NOAH FOSTER

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EDUCATION

Brown University Honors B.S. Applied Math B.S. Mathematics-Computer Science *GPA: 3.7* | Expected Graduation Spring 2024

- *Relevant Graduate Coursework*: Advanced Topics in Deep Learning, Deep Learning, Real Analysis, Functional Analysis, Recent Applications of Probability and Statistics,
- *Relevant Undergraduate Coursework*: Computational Linguistics, Machine Learning, Abstract Algebra, Honors Linear Algebra, Topology, Galois Theory, Information Theory, Statistical Inference I & II, Computational Probability and Statistics, Partial Differential Equations, Numerical Optimization, Mathematical Econometrics, Macroeconomics, Mathematical Microeconomics

RESEARCH EXPERIENCE

LiMBeR2 - Computer Science Research Assistant *Providence, RI* | Fall 2022 - Present

- Investigated the compositionality of conceptual information in large language and vision transformer models through the construction of a MAGMA-style model built on CLIP, BEiT and GPT-J as a follow up to the LiMBeR Paper
- Evaluated information loss between visual embeddings and linguistic decodings using PyTorch, Brown's High Performance Compute Cluster, and knowledge graph similarity metrics for Ellie Pavlick's LUNAR Lab
- Applied Mean Field Theoretic Manifold Analysis to understand the geometry of the latent spaces of large language models.

Better2022 - Computer Science Research Assistant *Providence, RI* | Fall 2022 - Present

- Built a pipeline to perform rapid multi-lingual document search and triage through a fine-tuned and prompt-tuned BLOOM 176B Model for IARPA to enable US intelligence analysts to extract and retrieve highly-detailed, personalized knowledge across diverse domains using Hugging Face models in Ellie Pavlick's LUNAR Lab
- Built better Human-in-the-Loop systems for large language models to effectively utilize human knowledge in deep learning

APTE - Econometrics Research Assistant *Providence, RI* | October 2021 - Present

- Proved asymptotic behavior of proposed estimators by applying theoretical statistical techniques involving the Functional Delta Method, Hadamard and Gateaux Differentiation, and Brownian Bridges
- Applied new statistical techniques to unemployment data using R, Python using Jupyter, Google Colab, and GPLK to better estimate elasticity of consumption under varying unemployment insurance with Jon Roth.

WORK & LEADERSHIP EXPERIENCE

Teaching Assistant for Information Theory *Providence, RI* | September 2022 - December 2022

- Held Office Hours and graded problem sets for Cole Graham's class on entropy, (lossless and lossy) compression and theoretical probability and statistics for over 70 advanced undergraduates and graduate students.
- Tied probability concepts to roots in real analysis to develop intuition for the theory of entropy and information with applications to error detecting and correction codes

Teaching Assistant for Recent Applications of Probability and Statistics *Providence, RI* | February 2023 - May 2023

- Held office Hours for Stuart Geman's class covering statistics behind SVMs, neural networks and high-dimensional inference
- Theoretical Material: Gibbs ensembles and their relation to maximum entropy, large deviations, exponential models, and information theory; statistical estimation and classification; graphical models, dynamic programming, MCMC, parameter estimation

Brown University Cycling Team, *Captain* *Providence, RI* | Fall 2021 - Spring 2022

- Organized a team 20+ riders through weekly practices and racing as well as managing sponsorships and fundraising.
- Coordinated with Brown Administration, USAC, and Eastern Collegiate Cycling Conference to support riders first engaging with competitive racing, as well as experienced racers in learning team racing strategy and technique

Applied Math Peer Advisor *Providence, RI* | Fall 2022 - 2023

- Held one-on-one and group advising sessions with undergraduates on class selection, internships, careers and graduate school
- Helped students prepare for advanced classes in probability and navigate research opportunities in statistics with faculty

PROJECTS

DeTex *Python* | October 2022 - Present

- Building a Convolutional Vision Transformer to caption pictures of math formulas with their corresponding LaTeX
- Scraped nearly every equation and corresponding LaTeXcode from Wikipedia to create a database of over a million labeled images before data augmentation allowing for complex network architecture

Information Theoretic Compression Class *C++* | September 2022 - Present

- Building a package for holding compressed text in memory using optimal prefix encoding for arithmetic blocks to enable large corpus processing with compressed data in RAM with marginal loss of reading speed

SKILLS & INTERESTS

- **Programming Languages**: Python (PyTorch, TensorFlow, Spacy, NumPy), R, MATLAB, Julia, C/C++, Slurm, SQL, LaTeX
- **Interests**: Statistics, Deep Learning, Machine Learning, NLP, Probability, Mathematics, Causal Inference
- **Hobbies**: Cycling (Strava), Skiing, Backpacking, Hiking, Photography