MINSHUO CHEN

Electrical and Computer Engineering
Princeton University

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RESEARCH INTEREST

My research focuses on developing principled and scalable methodologies and theoretical foundations of machine learning. A concentrated goal is to exploit rich data geometric structures for efficient learning.

I am particularly interested in

(i). approximation theory and statistical sample complexities of neural networks;

(ii). diffusion models for distribution estimation and black-box optimization;

(iii). (deep) reinforcement learning.

EDUCATION

2017 - 2022 Georgia Institute of Technology
Ph.D. in Machine Learning
– Advisors: Tuo Zhao and Wenjing Liao

2015 - 2017 University of California, Los Angeles
M.S. in Electrical Engineering

2011 - 2015 Zhejiang University
B.S. in Electrical and Information Engineering
– Graduated with honor from Chu Kochen Honor's College (advanced class of engineering education)

EMPLOYMENT

2022 - Princeton University
Postdoctoral Research Associate
– Host: Mengdi Wang

PREPRINTS AND PUBLICATIONS

Preprints

- **Reward-Directed Conditional Diffusion: Provable Distribution Estimation and Reward Improvement**
  Hui Yuan, Kaixuan Huang, Chengzhuo Ni, **Minshuo Chen**, Mengdi Wang
- **High Dimensional Binary Classification under Label Shift: Phase Transition and Regularization**
  Jiahui Cheng, **Minshuo Chen**, Hao Liu, Tuo Zhao, and Wenjing Liao
- **Distribution Approximation and Statistical Estimation Guarantees of Generative Adversarial Networks**
  Minshuo Chen, Wenjing Liao, Hongyuan Zha, and Tuo Zhao

Journal Publications and Submissions

- **Efficient RL with Impaired Observability: Learning to Act with Delayed and Missing State Observations**
  Minshuo Chen, Jie Meng, Yu Bai, Yinyu Ye, H. Vincent Poor, and Mengdi Wang
  Submitted to IEEE Transactions on Information Theory
- **Transition-Consistent Pessimistic Nonparametric Policy Learning in Partially Observed MDPs using Neural Networks**
  Minshuo Chen, Zhuoran Yang, Zhaoran Wang, Michael I. Jordan, and Tuo Zhao
  Submitted to Journal of Machine Learning Research
- **Deep nonparametric estimation of operators between infinite dimensional spaces**
  Hao Liu, Haizhao Yang, **Minshuo Chen**, Tuo Zhao, and Wenjing Liao
  Submitted to Journal of Machine Learning Research
- **Doubly Robust Off-Policy Learning on Low-Dimensional Manifolds by Deep Neural Networks**
  Minshuo Chen*, Hao Liu*, Wenjing Liao, and Tuo Zhao (Equal contribution)
  Submitted to Mathematics of Operations Research
- **A Manifold Two-Sample Test Study: Integral Probability Metric with Neural Networks**
  Jie Wang, **Minshuo Chen**, Tuo Zhao, Wenjing Liao, and Yao Xie
  Information and Inference: A Journal of IMA, 2023
- **Nonparametric Regression on Low-Dimensional Manifolds using Deep ReLU Networks : Function Approximation and Statistical Recovery**
  Minshuo Chen, Haoming Jiang, Wenjing Liao, and Tuo Zhao
  Information and Inference: A Journal of IMA, 2022

Conference Publications

- **Effective Minkowski Dimension of Deep Nonparametric Regression: Function Approximation and Statistical Theories**
  Zixuan Zhang, **Minshuo Chen**, Mengdi Wang, Wenjing Liao, and Tuo Zhao
  International Conference on Machine Learning (ICML), 2023
- **Score Approximation, Estimation and Distribution Recovery of Diffusion Models on Low-Dimensional Data**
  Minshuo Chen*, Kaixuan Huang*, Tuo Zhao, and Mengdi Wang (Equal contribution)
  International Conference on Machine Learning (ICML), 2023
- **Adaptive Budget Allocation for Parameter-Efficient Fine-Tuning**
  Qingru Zhang, **Minshuo Chen**, Alexander Bukharin, Pengcheng He, Yu Cheng, Weizhu Chen, and Tuo Zhao
  International Conference on Learning Representations (ICLR), 2023
- **Sample Complexity of Nonparametric Off-Policy Evaluation on Low-Dimensional Manifolds using Deep Networks**
  Xiang Ji, **Minshuo Chen**, Mengdi Wang, and Tuo Zhao
  International Conference on Learning Representations (ICLR), 2023
- **On Deep Generative Models for Approximation and Estimation of Distributions on Manifolds**
  Biraj Dahal, Alexander Havrilla, **Minshuo Chen**, Tuo Zhao, and Wenjing Liao
  Annual Conference on Neural Information Processing Systems (NeurIPS), 2022

