Lijun Zhang

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EDUCATION

University of Massachusetts, Amherst, Amherst MA, USA — Sept.2019 – May. 2025
Ph.D. in the College of Computer Science — Overall GPA: 4.0/4.0

Tongji University, Shanghai, China — Sept.2016 - Mar.2019
M.Sc. in Software Engineering — Overall GPA: 4.63/5.0

Tongji University, Shanghai, China — Sept.2012 - Jun.2016
B.Eng. in Software Engineering — Overall GPA: 4.78/5.0

RESEARCH INTERESTS

My research interest lies in *Efficient Machine Learning for Computer Vision Tasks*. Specifically, my past works focus on automatically developing multi-task models that achieve high task accuracy, small memory footprint, and low computation cost simultaneously for vision tasks. Beyond that, I am currently exploring generative AI, especially diffusion model, as a special case of MTL.

SELECTED PUBLICATIONS

- Qizheng Yang, Tianyi Yang, Mingcan Xiang, **Lijun Zhang**, Haoliang Wang, Marco Serafini, Hui Guan, GMorph: Accelerating Multi-DNN Inference via Model Fusion, European Conference on Computer Systems (EurSys), 2024.
- Kunjal Panchal, Sunav Choudhary, Nisarg Parikh, **Lijun Zhang**, Hui Guan, Flow: Per-instance Personalized Federated Learning, in Conference on Neural Information Processing Systems (NeurIPS), 2023.
- **Lijun Zhang**, Xiao Liu, Hui Guan, A Tree-Structured Multitask Model Architectures Recommendation System, IEEE Transactions on Neural Networks and Learning Systems (TNNLS), 2023
- **Lijun Zhang**, Qizheng Yang, Xiao Liu, Hui Guan, An Alternative Hard-Parameter Sharing Paradigm for Multi-Domain Learning, IEEE Access, 2023.
- **Lijun Zhang**, Xiao Liu, Hui Guan, AutoMTL: A Programming Framework for Automating Efficient Multi-Task Learning, in Conference on Neural Information Processing Systems (NeurIPS), 2022.
- **Lijun Zhang**, Xiao Liu, Hui Guan, A Tree-Structured Multi-Task Model Recommender, in International Conference on Automated Machine Learning (AutoML), 2022.
- **Lijun Zhang**, Qizheng Yang, Xiao Liu, Hui Guan, Rethinking Hard-Parameter Sharing in Multi-Domain Learning, in IEEE International Conference on Multimedia and Expo (ICME), 2022.
- Hui Guan, Umang Chaudhary, Yuanchao Xu, Lin Ning, **Lijun Zhang**, Xipeng Shen, Recurrent neural networks meet context-free grammar: Two birds with one stone, in IEEE International Conference on Data Mining (ICDM), 2021.
- **Lijun Zhang**, Hui Guan, Yufei Ding, Xipeng Shen, Hamid Krim, Reuse-centric K-means Configuration, in Information Systems, 2021. Lin Zhang, **Lijun Zhang**, Xiao Liu, Ying Shen, Shengjie Zhao, Shaoming Zhang, Zero-Shot Restoration of Back-lit Images Using Deep Internal Learning, in ACM International Conference on Multimedia (ACM MM), 2019.
- **Lijun Zhang**, Lin Zhang, Xiao Liu, Ying Shen, and Dongqing Wang, Image exposure assessment: A benchmark and a deep convolutional neural networks based model, in IEEE International Conference on Multimedia and Expo (ICME), 2018.

- **Lijun Zhang**, Lin Zhang, and Lida Li, Illumination quality assessment for face images: a benchmark and a convolutional neural networks based model, in International Conference on Neural Information Processing (ICONIP), 2017.

PREPRINTS

- **Lijun Zhang**, Xiao Liu, Antoni Viros Martin, Cindy Xiong Bearfield, Yuriy Brun, Hui Guan, Robust Image Watermarking using Stable Diffusion, in ArXiv, 2024.
- Xiao Liu, **Lijun Zhang**, Hui Guan, Uplifting Message Passing Neural Network with Graph Original Information, in ArXiv, 2023.
- **Lijun Zhang**, Xiao Liu, Kaleel Mahmood, Caiwen Ding, Hui Guan, Dynamic Gradient Balancing for Enhanced Adversarial Attacks on Multi-Task Models, in ArXiv, 2023.
- **Lijun Zhang**, Xiao Liu, Erik Learned-Miller, Hui Guan, SID-NISM: A Self-supervised Low-light Image Enhancement Framework, in ArXiv, 2020.

