HONGYI LI

+86 182 9287 4860 | lihongyi@stu.xidian.edu.cn | 2nd South Taibai Road, Yanta District, Xi'an 710071, China
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RESEARCH INTERESTS

Deep learning on graphs, nonconvex optimization, uncertainty quantification in deep learning models

EDUCATION

Xidian University, Xi'an, Shaanxi, China **Aug. 2019 – Nov.2022(quitted)**

Ph.D. student in Communications and Information Systems ***(GPA: 3.82/4.0, Major GPA: 3.84/4.0)***

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

Emory University, Atlanta, GA, USA **Dec. 2020 - Present**

Visiting scholar (remote) in Computer Science

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

B.Eng. in Telecommunications Engineering ***(GPA:3.80/4.0, Major GPA: 3.76/4.0), 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

Uncertainty Quantification for the Explanations of Image Classification Neural Networks Jun. 2022 - Current

Lab Research Program, Emory University (remote)

- Proposed methods to quantify both data and model uncertainties of the saliency map of image classification neural networks, in order to improve the network explainability.
- Two kinds of data uncertainty were considered: uncertainty due to the transformation of the input image, and uncertainty propagated from the output to the saliency map; model uncertainty was obtained via estimating the distribution of model parameters.
- Preliminary experiments demonstrated the effectiveness of the proposed approaches.

Accelerated gradient-free neural network training by multi-convex alternating optimization May 2021 – Jan. 2022

Lab Research Program, Emory University (remote)

- Proposed a novel formulation for neural network optimization named multi-convex Deep Learning Alternating Minimization (mDLAM), where the deeply nested activation functions are disentangled into separate functions innovatively coordinated by inherently convex inequality constraints.
- Provided closed-form solutions to all subproblems in mDLAM, and applied the Nesterov acceleration technique to speed up convergence, proving mDLAM higher efficiency rates.
- Extensive experiments demonstrated the effectiveness and linear convergence of our proposed mDLAM algorithm.

Model-parallel training of GA-MLPs based on ADMM framework Mar. 2021 - Jul. 2022

Lab Research Program, Emory University (remote)

- The Graph Augmented Multi-Layer Perceptron (GA-MLP) model was split into independent layer partitions that allow the Alternating Direction Method of Multipliers (ADMM) method to achieve model parallelism.
- A novel algorithm named pdADMM-G was proposed to train the GA-MLP model, and the solutions to all subproblems produced by the algorithm are deducted. Moreover, the quantized variant coined pdADMM-G-Q is proposed to reduce the communication cost due to parallel training.
- Both algorithms were proved to converge to a (quantized) stationary point with sublinear convergence rate; experimental results on nine benchmark datasets deployed on AWS EC2 machines demonstrated the superior performance, convergence, and massive speedup of the two algorithms.

Mixed-parallel training of GCNs based on ADMM framework Jun. 2021 - Jan. 2022

Lab Research Program, Emory University (remote)

- Proposed a distributed and parallel Graph Convolutional Network (GCN) training algorithm based on ADMM.

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- To alleviate the dependency of GCN layers, the proposed ADMM algorithm breaks the layers into independent blocks, which not only allowed layer-wise parallel training but also mitigated the heavy node dependency issue; partitioned a graph into communities to achieve node-wise parallel training, and kept the connections of inter-community nodes to avoid performance loss.
- Experiments on two benchmark datasets deployed on AWS EC2 machines demonstrated the performance and speedup of the proposed ADMM algorithm.

PUBLICATIONS & ACADEMIC SERVICES

- Junxiang Wang, **Hongyi Li (first-coauthor)**, Zheng Chai, Yongchao Wang, Yue Cheng, and Liang Zhao. Towards Quantized Model Parallelism for Graph-Augmented MLPs Based on Gradient-Free ADMM Framework. IEEE Transactions on Neural Networks and Learning Systems (TNNLS), (Impact Factor: 14.255), accepted.
- 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.
- **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), accepted.
- 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, accepted.
- **Hongyi Li**, Junxiang Wang, and Yongchao Wang. Improved Massive MIMO Detection Using Edge Graph Neural Network, preprint.
- PC member: OPT for Machine Learning NeurIPS Workshop 2022.
- External reviewers: NeurIPS'22, KDD'22, ICDM'22, ICLR'22, KDD'21, NeurIPS'21, etc.

TEACHING EXPERIENCE

Xidian University – *TA of Introduction to Electric and Electronic Engineering* **Sept. 2020 - Dec. 2020**

- Gave tutorials of fundamentals of analog and digital signal systems to a class of 95 students in English
- Led weekly office hours discussing class topics and graded assignments and test papers

HONORS, AWARDS & EXTRACURRICULARS

- Valedictorian, Xidian University, 2019
- 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 13th Meeting of the International Committee on Global Navigation Satellite System, 2018
- Chair of Xidian Toastmaster English Club, Xidian University, 2017

PROFESSIONAL SKILLS & INTERESTS

- Programming Languages: Python (Pytorch, Tensorflow, PaddlePaddle, Pytorch Geometric), MATLAB, C
- Cloud Computing Servers: AWS, Chameleoncloud
- Operating Systems: Windows, Linux
- Certificates: TOEFL: 107/120 (Speaking: 22/30)
- Interests: Calligraphy, Singing, Hiking, Roller Skating, Badminton