

MINGZE WANG

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SHORT BIO

I am a third-year Ph.D student in Computational Mathematics, Peking University. I am very fortunate to be advised by **Prof. Weinan E**. Prior to that, I received my B.S. degree in Pure and Applied Mathematics (ranking 1/111 for the first three years during my undergraduate study) from Zhejiang University in 2021. My homepage is <https://wmz9.github.io/>.

EDUCATION

Peking University

Ph.D Candidate, *Computational Mathematics*
School of Mathematical Sciences
Advisor: Prof. Weinan E.

Beijing, China
2021.09 - Present

Zhejiang University

Bachelor of Science, *Pure and Applied Mathematics*
School of Mathematical Sciences
Academic ranking: 1/111, Comprehensive ranking: 1/111, Major GPA: 4.84/5 (95.5/100).

Hangzhou, China
2017.09 - 2021.06

EXPERIENCE

Peking University

Teaching assistant: Deep Learning Theory, taught by **Prof. Zhiyuan Li**
Teaching assistant: Calculus (A)
Teaching assistant: Calculus (B)

Beijing, China
Summer School 2023.
Fall 2021
Fall 2022, 2023; Spring 2022, 2023

Moqi Technology

Algorithm Intern
Work on image processing and privacy protection for biometric technology.

Beijing, China
2021.09 - 2022.06

RESEARCH INTERESTS

I am broadly interested in theory, algorithm and application of machine learning. I am also interested in non-convex and convex optimization. Specifically, my recent research topics are

- **Deep learning theory**: optimization, generalization, implicit bias and approximation.
- **Foundation Model and Transformer**: theory and algorithm.
- **Non-convex and Convex Optimization**: theory and algorithm.
- **AI for Compositional Optimization**: theory and algorithm.
- **CV and NLP**: algorithm and application.

PUBLICATIONS & PREPRINTS

- [1] Mingze Wang, Chao Ma. **Early Stage Convergence and Global Convergence of Training Mildly Parameterized Neural Networks**. *Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS 2022)*(73 pages). 2022.
- [2] Lei Wu, Mingze Wang, Weijie J. Su. **The alignment property of SGD noise and how it helps select flat minima: A stability analysis**. *Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS 2022)*. 2022.
- [3] Mingze Wang, Chao Ma. **Generalization Error Bounds for Deep Neural Networks Trained by SGD**. Under review. *arXiv preprint: 2206.03299*, 2022.

- [4] **Mingze Wang, Chao Ma. Understanding Multi-phase Optimization Dynamics and Rich Nonlinear Behaviors of ReLU Networks.** *Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS 2023, Spotlight (Top 3%))*(94 pages). 2023.
- [5] **Mingze Wang, Lei Wu. The Noise Geometry of Stochastic Gradient Descent: A Quantitative and Analytical Characterization.** *NeurIPS 2023 Workshop on Mathematics of Modern Machine Learning (NeurIPS 2023 Workshop M3L)* Under review. *arXiv preprint: 2310.00692*, 2023.
- [6] **Mingze Wang, Zeping Min, Lei Wu. Achieving Margin Maximization Exponentially Fast via Progressive Norm Rescaling.** Under review. 2023.
- [7] **Mingze Wang, Weinan E. Understanding the Expressive Power of Transformer for Next Token Prediction.** On the preparation. 2023.
- [8] **Mingze Wang, Ziyin Liu. Global Minimum of Wide ReLU Net is Essentially Unique.** On the preparation. 2023.

SELECTED TALKS & PRESENTATIONS

Some mathematical modeling problems and machine learning theory, *Schlumberger (Beijing)*. 2023.07

SERVICE

Conference: Conference on Neural Information Processing Systems (NeurIPS); International Conference on Learning Representations (ICLR).

Journal: Journal of Machine Learning Research (JMLR); Journal of Machine Learning (JML).

SELECTED AWARDS & HONOURS

BICMR Mathematical Award for Graduate Students (top 1%, 110,000 RMB) 2023.11
 Schlumberge Scholarship (30,000 RMB) 2022.10
 PKU Academic Innovation Award (top 1%) 2022.10
 Outstanding Graduate of Zhejiang Province (top 5%) 2021.05
 Outstanding Graduate of ZJU 2021.05
 Chinese National Scholarship (top 1%) 2019.10
 First Class Scholarship of ZJU (top 3%) 2019, 2020.10
 Zhejiang Provincial Government Scholarship 2018.10
 First Prize of Mathematical Contest in Modeling of ZJU (top 1%) 2020.06
 Meritourious Award in The Mathematical Contest in Modeling 2020.02
 National Second Prize of Chinese Undergraduate Mathematical Contest in Modeling (top 2.5%) 2019.10

SELECTED UNDERGRADUATE TRANSCRIPT

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|----------------------|-----|----------------------------|-----|-------------------------------|-----|
| Real Analysis | 100 | Functional Analysis | 100 | Partial Differential Equation | 100 |
| Scientific Computing | 100 | Mathematical Analysis (II) | 99 | Differential Geometry | 99 |
| Point Topology | 99 | Mathematical Physics | 97 | Complex Analysis | 97 |
| Calculus (I) | 97 | Stochastic Process | 96 | Foundation of Analysis | 96 |