Yuchen Li

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EDUCATION

Carnegie Mellon University August 2020 - May 2025 (expected)
- Ph.D. student in Machine Learning, advised by Prof. Andrej Risteski Pittsburgh, PA
- Research interests: machine learning, natural language processing, and data mining GPA: 4.24/4.33
- I currently work on (1) improving mathematical understanding of language models (training dynamics, efficient sampling, mechanistic interpretability), and (2) developing principled approaches to self-supervised learning

Simons Institute for the Theory of Computing August 2024 - December 2024
- Visiting graduate student for the "Modern Paradigms in Generalization" program Berkeley, CA

University of Illinois at Urbana-Champaign August 2015 - May 2019
- B.S. Statistics and Computer Science; second major in Mathematics; minor in Electrical Engineering Urbana-Champaign, IL
- Research mentors: Prof. Jiawei Han, Prof. AJ Hildebrand, Prof. Pramod Viswanath GPA: 4.0/4.0
- Summa Cum Laude; Highest Distinction in both majors
- Bronze Tablet Scholar: top 3% in the graduating class
- John R. Pasta Outstanding Undergraduate Award 2018: 2 out of about 400 computer science undergraduate junior students

WORK

***Research Intern,* Microsoft Corporation** May 2024 - August 2024
- Working on formal understanding of "data quality" for language model post training New York City, NY, United States

***Student Researcher Intern,* Google LLC** May 2023 - December 2023
- Worked on efficient decoding / sampling for language models Remote and New York City, NY, United States
- Proposed a theoretical framework for reasoning about generative masked language models, and empirical guidelines for training them

***Research Intern,* ByteDance Ltd. (parent company of TikTok)** May 2022 - August 2022
- Worked on a research project about machine translation at the ByteDance AI Lab Remote, United States
- Investigating the effect of language similarity in machine learning models for multi-lingual translation

***Machine Learning Engineer,* Quora, Inc.** August 2019 - August 2020
- Developed neural network models for predicting ads clickthrough rate Mountain View, CA, United States
- Led team-wide initiative of improving system robustness and reducing on-call burden in the Ads Ranking team
- Developed features for modeling the ads and the users
- Improved backend for cost-efficient low-latency online serving of machine learning models
- Launched online A/B testing to compare different model variants based on a set of key business metrics

***Software Engineer Intern,* Facebook, Inc.** May 2018 - August 2018
- Designed and implemented a platform for investigating machine learning feature importance Menlo Park, CA
- Proposed and developed feature perturbation and statistical analysis methods

PUBLICATIONS

(* indicates equal contribution or alphabetical order)

1. **Yuchen Li**, Alexandre Kirchmeyer*, Aashay Mehta*, Yilong Qin*, Boris Dadachev*, Kishore Papineni*, Sanjiv Kumar, Andrej Risteski. *Promises and Pitfalls of Generative Masked Language Modeling: Theoretical Framework and Practical Guidelines*. International Conference on Machine Learning (ICML) 2024.
2. Kaiyue Wen, **Yuchen Li,** Bingbin Liu, Andrej Risteski. *Transformers are uninterpretable with myopic methods: a case study with bounded Dyck grammars*. Conference on Neural Information Processing Systems (NeurIPS) 2023.
3. **Yuchen Li,** Yuanzhi Li, Andrej Risteski. *How Do Transformers Learn Topic Structure: Towards a Mechanistic Understanding*. International Conference on Machine Learning (ICML) 2023.
4. Ashwini Pokle *, Jinjin Tian *, **Yuchen Li** *, Andrej Risteski. *Contrasting the landscape of contrastive and non-contrastive learning*. Conference on Artificial Intelligence and Statistics (AISTATS) 2022.
5. **Yuchen Li,** Andrej Risteski. *The Limitations of Limited Context for Constituency Parsing*. Association for Computational Linguistics (ACL) 2021.
6. Xinwei He *, A.J. Hildebrand *, **Yuchen Li** *, Yunyi Zhang *. *Complexity of Leading Digit Sequences*. Journal of Discrete Mathematics & Theoretical Computer Science, vol. 22 no. 1, Automata, Logic and Semantics 2020.
7. Yu Shi *, Jiaming Shen *, **Yuchen Li**, Naijing Zhang, Xinwei He, Zhengzhi Lou, Qi Zhu, Matthew Walker, Myunghwan Kim and Jiawei Han. *Discovering Hypernymy in Text-Rich Heterogeneous Information Network by Exploiting Context Granularity*. Conference on Information and Knowledge Management (CIKM) 2019.
8. Hongyu Gong, **Yuchen Li**, Suma Bhat and Pramod Viswanath. *Context-Sensitive Malicious Spelling Error Correction*. The Web Conference (WWW) 2019.
9. **Yuchen Li** *, Zhengzhi Lou *, Yu Shi, and Jiawei Han. *Temporal Motifs in Heterogeneous Information Networks*. In Proceedings of the 14th International Workshop on Mining and Learning with Graphs (MLG) 2018.

