

# HONGYI LI

Email: lihongyi@stu.xidian.edu.cn || Phone: (+86) 182-9287-4860

Homepage: [https://vistalee.github.io/Hongyi\\_Li.github.io/](https://vistalee.github.io/Hongyi_Li.github.io/)

## RESEARCH INTERESTS

Deep learning on graphs, nonconvex optimization, uncertainty quantification of neural networks.

## EDUCATION

**Xidian University**, Xi'an, Shaanxi, China **Aug 2019 – Sept 2024**

*M.Eng. student in Information and Telecommunication Engineering (GPA: 3.82/4.0)*

- Related Courses: Neural Networks and Fuzzy Systems, Stochastic Processes, Fundamentals of Information Theory

**Emory University**, Atlanta, GA, USA **Dec 2020 – Present**

*Visiting student (remote) in Computer Science*

**Xidian University**, Xi'an, Shaanxi, China **Aug 2015 – Jun 2019**

*B.Eng. in Telecommunications Engineering (GPA: 3.80/4.0), pilot class*

- Related Courses: Advanced Mathematics (I & II), Advanced Algebra, Selected Topics in Mathematical Statistics, Information Theory, Probability Theory and Mathematical Statistics, Introduction of Computer and C Language Program Design, Data Structure and Algorithm Analysis, Operating Systems
- Dissertation Title: Deep Learning Approaches to Large-Scale Nonlinear Problems and Applications in Wireless Communications

## PROJECT EXPERIENCE

**Model parallelism training of the GA-MLP model based on the ADMM framework** **Mar 2021 – Jul 2021**

*Project Co-leader, Emory University*

- Split the Graph Augmented Multi-Layer Perceptron (GA-MLP) model into independent layer components by the Alternating Direction Method of Multipliers (ADMM) to achieve model parallelism.
- Proposed a novel algorithm to train the GA-MLP model and resolved all subproblems by closed-form solutions.
- Conducted extensive experiments on nine large-scale benchmark datasets to demonstrate the effectiveness, convergence, and the massive speedup of the proposed algorithm.

**Accelerated neural network training by alternating optimization** **May 2021 – Sep 2021**

*Emory University*

- Proposed a novel reformulation for neural network optimization where the deeply nested activation functions were disentangled into separate functions innovatively coordinated by inherently convex inequality constraints.
- Proposed a novel algorithm to train a neural network by alternating minimization and addressed all subproblems of the proposed algorithm by closed-form solutions.
- Conducted extensive experiments to demonstrate the effectiveness and convergence of our proposed algorithm.

**Uncertainty quantification of explanations of neural networks for image classification** **Jun 2022 – Present**

*Project Leader, Emory University*

- Quantified both data and model uncertainties of the explanation of a neural network model for image classification.
- Measured data uncertainty from both transformation of the input image and propagation from the output of the neural network to the saliency map.
- Measured model uncertainty by estimating the distribution of neural network parameters.
- Conducted preliminary experiments to demonstrate the effectiveness of the proposed approaches.

**Mixed-parallel training of GCNs based on the ADMM framework** **Jun 2021 – Jan 2022**

*Project Leader, Emory University*

- Proposed a distributed training algorithm based on the ADMM framework by breaking Graph Convolutional Network (GCN) layers into layerwise blocks and partitioning a graph into independent communities.
- Conducted experiments on two benchmark datasets to demonstrate the performance and the speedup of the proposed algorithm.

**Improved Massive MIMO Detection Using Edge GNN** **Aug 2020 – Nov 2020**

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## *Project Leader, Xidian University*

- Extended the application of the Graph Neural Network (GNN) to achieve Multiple-Input Multiple-Output (MIMO) signal detection in wireless communication systems.
- Used graph edge attributes that represented the channel correlations to measure the importance of neighboring messages for each node.
- Sparsified the complete graph model that represented the signal transmission process based on the channel correlations to reduce training time.
- Conducted experiments to demonstrate the effectiveness and efficiency of the proposed model.

## **PUBLICATIONS**

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- Junxiang Wang, **Hongyi Li (first-coauthor)**, Zheng Chai, Yongchao Wang, Yue Cheng, and Liang Zhao. Toward Quantized Model Parallelism for Graph-Augmented MLPs Based on Gradient-Free ADMM Framework. IEEE Transactions on Neural Networks and Learning Systems (TNNLS), (Impact Factor: 10.4), vol. 35, no. 4, pp. 4491-4501, April 2024, doi: 10.1109/TNNLS.2022.3223879.
- Junxiang Wang, **Hongyi Li**, and Liang Zhao. Accelerated Gradient-free Neural Network Training by Multi-convex Alternating Optimization. Neurocomputing, (Impact Factor: 5.779), 2022, 487: 130-143, doi: 10.1016/j.neucom.2022.02.039.
- **Hongyi Li**, Junxiang Wang, Yongchao Wang, Yue Cheng, and Liang Zhao. Community-based Layerwise Distributed Training of Graph Convolutional Networks. NeurIPS 2021 Workshop on Optimization for Machine Learning (OPT 2021).
- Junxiang Wang, **Hongyi Li**, Yongchao Wang, and Liang Zhao. Accelerated Gradient-free Neural Network Training by Multi-convex Alternating Optimization. Workshop on “Beyond first-order methods in ML systems” of the 38th International Conference on Machine Learning.
- Junji Jiang, Chen Ling, **Hongyi Li**, Guangji Bai, Xujiang Zhao, and Liang Zhao. Quantifying Uncertainty in Graph Neural Network Explanations. Frontiers in Big Data, (Impact Factor: 3.1), 2024, doi: 10.3389/fdata.2024.1392662
- **Hongyi Li**, Junxiang Wang, and Yongchao Wang. Improved Massive MIMO Detection Using Edge Graph Neural Network, arXiv preprint arXiv:2206.06979.

## **ACADEMIC SERVICES**

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- PC member: OPT for Machine Learning NeurIPS Workshop 2023&2022.
- Reviewer: TKDE.
- External reviewers: NeurIPS’22, KDD’22, ICDM’22, ICLR’22, KDD’21, NeurIPS’21, CSUR.
- TA for the courses “Introduction to Electric and Electronic Engineering” and “Principles of Communications”.

## **HONORS, AWARDS & EXTRACURRICULARS**

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- Valedictorian, Xidian University, 2019.
- The Second Prize Scholarship, Xidian University, 2022, 2021, 2018 & 2017.
- The First Prize for National English Competition for College Students (Top 0.5%), 2018.
- The Second Prize for FLTRP National English Writing Competition for College Students (Top 0.03%), 2017.
- China National Endeavor Scholarship (Top 5%), 2016.
- Academic English Communication and Writing Skills Program, University of Cambridge (Online), 2022.
- Team Leader of Future Elite Development Program, Harvard University, 2018.
- Volunteer of the 13<sup>th</sup> Meeting of the International Committee on Global Navigation Satellite System, 2018.
- President of Xidian Toastmaster English Club, Xidian University, 2017.

## **PROFESSIONAL SKILLS**

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- Programming Languages: Python (Pytorch, Tensorflow, Pytorch Geometric), MATLAB, C.
- Cloud Computing Servers: AWS, Google Cloud, Chameleoncloud.
- Operating Systems: Windows, Linux.