaker**: Tensor Decomposition Methods for Cybersecurity. *Purdue University - The Center for Education and Research in Information Assurance and Security (CERIAS) Webinar.* Virtual Event, Feb. 07, 2024. (https://youtu.be/Ha3EB-QuTg0)
- **Invited Speaker**: Tensor Decomposition Methods for Cybersecurity. *Lab Research Technical Exchange (LRTE).* Virtual Event, Nov. 16, 2023.
- **Project Presentation**: Scientific Leadership Identification and Characterization: Interactive Distillation of Large Single-Topic Corpora of Scientific Papers. *Lawrence Livermore National Laboratory, DOE Data Days (D3).* Livermore, CA, Oct. 24-26, 2023.
- **Invited Speaker**: Tensor Decomposition Methods for Cybersecurity. *Los Alamos National Laboratory, Cybersecurity Capabilities Day.* Los Alamos, NM, Oct. 11, 2022.
- **Invited Speaker**: Tensor Decomposition Methods for Cybersecurity. *DOE Omni Technology Alliance Internship Program.* Virtual Talk. Jun. 22, 2021.
- **Student Presentation**: Anomalous Event Detection using Non-Negative Poisson Tensor Factorization. *Los Alamos National Laboratory Student Symposium.* Virtual Event, Aug. 10, 2020. (https://youtu.be/_z7yCd4vqrc)

Grants

- **Co-Principal Investigator**: Los Alamos National Laboratory (LANL), Cyber Science Research Program (CSRP) Invited Speaker Series. Information Science and Technology Institute (ISTI) Institutional Program Development. June 2025 - Aug.. 2025
- **Principal Investigator**: Los Alamos National Laboratory (LANL), Cyber Science Research Program (CSRP) Invited Speaker Series. Information Science and Technology Institute (ISTI) Institutional Program Development. June 2024 - Aug.. 2024

- **Principal Investigator**: Los Alamos National Laboratory (LANL), Information Science and Technology Institute (ISTI) Rapid Response. Dec. 2022 - Oct. 2023
- **Co-Principal Investigator**: Los Alamos National Laboratory (LANL), Information Science and Technology Institute (ISTI) Rapid Response. Dec. 2022 - Oct. 2023
- **Principal Investigator**: Los Alamos National Laboratory (LANL), Cyber Toaster Invited Speaker Series. Information Science and Technology Institute (ISTI) Institutional Program Development. June 2023 - Aug.. 2023

Professional Activities

- **Principal Investigator, Organizer**: Los Alamos National Laboratory, Information Science and Technology Institute (ISTI) Cyber Science Research Program (CSRP) Invited Speaker Series. May-Aug. 2023, 2024.
- **Data Analyst Volunteer**: Los Alamos National Laboratory, Northern New Mexico Community Data Sprint. Assisted Rocky Mountain Youth Corps. Aug. 2021
- **Editor**: Los Alamos National Laboratory, Harnessing Transformational Technology Seminar (HTT). Aug. 2021

In the Press

- **Using AI to develop enhanced cybersecurity measures**: https://www.lanl.gov/media/news/0215-ai-cybersecurity-measures. 2024.
- **Not too big: Machine learning tames huge datasets**: https://tensors.lanl.gov/news/not_too_big. 2023.
- **Computer scientists build new tool to fight coronavirus**: https://freethink.com/science/text-mining. 2020.

Software Releases

- **T-ELF**: Comprehensive machine learning toolbox for analyzing large datasets (https://github.com/lanl/T-ELF).
- **RFoT**: Tensor decomposition based semi-supervised ensemble classifier for malware (https://github.com/MaksimEkin/RFoT).
- **pyCP_APR**: Non-negative Poisson tensor decomposition algorithm on GPU with anomaly detection interface (https://github.com/lanl/pyCP_APR).
- **pyCP_ALS**: Python implementation of the CP-ALS tensor decomposition algorithm (https://github.com/MaksimEkin/pyCP_ALS).
- **pyDNMFk**: Distributed non-negative matrix factorization with automatic model determination (https://github.com/lanl/pyDNMFk).
- **pyDNTNK**: Distributed non-negative tensor networks (https://github.com/lanl/pyDNTNK).
- **pyQBTNs**: Boolean tensor factorization using D-Wave quantum annealers (https://github.com/lanl/pyQBTNs).
- **pyDRESCALk**: Distributed non-negative RESCAL decomposition for relational data (https://github.com/lanl/pyDRESCALk).

Students

- **LLM Compression and Acceleration**: Ph.D. Student at the University of Texas at Arlington. Summer 2024.
- **Malware Characterization with LLMs**: B.S. Student at the University of Southern California. Summer 2024.
- **Power Grid Anomaly Detection**: M.S. Student at the Montana State University. Summer 2023.

Skills

- **Programming Languages**: Python, C++, C, x86_64 Assembly.
- **Foreign Language**: Turkish.
- **Technology, Interests, and Expertise**: AI, Anomaly Detection, Cybersecurity, Data Analysis, Data Privacy, Docker, Generative AI, Git, GPU Programming, HPC, Knowledge Graphs, Linux, Malware Analysis, ML, Photography, Software Development, Student Mentorship, Tensor Decomposition, Text Mining, User Behaviour Analysis.

Honors and Awards

- **Employee Achievement Award**: Los Alamos National Laboratory. WESST Star Award, 2025.
- **Employee Achievement Award**: Los Alamos National Laboratory. SPOT Award, 2021, 2023, 2025.
- **Employee Achievement Award**: Los Alamos National Laboratory. LAAP Award, 2024.
- **R&D100 Winner**: R&D100 winner at R&D Magazine for SmartTensors project (team award), 2021.
- **R&D100 Bronze Award**: R&D100 special recognition award, Market Disruptor - Services category, at R&D Magazine for SmartTensors project (team award), 2021.
- **Competition Winner**: University of Maryland, College Park, UMD Data Challenge 2020. Awarded the Most Innovative Project, and the Outstanding UMBC Project categories.
- **Honors**: University of Maryland, Baltimore County, Phi Kappa Phi Honors, 2020.
- **Hackathon Winner**: University of Maryland, Baltimore County, hackUMBC 2019. Elected hackathon winning project. Additionally, awarded the Best Data Science Hack, and the Most Unique Hack categories.
- **Hackathon Winner**: Georgetown University, Hoya Hacks 2019. Elected second place in the Best Hardware Hack category.
- **Academic Excellence**: University of Maryland, Baltimore County, President's List, 2019, 2020.
- **Academic Excellence**: University of Maryland, Baltimore County, Dean's List, 2018, 2019, 2020.
- **Scholarship**: National Science Foundation (NSF) CyberCorps: Scholarship for Service (SFS), 2017-2020.
- **Academic Excellence**: Montgomery College, Dr. Harry Harden Jr. Student Academic Excellence Award, 2018.
- **Academic Excellence**: Montgomery College, Frank L. Verwieve Academic Excellence Award, 2017.
- **Honors**: Montgomery College, Phi Theta Kappa Honors, 2016.
- **Academic Excellence**: Montgomery College, Dean's List, 2016, 2017, 2018.