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

PUBLICATIONS AND PREPRINTS

Journal Publications and Submissions

- **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

- **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

- **Distribution Approximation and Statistical Estimation Guarantees of Generative Adversarial Networks**
  Minshuo Chen, Wenjing Liao, Hongyuan Zha, and Tuo Zhao
  Reject and Resubmit, Annals of Statistics

- **High Dimensional Binary Classification under Label Shift: Phase Transition and Regularization**
  Jiahui Cheng, **Minshuo Chen**, Hao Liu, Tuo Zhao, and Wenjing Liao
  Sampling Theory, Signal Processing, and Data Analysis, 2023

- **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

- **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
  Annual Conference on Neural Information Processing Systems (NeurIPS), 2023

- **Reward-Directed Conditional Diffusion: Provable Distribution Estimation and Reward Improvement**
  Hui Yuan, Kaixuan Huang, Chengzhuo Ni, **Minshuo Chen**, Mengdi Wang
  Annual Conference on Neural Information Processing Systems (NeurIPS), 2023

- **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

Preprints

- **Sample Complexity of Neural Policy Mirror Descent for Policy Optimization on Low-Dimensional Manifolds**
  Zhenghao Xu, Xiang Ji, **Minshuo Chen**, Mengdi Wang, and Tuo Zhao

- **Sample-Efficient Learning of POMDPs with Multiple Observations In Hindsight**
  Jiacheng Guo, **Minshuo Chen**, Huan Wang, Caiming Xiong, Mengdi Wang, and Yu Bai

- **Nonparametric Classification on Low Dimensional Manifolds using Overparameterized Convolutional Residual Networks**
  Kaiqi Zhang, Zixuan Zhang, **Minshuo Chen**, Mengdi Wang, Tuo Zhao, and Yu-Xiang Wang

- **Provable Benefits of Policy Learning from Human Preferences in Contextual Bandit Problems**
  Xiang Ji, Huazheng Wang, **Minshuo Chen**, Tuo Zhao, and Mengdi Wang

- **Counterfactual Generative Models for Time-Varying Treatments**
  Shenghao Wu, Wenbin Zhou, Minshuo Chen, and Shixiang Zhu

TALKS AND VISITS

- INFORMS Annual meeting 2023
  MA35. The Interplay between Learning, Optimization, and Statistics
  "Score Approximation, Estimation and Distribution Recovery of Diffusion Models on Low-Dimensional Data"

- Invited speaker at Cornell ORIE Young Researchers Workshop, 2023

- Group Meeting Talk "Diffusion Models for Distribution Estimation and Optimization"
  Wharton Department of Statistics and Data Science, University of Pennsylvania

- Group Meeting Talk "Score Approximation, Estimation and Distribution Recovery of Diffusion Models on Low-Dimensional Data"
  Department of Statistics and Data Science, Yale University

- Invited Talk "Representation and Statistical Properties of Deep Neural Networks on Low-Dimensional Data"
  SIAM Conference on Mathematics of Data Science, San Diego 2022

- Guest lecture "Representation and Statistical Properties of Deep Neural Networks on Structured Data"
  Advanced Machine Learning (ISYE 8813), Fall 2021

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

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