Noel Elias

nelias@utexas.edu | noelkelias.github.io

EDUCATION

The University of Texas at Austin, Austin, TX — Aug 2021 – May 2025

Bachelor of Science in Mathematics

Bachelor of Science in Computer Science with Special Departmental Honors

Coursework: Grad Cryptography, Grad Computer Security, Distributed Systems, Trustworthy Machine Learning, Cloud Computing, Stochastic Processes, Linear Algebra, Honors Vector Calculus, Algorithms, Computer Architecture, Data Structures, Operating Systems, Number Theory, Real Analysis, Algebraic Structures

Honors Thesis: Pairing-Based Batch Arguments for NP with a Linear-Size CRS

SKILLS

Technical Skills: *Python, Rust, Java, C/C++, MATLAB*

Tools/Frameworks: *PyTorch/Tensorflow, Circom, NumPy, OpenCV, Rest APIs, CI/CD Pipelines, Docker, Kubernetes*

Certifications: *Deep Learning Specialization, Zero-Knowledge Proofs, MATLAB for Quantitative Analytics*

EXPERIENCE

LINC Lab + Network Coding and Reliable Communications Group, UT Austin & MIT — Aug 2023 – Present

Undergraduate Researcher

- Led a research group of graduate and undergraduate students to develop a novel and efficient LLM tokenizer utilizing Lempel-Ziv-Welch compression. Achieved performance comparable to BERT & GPT-2 standards, while enabling approximately ~2.5x faster training with 30% less training data.
- Developed and implemented robust LLM training methods leveraging information-theoretic principles. Achieved 6x compression of LLM embedding dimension while minimizing mutual information of sensitive data labels.
- Published and presented findings in top ML and information-theory conferences.

Apple Inc. (Vision Products Group – Algorithms & Automation), Boulder, CO — May – Aug 2023

Software Engineering Intern

- Built an internal Python package that can analyze results, catalog failures and deploy notifications. 5000+ users.
- Designed and developed an automated evaluation codebase for multiple augmented reality–based computer vision and machine learning algorithms within Vision Pro.
- Quickly learned complex research architectures and independently developed creative solutions given minimal direction within such a high-stakes project.
- Present project to top executives within the Vision Products Group. Received full-time return offer.

UT Theoretical Cryptography Group + Applied Cryptography Group, UT Austin — Dec 2022 – Present

Undergraduate Researcher

- Engineered lattice/pairing based cryptographic primitives for batch arguments and functional commitments utilizing polynomial techniques. Devised novel kernel-based cryptanalysis attacks and employed advanced proof reduction strategies to analyze the security of proposed assumptions. Reduced protocol overhead from quadratic to linear.
- Built a cryptographic, Rust-based framework for mathematical proof verification by improving and generalizing state-of-the-art protocols in Incrementally Verifiable Computation (IVC). Supports use cases including proving secure ML inference, blockchain transaction correctness, security of cyber-physical systems, and hardware formal verification.
- Researched methods for utilizing error-correcting codes, like rank-metric and polar codes, to create efficient Succinct Non-interactive Arguments of Knowledge (SNARKs). Drafted report of findings.
- Published and invited to present research as first author in top cryptography conferences & workshops.

Applied Research Laboratories, Austin, TX — Jan – Dec 2022

Machine Learning Researcher

- Built and deployed binary, one-class, and siamese Python machine learning pipelines utilizing novel CNN architectures for various passive sonar data distributions with ~97% accuracy.
- Developed novel denoising algorithm for extracting spectrographic signatures from noisy audio signal data utilizing Score-CAM analysis.
- Published and presented research papers as first author in top ML conferences.

Thinkery, Austin, TX, Austin, TX — Nov 2018 – Aug 2021

Software Engineering Intern

- Led the development and production of an augmented reality app implementing MIT Media labs computational thinking strategies to teach students programming. Over 100+ daily students.
- Implemented Vuforia Augmented Reality SDK for feature tracking and detection, Unity Scripting APIs in C# and JavaScript for 3D animations, and Android Studio for building the app framework.

PUBLICATIONS

1. **Pairing-Based Batch Arguments for NP with a Linear-Size CRS** [PDF]
   Noel Elias, David Wu, Binyi Chen. *Submitting to Theory of Cryptography Conference (TCC)*, 2025.
2. **MultiTok: Variable-Length Tokenization for Efficient LLMs Adapted from LZW Compression** [PDF] [Code]
   Noel Elias, Homa Esfahanizadeh, Kaan Kale, Sriram Vishwanath, Muriel Medard. *Under revision for IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2025.
3. **Lova: A Novel Framework for Verifying Mathematical Proofs with Incrementally Verifiable Computation** [PDF] [Code]
   Noel Elias. *ACM Conference on Data and Application Security and Privacy (CODASPY), 2025. Presented at the CIFRIS: Topics in Applied Cryptography Workshop 2024.*
4. **TexShape: Information Theoretic Sentence Embedding for Language Models** [PDF] [Code]
   Kaan Kale, Homa Esfahanizadeh, Noel Elias, Oguzhan Baser, Muriel Medard, Sriram Vishwanath. *IEEE International Symposium on Information Theory (ISIT)*, 2024.
5. **A Novel Score-CAM based Denoiser for Spectrographic Signature Extraction without Ground Truth** [PDF]
   Noel Elias. *IEEE International Joint Conference on Neural Networks (IJCNN)*, 2023.
6. **Audio Classification of Low Feature Spectrograms Utilizing Convolutional Neural Networks** [PDF]
   Noel Elias. *IEEE International Conference on Machine Learning and Applications (ICMLA)*, 2022.
7. **Robust estimation of bacterial cell count from optical density** [PDF]
   Jacob Beal, Natalie G. Farny, et. all & iGEM Interlab Study Contributors. *Communications Biology,* 2020.