Nathan Louie

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Education

- **University of Texas at Austin** — Austin, TX
  Doctor of Philosophy in Mathematics — *Aug. 2024 - Present*
- **University of Washington: 3.95** — Seattle, WA
  Bachelor of Science in Mathematics with Distinction: 3.96 — *Sept. 2021 - June 2024*
  Bachelor of Science in Computer Science: 3.91
  Courswork: Data Structures, Algorithms, ML, Database, AI, Security, Systems, Data Visual, Software Design

Experience

- **Freelance Data Labeling** — Remote
  AI Data Annotation Specialist — *Jan 2025 – Present*
  - Conducted high-quality data labeling to train machine learning models, contributing to the improvement of AI systems, as a freelance contractor under *Alignerr*, *Outlier*, and *DataAnnotation*.
  - Applied advanced knowledge of mathematical principles (e.g. abstract algebra, topology, differential geometry, probability theory) to ensure AI responses to PhD-level questions are correct and meets all the standards.
  - Effectively manage a self-directed work schedule, balancing multiple projects and personal commitments to consistently meet deadlines.
- **University of Texas** — Austin, TX
  Mathematics Mentor — *Aug 2024 – Present*
  - Mentored and tutored UT undergraduate students individually in a directed reading group on advanced topics in mathematics, particularly in algebra, topology, and geometry.
  - Organized weekly hour-long meetings, assigned readings, and practice problems, and provided guidance and feedback on students' progress.
- **University of Washington** — Seattle, WA
  Undergraduate Researcher — *Sept 2023 – March 2024*
  - Applied Lean, a proof assistant and a functional programming language, to formalize mathematical results.
  - Participated in collaborative discussions to design a foundational framework to base proofs of related topics on.
  - Formally proved the Witt's Cancellation Theorem from quadratic form theory in addtion to basic results on transfer systems from homotopical combintorics.
- **Northwestern University** — Evanston, IL
  Undergraduate Researcher — *June 2023 – Aug 2023*
  - Proved the existence of a smooth Anosov action on the 3-torus and other nilmanifolds by surface groups. Further, we explored properties surrounding it, including structural stability and an Anosov $\mathrm{PSL}(2,\mathbb{Z})$ action.
  - Applied Mathematica and other mathematical coding softwares to create visual and computational models for such Anosov actions on the 3-torus.
- **Mojang Studio Design Workshop** — Seattle, WA
  Jr. Content Designer & Team Lead — *June 2021 – Aug 2021*
  - Created 50+ custom blocks in one month by modeling, texturing, and programming using Blockbench and JSON
  - Led daily standups for a team and assisted students with questions
  - Regularly communicated with Mojang employees, providing feedback on team progress and devising solutions

Projects

- **Flight Reservation System**
  Databases: Java, SQL, Maven, JUnit Testing, Concurrency *Jan 2022 - Mar 2022*
  - Designed and implemented a mock flight reservtion system using a large dataset of real-world flight data with a wealth of functionality, such as user accounts managment, itineraries searching, and flights booking.
  - Utilized SQL and Java schema to construct core functions, such as user creation, login, search, payment, and reservations. Created and applied JUnit test cases to validate functionality and efficiency.
- **Reinforcement Learning via Pacman**
  Artificial Intelligence: Python, Reinforcement Learning and Markov Decision Process Libraries, *Nov 2022 - Dec 2022*
  - Designed and implemented reinforcement learning algorithms, including Value Iteration, Q-Learning, and Approximate Q-Learning, to solve Markov Decision Processes and control agents in simulated environments.
  - Used techniques such as epsilon-greedy action selection, prioritized sweeping, and feature-based function approximation to enhance agent performance and scalability.
- **Gale-Shapley Algorithm Visualization**
  Data Visualization: JavaScript, HTML, CSS, D3 *Feb 2023 - Mar 2023*
  - Designed and developed an engaging website that provides an interactive learning platform for users to explore stable-matchings and the Gale-Shapley algorithm for stable matching.
  - Created an immersive learning environment by incorporating unlimited visual examples that enables users to practice and deepen their understanding of the concepts.
- **Movie Recommendation System**
  Machine Learning: Python (NumPy, SciPy), SVD, Matrix Factorization *Jan 2023 - Mar 2023*
  - Constructed a personalized movie recommendation system model using a dataset of real-world movie rating data with over 100,000 ratings.
  - Applied Singular Value Decomposition (SVD) for low-rank matrix factorization to optimize the model, and developed an alternating minimization algorithm to further improve prediction accuracy.

Additional Informations

- **Languages**: Java, Python, C, C++, SQL, HTML, CSS, LaTeX, Mathematica, MatLab, Sage, GAP, and Lean.
- **Outreach**: Harmony School Math Carousel Judge *2025*, UT Austin Directed Reading Group Mentor *2024-Present*, Sunday Morning Math Group *2024*, Meet a Mathematicians Panelist *2024*, UW Math Hour Olympiad Judge *2023*, UW Undergraduate Reading Group Mentor *2023-2024*, and UW Undergraduate Journal Peer Reviewer *2022-2024*.
- **Awards**: Dean's Strategic Fellowship *2024*, Wisniewski Endowed Scholarship *2024*, BAVA Scholarship *2021-2024*, Washington State Opportunity Scholarship *2021-2024*, and HS Valedictorian.
- **Conferences/Summer Schools**: GSTGC Bloomington *2025*, Joint Mathematics Meetings *2025*, Texas Geometry and Topology Conference *2024*, SU UnKnot Conference *2024*, UGA Summer School on Topology *2024*, NU Summer School on Dynamical Systems *2023*
- **Spoken Languages**: English *native*, Cantonese *native*