

Yuanzhe Liu |

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Education

Rensselaer Polytechnic Institute

Ph.D. in Computer Science

Advisor: Prof. Ziniu Hu

Troy, USA

2023 – now

New York University

M.S. in Computer Science

New York, USA

2021 – 2023

Oberlin College and Conservatory

B.A. in Computer Science, Piano Performance and Mathematics

Piano Advisor: Prof. Peter Takács

Oberlin, USA

2016 – 2021

Research Interests

(Controllable and Interactive) Generative Models (autoregressive, diffusion and others), especially for creative art and **music**, with the goal of facilitating artists and composers with AI models.

In the past, I did research on approximation theory and economic game theory.

Selected Honors and Awards

2023: SIGKDD 2023 Student Volunteer

2019: Presented my work on “harmonic measure distribution functions on cantor set” at MAA (Mathematical Association of America) Annual Meeting

2018: Perform at Several **Piano Ensemble Recitals** at Oberlin Conservatory

2018: Third Prize of Ohio Wesleyan Programming Contest

2017: Final Round for Annual Scholarship Competition in Akron, organized by Tuesday Musicale

2016-2021: Oberlin College Scholarship

Publications

1. Symbolic Music Generation with Plug-and-Play Rule-Guided Diffusion Models

- Yujia Huang, Yuanzhe Liu, Adishree Ghatare, Ziniu Hu, Qincheng Zhang, Chandramouli Sastry, Siddharth Gururani, Sageev Oore, Yisong Yue
- Under Review.

2. Algorithmic Delegation

- Ali Khodabakhsh, Yuanzhe Liu, Emmanouil Pountourakis, Samuel Taggart, Yichi Zhang
- algorithmic contract theory workshops at both STOC and EC

Work and Research Experience

Rule-Guided Music Generation

Visiting Student Researcher

Caltech

Jun. 2023 – Present

- Advisor: Sageev Oore, Ziniu Hu and Yisong Yue
- Working on ‘Symbolic Music Generation (e.g., piano rolls) with Non-differentiable Rule-Guided Diffusion Models’.
- Implement a *Transformer-based Latent Diffusion Model* for piano-roll music generation, further extending for long-music generation using *DiffCollage*.
- We study how to use music rules (e.g., note density, chord pregression to **control diffusion process** as a plug-and-play framework. I implement those APIs for key and chord prediction using Music21, and support Yujia in investigating derivative free conditional sampling methods. I also implement classifier-guidance baselines.
- The work is currently under review for publication.**

Self-Supervised Classification and Detection for Medical Images

Research Assistant

NYU

Mar. 2023 – Present

- *Advisor:* Sonam Khurana
- Implement Swin Transformer backbone to detect Internal Carotid Artery Calcification. For detection, further use Mask R-CNN and Faster R-CNN with Feature Pyramid Network to detect and segment images.
- Use SSL algorithms (DINO and SwAV) to pre-train the model. Achieved more than 18 percent of accuracy with bounding boxes under DINO and Faster R-CNN.

Theoretical Algorithmic Delegation

TCS Research Assistant

Oberlin College, TCS

Jul. – Sep. 2018, Jun. – Sep. 2019

- *Advisor:* Sam Taggart
- Analyze the welfare and revenue of Bayes-Nash equilibrium in first-price auctions with agents. Wrote a python program to compute the equilibrium by applying dynamic programming
- Extend the proof of the existence of the low bound under several constraints. Proved the APX hardness result of this particular delegation problem under certain conditions. Attempted to disprove the 2-approximation of the threshold policy by invoking examples that would break the 2-approximation.
- **The work is presented on algorithmic contract theory workshops at both STOC and EC.**

Brownian Motion and Cantor Set

Mathematics Research Assistant

Oberlin College, Math

Jan. – Feb. 2018

- *Advisor:* Kevin Gerstle
- Study of harmonic measure distribution functions (H-Functions) with focus on domains with fractal boundary shapes through MATLAB simulation. Found H-Functions on Cantor Set by simulating Brown Motion with teleportation algorithm.
- **This work is presented at the MAA Ohio Spring Section Meeting in April 2018.**

Teaching Experience

- **Teaching Assistant for RPI CSCI 2500: Computer Organization, 2023 Fall.**
 - Hold a 46-student on-campus lab (2 hours per week), review students' work, and address their queries regarding lab materials. During TA office hours, explain many details to many attended students.

Relevant Courses

- **Computer Science:** Algorithm, Deep Learning System, Natural Language Processing, Machine Learning, Operating System, Programming Language
- **Mathematics:** Linear Algebra, Group Theory, Number Theory, Analysis, Fourier Series, Probability
- **Piano Performance:** Piano Private Lesson, Degree Recitals, Keyboard Skills, Form and Analysis, Rhythmic Theory, Aural Skills, Music in the Classic Era, Intro to Electroacoustic Music