

# Jiaxin (Margot) Yuan

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## Education

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**Ph.D. in Applied Mathematics**, University of Maryland | College Park, MD | May 2025 | GPA: 3.84/4.00

- Area of interest: Stochastic differential equation, Molecular dynamics, Machine learning, Optimal control, Causal inference, LLM
- Advisor: Maria Cameron

**B.S. in Mathematics**, The Pennsylvania State University, State College, PA | May 2020

- Minor in **Economics** | **Schreyer Honors College** | Honor Roll and best student award every year | **GPA: 4.0/4.0**
- Dean's list; The President's Freshman Award; The President Sparks Award

## Publications and Preprints

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- **Jiaxin Yuan**, Amar Shah, Channing Bentz, and Maria Cameron. *Optimal control for sampling the transition path process and estimating rates*. Communications in Nonlinear Science and Numerical Simulation, 2023. Accepted.
- Xiaoyu Liu, **Jiaxin Yuan**, Bang An, Yuancheng Xu, Yifan Yang, and Furong Huang. *C-Disentanglement: Discovering Causally-Independent Generative Factors under an Inductive Bias of Confounder*. International Conference on Machine Learning (ICML) workshop on Structured Probabilistic Inference & Generative Modeling, 2023.
- Xiaoyu Liu, **Jiaxin Yuan**, Bang An, Yuancheng Xu, Yifan Yang, and Furong Huang. *C-Disentanglement: Discovering Causally-Independent Generative Factors under an Inductive Bias of Confounder*. Conference on Neural Information Processing Systems (NeurIPS), 2023.

## Research Projects

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**Alignment of causal reasoning between LLM and small-scale task specific models** | University of Maryland College Park, MD | October 2023 - Current

- Introduces a training algorithm to improve the causal reasoning in LLM via alignment with small-scale task specific models

**Discovery of collective variables that minimizes error from model reduction** | University of Maryland College Park, MD | May 2023 - Current

- Introduces a method to learn collective variables that preserves original dynamics with variational autoencoder

**Optimal controller and estimation of transition rate in Transition Path Theory** | University of Maryland College Park, MD | May 2022 – June 2023

- Derived an optimal controller that is applicable to both overdamped Langevin dynamics and full Langevin dynamics
- Developed an innovative method for estimating the transition rate of rare events with high precision, by using information from optimal controlled processes under the framework of Transition Path Theory
- Obtained transition rates for rare transitions effectively and robustly with simulation of controlled process using committors from reduced model or rough approximation, outperforming ones from Transition Path Theory formula
- Improved the accuracy of estimating transition rate by at most 200% in high-dimensional systems

**C-Disentanglement: Discovering Causally-Independent Generative Factors under an Inductive Bias of Confounder** | University of Maryland

College Park, MD | September 2022 – June 2023

- Learned causally disentangled representation with inductive bias of confounder, and proved bounded interventional robustness
- Provided a unified framework that solves the conflict between human annotated-labels and causally disentangled representation

### **Computing Committor function using the tensor train format** | University of Maryland

College Park, MD | October 2021— April 2022

- Solved high dimensional committor function using tensor train format in Python
- Adapted the method to example with Mueller's potential in 2D, whose results outperformed the ones solved by neural network

### **Pricing and hedging variable annuity via Monte Carlo simulation** | The Pennsylvania State University

State College, PA | August 2018 – May 2020

- Created a pricing estimation model for Variable Annuity via Monte Carlo simulation in C++ for different assumptions
- Constructed various methods of hedging strategies and made comparisons under different scenarios

### **Matrix Lie Groups** | The Pennsylvania State University

State College, PA | June 2019 - August 2019

- Accomplished REU project report and presented at the poster symposium with literature reviews in the fundamentals of matrix Lie groups and application in integrability of Lie systems

## **Skills**

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**Programming:** Proficient in Python (Pandas, PyTorch, NumPy, Scikit-learn, Matplotlib), MATLAB, R, C++ , LaTeX

**Languages:** English, Mandarin, Cantonese

## **Leadership**

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### **Secretary** | Women in Math

College Park, MD | October 2021— April 2022

- Provided support for the organization running via recording minutes and advertising events through emails and social media

### **Teaching Assistant** | University of Maryland

College Park, MD | October 2021— Current

- Guided discussion sessions in pre-calculus, calculus I, II, and fundamental statistic courses and taught pre-calculus as sole instructor
- Helped supervising REU program in summer 2022 as a teaching assistant

### **Sisterhood Development chair** | Kappa Beta Gamma Phi Chapter

Harrisburg, PA | April 2017 - December 2017

- Led and organized a trip to Eastern State Penitentiary and raised funding from educational institutions
- Organized weekly and monthly bonding events for new members and other active members