RESEARCH EXPERIENCES

Exploring Stable Diffusion Models Sept.2023-Present

Research Assistant, Advised by Prof. Hui Guan, MLSys Lab, UMass Amherst

Summary: Rapid evolution in deep generative models has led to methods capable of synthesizing high-quality, realistic images. As a representative, stable diffusion models become popular in both traditional and emerging computer vision tasks. We would like to explore whether powerful diffusion models could serve as an off-the-shelf tool for downstream tasks, and whether the philosophy of multi-task learning and the power of stable diffusion models could facilitate each other.

- Adapted well-trained stable diffusion models to image watermarking task without additional training process; our research demonstrates that stable diffusion is a promising approach to robust watermarking, able to withstand even stable-diffusion-based attacks. (A preprint posted on ArXiv'24)
- Exploring solution of explicitly incorporating MTL into the framework of diffusion models for better generation performance, treating the multi-step denoising process as a special case of multi-task learning.
- Exploring possibility of efficiently generating parameters for multi-task models from single-task models, utilizing the generation power of stable diffusion models.

Programming Systems for Efficient Multi-Task Learning Oct.2020-June.2023

Research Assistant, Advised by Prof. Hui Guan, MLSys Lab, UMass Amherst

Summary: A fundamental challenge in multi-task learning is to determine the set of parameters to share across tasks to achieve the best performance for tasks. Existing manually designed network architectures and learning-based methods have limitations on either task performance or application generality. There is a strong need to develop programming systems for efficient multi-task learning that overcome current issues.

- Conducted an empirical study on how to share model parameters in multi-domain learning and concluded insights that challenge the common practice in hard parameter sharing and promote an alternative parameter sharing strategy as a stronger baseline. (A paper published on ICME'22, IEEE Acess'23)
- Designed a tree-structured multi-task models recommender that explore the architecture design space completely and automatically in a white-box manner via building recursive space enumerator and reliable task accuracy estimator; our recommended multi-task architectures are competitive with state-of-the-art under specified computation budgets. (A paper published on AutoML'22, TNNLS'23)

- Proposed a programming framework that largely automates architecture search of multi-task models given an arbitrary backbone model and a set of tasks via compiler support and policy-architecture co-training; the framework could identify compact multi-task models that outperform state-of-the-art approaches in task performance. (A paper accepted by NeurIPS'22)
- Explored the security aspect of multi-task models by first adapting of single-task white-box attacks to multi-task models and identifying their limitations; a novel attack framework, the Gradient Balancing Multi-Task Attack, is then introduced to effectively attack both standard and adversarially trained multi-task models. (A preprint posted on ArXiv'23)

Zero-shot Low-light Image Enhancement Jan.2018-June.2020

Research Assistant, Advised by Prof. Erik G. Learned-Miller, Vision Lab, UMass Amherst
Prof. Lin Zhang, Computer Vision Lab, Tongji University

Summary: To get rid of the restriction of using training data when conducting image restoration via neural networks, it is necessary to design self-supervised image enhancement approaches to restore the quality of any single back-lit image only relying on the visual information of the image itself.

- Proposed a self-supervised image decomposition network based on Retinex Theory, an image decomposition theory, which takes a low-light image and its histogram equalization image as only inputs for image illumination extraction and noise removal. (A preprint posted on ArXiv'20)
- Modeled the S-curve adjustment procedure in the back-lit image restoration with Markov Random Field (MRF) and proposed the first self-supervised learning solution to estimate the S-curve parameters that best fit the back-lit image; as an image-specific framework with low computation cost, the proposed method could be applied to video stream directly. (A paper published on ACMMM'19)

WORK EXPERIENCES

Amazon Robotics May.2023-August.2023

Applied Scientist II Summer Intern

Summary: Design and provide multi-task solution to the multiple vision tasks involved in the Amazon Robotics Stow system.

- Designed a multi-task framework that can solve semantic segmentation, instance segmentation, depth estimation, and surface normal prediction simultaneously.
- Overcame the challenge from disjoint training datasets for different tasks and successfully constructed a multi-task model with high accuracy as single-task models and much lower latency and computations.

RECOGNITION

IBM PhD Fellowship	IBM, 2023-2024
Scholar Award & Top Reviewer	NeurIPS, 2022
Travel Grant Award	Conf-AutoML, 2022
The Lori a. Clarke Scholarship	UMass Amherst CICS, MA, 2020
Best Undergraduate & Graduate Thesis	Tongji University, Shanghai, 2016 & 2019
Outstanding Graduates in Shanghai	Education Committee, Shanghai, 2016 & 2019
National Scholarship for Graduate Students	Ministry of Education, China, 2018