

# Yingcong Li

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University of Michigan, Ann Arbor, MI 48105

## EDUCATION

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- **University of Michigan, Ann Arbor**  
PhD in Electrical Engineering and Computer Science (Jan. 2024–EST: Apr. 2025)
- **University of California, Riverside**  
PhD in Electrical and Computer Engineering (Jun. 2020–Dec. 2023)  
MS in Electrical and Computer Engineering (Sep. 2019–Jun. 2020)
- **University of Science and Technology of China**  
BS in Electrical Engineering and Information Science (Jun. 2015–Sep. 2019)

## RESEARCH EXPERIENCE

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Google scholar: <https://scholar.google.com/citations?user=9uWgIUAAAAJ&hl=en&oi=ao>

**Research at SOTA Lab**      *Advisor: Samet Oymak*      (Jun. 2020–Present)

- **Optimization Theory for Sequence Models.** Conducted research on the optimization of model training, focusing on sequence models like Transformers and State-space Models. Specifically, studied the optimization landscape of linear Transformers [2,3], State-space Models [3], and Gated Linear Attention [1] in the context of in-context learning. Developed a theoretical framework that equates the optimization geometry of self-attention in Transformers to max-margin SVM problems [4,7,8] and Markov models [5].
- **Emergent Abilities of Autoregressive Models.** Investigated both empirical and theoretical performance of autoregressive models, such as Mamba and Transformers. Empirically studied the emergent behavior of Mamba compared to Transformers under task-mixture settings [6]. Analyzed generalization bounds of Transformers in in-context learning and applied insights to dynamical systems [10]. Researched the emergent “chain-of-thought” reasoning in Transformers, supporting its compositional learning capabilities through in-context filtering from both empirical evidence and theoretical exploration [9].
- **Statistical Learning and Model Architectures.** Extensively studied statistical learning with a focus on sample efficiency and model architecture across diverse learning paradigms. Tackled challenges of data dependency in in-context learning [10], and analyzed sample complexity in multitask [11,13] and continual learning [14] scenarios using heterogeneous model architectures.

## PUBLICATIONS

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\* Equal contribution.

**3 NeurIPS (1 spotlight), 2 ICML, 1 AISTATS, 3 AAAI papers**

- [1]. [Yingcong Li](#), Davoud Ataee Tarzanagh, Ankit Singh Rawat, Maryam Fazel, Samet Oymak. “Gating is Weighting: Understanding Gated Linear Attention through In-context Learning” *in submission*, 2024.
- [2]. Xiangyu Chang, [Yingcong Li](#), Muti Kara, Samet Oymak, Amit Roy-Chowdhury. “Provable Benefits of Task-Specific Prompts for In-context Learning” *in submission*, 2024.
- [3]. [Yingcong Li](#), M. Ankit Singh Rawat and Samet Oymak. “Fine-grained Analysis of In-context Linear Estimation.” *Thirty-eighth Conference on Neural Information Processing Systems (NeurIPS)*, 2024.
- [4]. [Yingcong Li](#)\*, Yixiao Huang\*, M. Emrullah Ildiz, Ankit Singh Rawat and Samet Oymak. “Mechanics of Next Token Prediction with Self-Attention.” *Artificial Intelligence and Statistics (AISTATS)*, 2024.
- [5]. M. Emrullah Ildiz, Yixiao Huang, [Yingcong Li](#), Ankit Singh Rawat, and Samet Oymak. “From Self-Attention to Markov Models: Unveiling the Dynamics of Generative Transformers” *The Forty-first International*

*Conference on Machine Learning (ICML)*, 2024.

- [6]. Li, Yingcong, Xupeng Wei, Haonan Zhao, and Taigao Ma. "Can Mamba In-Context Learn Task Mixtures?" *In ICML 2024 Workshop on In-Context Learning*.
- [7]. Tarzanagh, Davoud Ataee\*, Yingcong Li\*, Christos Thrampoulidis, and Samet Oymak. "Transformers as Support Vector Machines." *in submission*, 2023.
- [8]. Tarzanagh, Davoud Ataee, Yingcong Li, Xuechen Zhang, and Samet Oymak. "Max-Margin Token Selection in Attention Mechanism" *Thirsty-seventh Conference on Neural Information Processing Systems (NeurIPS, spotlight)*, 2023.
- [9]. Yingcong Li, Kartik Sreenivasan, Angeliki Giannou, Dimitris Papailiopoulos, and Samet Oymak. "Dissecting Chain-of-Thought: Compositionality through In-Context Filtering and Learning." *Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS)*, 2023.
- [10]. Yingcong Li, M. Emrullah Ildiz, Dimitris Papailiopoulos, Samet Oymak "Transformers as Algorithms: Generalization and Stability in In-Context Learning" *The Fortieth International Conference on Machine Learning (ICML)*, 2023.
- [11]. Yingcong Li, Samet Oymak "Provable Pathways: Learning Multiple Tasks over Multiple Paths" *The Thirty-Seventh AAAI Conference on Artificial Intelligence (AAAI)*, 2023.
- [12]. Yuzhen Qin, Yingcong Li, Fabio Pasqualetti, Maryam Fazel, Samet Oymak "Stochastic Contextual Bandits with Long Horizon Rewards" *The Thirty-Seventh AAAI Conference on Artificial Intelligence (AAAI)*, 2023.
- [13]. Yingcong Li and Samet Oymak, "On the Fairness of Multitask Representation Learning," *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2023.
- [14]. Yingcong Li, Mingchen Li, M Salman Asif, Samet Oymak "Provable and Efficient Continual Representation Learning" *arXiv preprint*, 2022.
- [15]. Xiangyu Chang\*, Yingcong Li\*, Samet Oymak, Christos Thrampoulidis "Provable Benefits of Overparameterization in Model Compression: From Double Descent to Pruning Neural Networks" *The Thirty-Fifth AAAI Conference on Artificial Intelligence (AAAI)*, 2021.

## PROFESSIONAL SERVICE

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- Reviewer for NeurIPS, ICLR, AAAI, AISTATS, ICASSP, TOPML, and SIGKDD

## EXTRACURRICULAR ACTIVITIES

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- 41<sup>st</sup> International Conference on Machine Learning (ICML2024) *invited talk* (Jul. 2024)
- Midwest Machine Learning Symposium (MMLS 2024) *presenter* (May. 2024)
- 37<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS2023) *presenter* (Dec. 2023)
- 40<sup>th</sup> International Conference on Machine Learning (ICML2023) *presenter* (Jul. 2023)
- 2023 Information Theory and Applications workshop (ITA2023) *presenter* (Feb. 2023)
- 37<sup>th</sup> AAAI Conference on Artificial Intelligence (AAAI2023) *presenter* (Feb. 2023)
- MURI Workshop *presenter* (Sep. 2022)
- 39<sup>th</sup> International Conference on Machine Learning (ICML2022) *attendance* (Jul. 2022)
- C Language programming *teaching assistant* (Sep. 2017–Feb. 2018)
- iOS Club Summer Club *trainee* (Aug. 2017)

## HONORS & AWARDS

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- NeurIPS 2023 Scholar Award (2023)
- AAAI-23 Student Scholarship (2023)
- UCR Dean's Distinguished Fellowship Award (2020–2021)
- USTC Bronze Award of Scholarship for Undergraduates (2017 & 2016)