# Minxing Xu

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## Education

**University of California, Santa Barbara** Santa Barbara, CA

Master of Arts in Statistics (Mathematical Statistics Specialization)(*Fully Funded*) *Jan. 2025 – Jul. 2026*

- *GPA: 3.967/4.0*

Bachelor of Science in Statistics & Data Science *Sept. 2022 – Dec. 2024*

- *GPA: 3.89/4.0 (High Honor, Dean's Honor List)*

## Research Experience

**Topological HMM for Regime Switching Volatility** | *Prof. Gareth Peters* *Sept. 2025 – Present*

- Modeled regime-switching volatility dynamics using a Polynomial Diffusion SDE and a continuous-time Hidden Markov Model, using the Onsager-Machlup Functional as a proxy for the path emission probability.
- Adjusted the Baum-Welch algorithm and Viterbi algorithm under topological space to identify optimal sequences
- Paper in preparation for peer-reviewed journal submission; pre-print to be available on SSRN by December 2025.

**Flow Matching Posterior Estimation for PDE Solution** | *Prof. Xuhui Meng* *Jun. 2025 – Present*

- Developed a variational inference framework using flow matching techniques to solve partial differential equations (PDEs) in scientific computing contexts.
- Designed neural ODE-based generative models to sample solution fields satisfying complex PDE constraints.

**AI, deep neural network and kernel methods Reading Group** | *Prof. Mengyang Gu* *Jan. 2025 – Present*

- Engaged in a research reading group focused on deep learning, variational inference, and kernel methods.
- Rotated weekly presentations among students to analyze foundational papers and reproduce core experiments.

**Dynamic Bond Ladder Investment Decision Making** | *Prof. Gareth Peters* *Sept. 2024 – Sept. 2025*

- Bootstrapped Treasury bond data using penalized splines and fitted a Kalman Filter based on the Dynamic Nelson-Siegel model with volatility adjustments, applying non-convex optimization for robust parameter estimation and improved yield curve forecasting.
- Developed optimal stopping mechanism for callable bond ladder portfolios, using the forecasted yield curve to identify multiple exercise opportunities and enhance fixed-income reinvestment strategies.

## Selected Academic Projects

**Data Scientist Salary Prediction** *Apr. 2024 – Jun. 2024*

- Modeled data science salary prediction using methods including tuned KNN, Random Forest, XGBoost, and Elastic Net, and engineered over 15 skill variables to identify high-impact factors for career advancement.

**Wikipedia Voting Network Analysis** *Apr. 2024 – Jun. 2024*

- Applied Network Analysis on a Wikipedia voting dataset, employed the Walktrap Algorithm for community detection and evaluated core metrics to identify strong Core-Periphery Structure and highly influential hub nodes.

**Adjusted Dynamic Nelson-Siegel Yield Curve Modeling** *Jan. 2025 – Mar. 2025*

- Modeled US Treasury yield curve using the Dynamic Nelson-Siegel state-space framework and the Kalman Filter, developed an enhanced KF-GARCH model by integrating a GARCH process to capture time-varying volatility.

**Kalman Filter for Stock Price Prediction** *Independent Project* *Jan. 2025 – Mar. 2025*

- Developed a Kalman Filter state-space model for short-term stock price (AAPL) prediction based on market indexes, generating probabilistic forecasts and leveraging the EM Algorithm for robust parameter estimation.

**Multidimensional Kalman Filter Analysis** *Jan. 2025 – Mar. 2025*

- Designed a discrete-time Multidimensional Kalman Filter in matrix form to estimate multi-dimensional latent states; derived and implemented MLE for optimal parameter estimation and uncertainty quantification.

**COVID-19 Risk Prediction Report** *Jan. 2025 – Mar. 2025*

- Produced a report based on modeling COVID-19 infection risk on patient records using Tuned Logistic Regression, which quantified the protective effects of key laboratory markers and vaccination.

## Publications

**Peters, G., Xu, M., Zhu, Z., and Shevchenko, P. V. (2026).** *Regime-Switching Polynomial Diffusions via Topological Hidden Markov Model Inference with Onsager–Machlup Functionals for Asset Pricing.* Submitted. Available at SSRN.

## Presentations and Poster Sessions

**60th Actuarial Research Conference (Poster Session)** | *Toronto, Ontario, Canada* *Aug. 2025*

- Xu, M., Anderson, A., and Peters, G. (2025, August). *Dynamic Bond Ladder Investment Decision Making.* Poster presented at the 60th Actuarial Research Conference, Toronto, Ontario, Canada.

## Teaching Assistant Experience

**Transition to Data Science, Probability and Statistics** | *Doris Padilla* *Sept. 2024 - Dec. 2024*

**Data Science Principles** | *Prof. Uma Ravat* *Jan. 2025 - Mar. 2025*

**Design of Experiment** | *Prof. Peter Chi* *Apr. 2025 – Jun. 2025*

**Applied Stochastic Processes** | *Prof. Vellaisamy Palaniappan* *Sept. 2025 - Dec. 2025*

**Mathematics of Fixed Income Markets** | *Prof. Hal Pedersen* *Jan. 2026 - Mar. 2026*

## Research Mentorship

**Adjusting Mortality Curves for Rising Opioid-Related Deaths** | *Mentored Team of 5* *Sept. 2025 – Present*

- Developed a mortality modeling approach by decomposing total mortality into baseline and opioid-driven excess components, utilizing isotonic regression to enforce biologically-plausible monotonicity on the baseline age effect.
- Quantified and isolated the impact of rising opioid-related deaths, capturing the characteristic middle-age mortality hump, yielding robust mortality inputs for annuity pricing, reserving, and portfolio risk management.

## Internship Experience

**Data Audit Intern** | *Industrial and Commercial Bank of China* *Jul. 2025 – Sept. 2025*

- Conducted data audits on loan transaction records and customer information to ensure accuracy, completeness, and compliance with regulatory requirements.
- Applied Python to validate and analyze large-scale banking datasets, detecting anomalies and generating audit reports for risk management.

**Business Intelligence Engineer** | *Motion Global* *Mar. 2024 – May 2024*

- Supported semantic classification of consumer feedback to classify areas for improvement.
- Implemented daily data updates to dashboards by integrating Amazon QuickSight with other platforms for real-time business insights.

**Data Analyst** | *TF Securities Co. Ltd* *Jul. 2023 – Sept. 2023*

- Developed a real-time risk-alert system tracking financing and securities lending, stock-pledge repos, and securities borrowing by incorporating metrics like credit exposure, asset deterioration rates, and asset limits to support real-time alerts.
- Deployed real-time data extraction, visualization and threshold-based alerts interactive system, improving risk oversight and daily operational responsiveness.

## Professional Skills

**Programming**: Python, Java, R, SQL, LaTeX, Excel, HTML, JavaScript, SAS

**Database Management**: MySQL, Oracle, PostgreSQL, SQLite, Amazon Redshift

**DevOps & Version Control**: Docker, Git, GitHub

**Machine Learning Coding**: Scikit-learn, PyTorch, TensorFlow