TALKS

Towards Mathematical Understanding of Modern Language Models

- Flatiron Institute Transformers Reading Group — New York City, NY, August 2024
- Seminar on Foundational Artificial Intelligence — Virtual, April 2024
    - Recording (Chinese audio, English slides): https://www.bilibili.com/video/BV1F1421R7kb

Transformers are uninterpretable with myopic methods: a case study with bounded Dyck grammars

- DeepMath Conference on the Mathematical Theory of Deep Neural Networks — Virtual, November 2023
    - Recording: https://www.youtube.com/live/BZ34XH4ffEc?si=LjXAiYywQWys4zG5&t=20360

How Do Transformers Learn Topic Structure: Towards a Mechanistic Understanding

- Prof. Graham Neubig's lab (NeuLab), CMU Language Technologies Institute — Pittsburgh, PA, May 2023
- Machine Learning Reading Group, University of Illinois at Urbana-Champaign (UIUC) — Virtual, April 2023

The Limitations of Limited Context for Constituency Parsing

- Association for Computational Linguistics (ACL) Conference — Virtual, August 2021
- NEC Laboratories Europe — Virtual, July 2021
- Approximately Correct Machine Intelligence (ACMI) Lab, CMU — Virtual, June 2021

TEACHING

***Teaching Assistant,* Advanced Introduction to Machine Learning** August 2022 - December 2022
- Taught one recitation session on optimization Pittsburgh, PA
- Held weekly office hours; created and graded homework problems
- Course webpage: https://www.cs.cmu.edu/~nihars/teaching/10715-Fa22/index.html
- Instructor: Prof. Nihar Shah

***Teaching Assistant,* Probabilistic Graphical Models** January 2022 - May 2022
- Taught two recitation sessions (about algorithmic reduction and causality, respectively) Pittsburgh, PA
- Mentored nine teams of student projects (topics include natural language processing, information retrieval, 3D computer vision, and causality)
- Held weekly office hours; created and graded homework and quiz problems
- Course webpage: https://andrejristeski.github.io/10708-22/
- Instructors: Prof. Andrej Risteski and Prof. Hoda Heidari

***Volunteer Teaching Assistant,* Data Science Bootcamp** May 2019
- Contributed to creating a Python tutorial focusing on NumPy and Matplotlib libraries. Urbana, IL
- Helped in the class section for about 20 math graduate students and answered their programming questions
- Program webpage: https://ravat1.github.io/2019DSB-website/
- Instructor: Prof. Uma Ravat

***Member,* Eta Kappa Nu (HKN) Honors Society Alpha Chapter at UIUC** August 2016 - May 2019
- Contributed to its educational website Weber's Wiki Urbana, IL
- Developed and taught two Analog Signal Processing midterm review sessions, each with about 40 students attending

SERVICE

***Reviewer,* Academic Research Conferences**
- Artificial Intelligence and Statistics (AISTATS) 2022, 2024
- International Conference on Learning Representations (ICLR) 2023, 2024
- International Conference on Machine Learning (ICML) 2024
- Journal of Machine Learning Research (JMLR) 2024
- Conference on Neural Information Processing Systems (NeurIPS) 2021, 2023
- Mathematics of Modern Machine Learning Workshop at NeurIPS 2023
- Knowledge and Logical Reasoning Workshop at ICML 2023

***Volunteer,* Conference on Neural Information Processing Systems (NeurIPS)** 2023
- Signed up to help with conference logistics during December 11-16 New Orleans, LA

***Session Chair,* Learning Theory Alliance Mentorship Workshop** 2023
- Volunteered in this mentorship workshop centered on communicating one's research verbally for undergraduate, masters, PhD students, and postdocs interested in learning theory and adjacent fields Online
- Hosted a session in which participants gave research talks and the audience discussed learnings and provided feedback

***Member,* CMU Machine Learning Programs Admissions Committee** multiple years
- Assisted in faculty-led tasks and meetings for reviewing and admitting applicants Pittsburgh, PA

***Mentor,* CMU Computer Science Graduate Application Support Program** 2020

- Connected with potential applicants, particularly those from underrepresented groups Pittsburgh, PA
- Offered feedbacks on their application materials and answered their questions related to graduate school application

SKILLS

- Proficient in *Python, PyTorch, TensorFlow, Jax, C, SQL, MATLAB, PHP*
- Intermediate in *C++, R, Haskell*; Basic in *Java, JavaScript*