

Reading Materials

Textbooks

Optimization

1. Amir Beck, *First-Order Methods in Optimization*, SIAM, 2017. Chapters 1-6, 8-10, 15.

Or Chapter 1-6 plus:

Pavel Dvurechensky, Shimrit Shtern, Mathias Staudigl, *First-Order Methods for Convex Optimization*, EURO Journal on Computational Optimization 9 (2021) 100015.

Machine Learning

2. Christopher M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006. Chapters 1-7. (Although Bishop has a newly updated book: *Deep Learning - Foundations and Concepts*, I would prefer students learn more about traditional machine learning techniques, rather than knowing deep learning only.)

Papers

Implicit DNNs

1. Xingyu Xie, Qiuhaio Wang, Zenan Ling, Xia Li, Guangcan Liu, and Zhouchen Lin, *Optimization Induced Equilibrium Networks: An Explicit Optimization Perspective for Understanding Equilibrium Models*, IEEE Trans. Pattern Analysis and Machine Intelligence, 45(3): 3604-3616 (2023). [[pdf](#)]

DNN Training Algorithms

2. Jia Li, Cong Fang, and Zhouchen Lin, *Lifted Proximal Operator Machines*, AAAI 2019, arXiv: [1811.01501](#). [[pdf](#)][[supplementary material](#)]

Optimization Algorithms

3. Fanhua Shang, Yuanyuan Liu, James Cheng, Zhi-Quan Luo, and Zhouchen Lin, *Bilinear Factor Matrix Norm Minimization for Robust PCA: Algorithms and Applications*, IEEE Trans. Pattern Analysis and Machine Intelligence, 40(9): 2066-2080 (2018). [[pdf](#)][[supplementary material](#)]

4. Anda Tang, Yiming Dong, Yutao Zeng, Zhou Xun, and Zhouchen Lin, *Stepsize Anything: A Unified Learning Rate Schedule for Budgeted-Iteration Training*, NeurIPS 2025. [[pdf](#)]

DNN Design

5. Zhoutong Wu, Mingqing Xiao, Cong Fang, and Zhouchen Lin, *Designing Universally-Approximating Deep Neural Networks: A First-Order Optimization Approach*, IEEE Trans. Pattern Analysis and Machine Intelligence, 46(9): 6231-6246 (2024). [[pdf](#)]

6. Xin Xu and Zhouchen Lin, *Learning Nonseparable Sparse Regularizers via Multivariate Activation Functions*, Neurocomputing 651: 130853 (2025). [[pdf](#)]