# NOAH FOSTER

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## EDUCATION

**Brown University**, Sc. B. in Applied Math, Sc. B. in Mathematics *Major GPA: 4.0* | Expected Graduation Spring 2024

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

## 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
- Rendered new test data using Blender allowing for flexible tests of compositionality and flexible assessments of ground truth based on knowledge graphs generated using Shapeworld.

**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
- Advised students through the analysis of error-correcting codes

**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
- **Seminars**: Webscraping and Data Visualization, CCV Brown University, June 2020
- **Hobbies**: Cycling (Strava), Skiing, Backpacking, Hiking, Photography