- **Benefits of Overparameterized Convolutional Residual Networks: Function Approximation under Smoothness Constraint**
  Hao Liu, **Minshuo Chen**, Siawpeng Er, Wenjing Liao, Tong Zhang, and Tuo Zhao
  International Conference on Machine Learning (ICML), 2022
- **Large Learning Rate Tames Homogeneity: Convergence and Balancing Effect**
  Yuqing Wang, **Minshuo Chen**, Tuo Zhao, and Molei Tao
  International Conference on Learning Representations (ICLR), 2022
- **Pessimism Meets Invariance: Provably Efficient Offline Mean-Field Multi-Agent RL**
  Minshuo Chen, Yan Li, Zhuoran Yang, Zhaoran Wang, and Tuo Zhao
  Annual Conference on Neural Information Processing Systems (NeurIPS), 2021
- **Besov Function Approximation and Binary Classification on Low-Dimensional Manifolds Using Convolutional Residual Networks**
  Hao Liu, **Minshuo Chen**, Tuo Zhao, and Wenjing Liao
  International Conference on Machine Learning (ICML), 2021
- **How Important is the Train-Validation Split in Meta-Learning?**
  Yu Bai, **Minshuo Chen**, Pan Zhou, Tuo Zhao, Jason D. Lee, Sham Kakade, Huan Wang, and Caiming Xiong
  International Conference on Machine Learning (ICML), 2021
- **Super Tickets in Pre-Trained Language Models: From Model Compression to Improving Generalization**
  Chen Liang, Simiao Zuo, **Minshuo Chen**, Haoming Jiang, Xiaodong Liu, Pengcheng He, Tuo Zhao, and Weizhu Chen
  International Joint Conference on Natural Language Processing (ACL-IJCNLP), 2021
- **Deep Learning Assisted End-to-End Synthesis of mm-Wave Passive Networks with 3D EM Structures: A Study on A Transformer-Based Matching Network**
  Siawpeng Er, Edward Liu, **Minshuo Chen**, Yan Li, Yuqi Liu, Tuo Zhao, and Hua Wang
  International Microwave Symposium (IMS), ***Oral presentation***, 2021
- **Towards Understanding Hierarchical Learning: Benefits of Neural Representations**
  Minshuo Chen, Yu Bai, Jason D. Lee, Tuo Zhao, Huan Wang, Caiming Xiong, and Richard Socher
  Annual Conference on Neural Information Processing Systems (NeurIPS), 2020
- **Differentiable Top-k Operator with Optimal Transport**
  Yujia Xie, Hanjun Dai, **Minshuo Chen**, Bo Dai, Tuo Zhao, Hongyuan Zha, Wei Wei, and Tomas Pfister
  Annual Conference on Neural Information Processing Systems (NeurIPS), 2020
- **On Generalization Bounds of a Family of Recurrent Neural Networks**
  Minshuo Chen, Xingguo Li, and Tuo Zhao
  International Conference on Artificial Intelligence and Statistics (AISTATS), 2020
- **Residual Network Based Direct Synthesis of EM Structures: A Study on One-to-One Transformers**
  David Munzer, Siawpeng Er, **Minshuo Chen**, Yan Li, Naga S. Mannem, Tuo Zhao, and Hua Wang
  IEEE Radio Frequency Integrated Circuits Symposium (RFIC), 2020
- **On Computation and Generalization of Generative Adversarial Imitation Learning**
  Minshuo Chen, Yizhou Wang, Tianyi Liu, Zhuoran Yang, Xingguo Li, Zhaoran Wang, and Tuo Zhao
  International Conference on Learning Representations (ICLR), 2020

- **Efficient Approximation of Deep ReLU Networks for Functions on Low Dimensional Manifolds**
  Minshuo Chen, Haoming Jiang, Wenjing Liao, and Tuo Zhao (Alphabetical order)
  Annual Conference on Neural Information Processing Systems (NeurIPS), 2019
- **Towards Understanding the Importance of Shortcut Connections in Residual Networks**
  Tianyi Liu*, **Minshuo Chen***, Mo Zhou, Simon S. Du, Enlu Zhou, and Tuo Zhao (Equal contribution)
  Annual Conference on Neural Information Processing Systems (NeurIPS), 2019
- **On Scalable and Efficient Computation of Large Scale Optimal Transport**
  Yujia Xie, **Minshuo Chen**, Haoming Jiang, Tuo Zhao, and Hongyuan Zha
  International Conference on Machine Learning (ICML), 2019
- **On Computation and Generalization of Generative Adversarial Networks under Spectrum Control**
  Haoming Jiang, Zhehui Chen, **Minshuo Chen**, Feng Liu, Dingding Wang, and Tuo Zhao
  International Conference on Learning Representations (ICLR), 2019
- **Dimensionality Reduction for Stationary Time Series via Stochastic Nonconvex Optimization**
  Minshuo Chen, Lin F. Yang, Mengdi Wang, and Tuo Zhao
  Annual Conference on Neural Information Processing Systems (NeurIPS), 2018

Awards

2021	IDEaS-TRIAD Scholarship
2019, 2022	ICML Travel Award
2019	ARC-TRIAD Student Fellowship
2018, 2019	NeurIPS Travel Award
2017 - 2018	William S. Green Fellowship

Experiences

Teaching Assistantships:

- Computational Data Analysis / Machine Learning (CSE6740/ISYE6740), Fall 2017, Fall 2019
- Business Analytics (ISYE 4803), Spring 2018
- Regression Analysis (ISYE 6414), Fall 2018
- Basic Statistical Methods (ISYE 2028), Summer 2018, Summer 2019

Guest lecture “Representation and Statistical Properties of Deep Neural Networks on Structured Data” in Advanced Machine Learning (ISYE 8813), Fall 2021.

Internships:

- Research Intern, Salesforce, Summer 2020
- Research Intern, Microsoft, Fall 2020 2021

Services

- Area Chair: NeurIPS 2023
- Conference referee: AAAI, ICML, NeurIPS, ICLR
- Journal referee: IEEE Transactions on Signal Processing, IEEE Transactions on Information Theory,

IEEE Transactions on Pattern Analysis and Machine Intelligence, Operations Research, Mathematics of Operations Research, Transactions on Machine Learning Research