

Alex Xu

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Skills

Programming Languages: Python, Java, C/C++, Rust, PyTorch, Scikit-learn, Numpy, Pandas, Polars, SQL, LaTeX

Mathematics & Statistics: Bayesian Statistics, Variational Inference, Convex Optimization, Linear Regression, Partial Differential Equations, Differential Geometry, Riemannian Manifolds

Machine Learning: Variational Autoencoders, Diffusion Models, Transformers, Retrieval Augmented Generation, Low Rank Adaption

Languages: Native proficiency in English and Chinese

Experience

Columbia University, Graduate Student Instructor New York, NY
 • Created course curriculum and taught biweekly 30 student classes for Calculus 1 as Instructor of Record Sept 2020 – June 2025
 • Graduate TA for Calculus and Optimization, Linear Algebra, Calculus 3, Calculus 2, Calculus 1, and Algebraic Topology

Education

PhD **Columbia University**, Mathematics New York, NY
 • Advisor: Prof. Francesco Lin Sept 2020 – June 2025
 • Thesis: The Seiberg–Witten Equations and Asymptotically Hyperbolic Einstein Metrics

MA **Columbia University**, Mathematics New York, NY
 • Advisor: Prof. Francesco Lin Sept 2020 – June 2022

BS **University of California, Santa Barbara**, Mathematics Santa Barbara, CA
 • Advisor: Prof. Xianzhe Dai Sept 2016 – June 2020
 • Thesis: Adiabatic Limits and Hodge Leray Theory

Projects

localRAG [🔗](#)

- Implemented retrieval augmented generation (RAG) for a local collection of academic texts using open source models

mini-diffusion [🔗](#)

- Implemented a tiny (825k) parameter U-net diffusion model in PyTorch for generation of self-portraits.

LoRA_gpt2 [🔗](#)

- Implemented low-rank adaption (LoRA) fine tuning on the GPT2 124M checkpoint in PyTorch to generate text in the style of different authors.

VAEs [🔗](#)

- Implementation of a variational autoencoder (VAE) to learn the MNIST dataset.

Publications

Seiberg-Witten Equations and Einstein Metrics on Finite Volume 4-Manifolds with Asymptotically Hyperbolic Ends

Feb 2024

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arxiv.org/abs/2402.1036 [🔗](#)