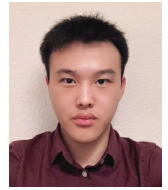


# Dacheng Li

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## EDUCATION

- Carnegie Mellon University** Dec 2021 - Feb 2023
- Research Assistant at Machine Learning Department; Supervisors: [Prof. Eric P. Xing](#) and [Prof. Hao Zhang](#).
  - Research: [MPCFormer: fast, performant and private Transformer inference with MPC](#).
- Carnegie Mellon University** Aug 2020 - Dec 2021
- Master of Science in Machine Learning
- GPA: 3.95/4.0; Supervisors: [Prof. Eric P. Xing](#) and [Prof. Hao Zhang](#).
  - Research: [AMP: Automatically Finding Model Parallel Strategies with Heterogeneity Awareness](#).
- University of California, San Diego** Sep 2016 - Mar 2020
- Double Majors in Computer Science and Mathematics
- Major GPA: 3.99/4.0; Supervisor: [Prof. Zhuowen Tu](#);
  - Research: [Dual Contradistinctive generative autoencoder](#).

## PUBLICATION

- Li, Dacheng**, Hongyi Wang, Eric P. Xing, and Hao Zhang. "AMP: Automatically Finding Model Parallel Strategies with Heterogeneity Awareness." (**NeurIPS 2022**)
- Li, Dacheng\***, Rulin Shao\*, Hongyi Wang\*, Han Guo, Eric P. Xing, Hao Zhang, "MPCFormer: fast, performant and private Transformer inference with MPC." (Under Submission to **ICLR 2023**)
- Bian, Song, **Dacheng Li**, Hongyi Wang, Eric P. Xing, Shivaram Venkatarman. "Does compressing activations help model parallel training?" (Under submission to **MLSys 2023**)
- Parmar, Gaurav\*, **Dacheng Li\***, Kwonjoon Lee\*, and Zhuowen Tu. "Dual contradistinctive generative autoencoder." (**CVPR 2021**) \* denotes equal contribution

## Awards

- Amazon Research Awards (Proposal and Project Lead)** Dec 2022
- [A Faster and More Accurate Secure Model Serving Framework on the Cloud](#) (PI: [Eric P. Xing](#), Award funding: \$80000)

## RESEARCH EXPERIENCE

- Automatically Finding Model Parallel Strategies with Heterogeneity Awareness (Project Lead)** Feb 2021 - Nov 2022
- [NeurIPS 2022 Paper](#) | [Code](#) | [Presentation](#) (Supervisors: [Prof. Eric P. Xing](#), [Prof. Hao Zhang](#))
- Developed an **automatic** procedure and a **cost model** to find good **model-parallel** strategies specifically for **heterogeneous** distributed clusters and deep learning models.
  - Matched expert-designed strategies in no heterogeneous setup; found **1.54x** and **1.77x** faster strategies when heterogeneity exists in the cluster and model.
- Fast, performant and private Transformer inference (Project Lead)** Feb 2022 - Present
- [Paper](#) (Supervisors: [Prof. Eric P. Xing](#), [Prof. Hao Zhang](#))
- Developed a framework that speeds up privacy-preserving Transformer inference by using MPC-friendly approximations and Knowledge distillation(**KD**) on Secure Multi-Party computation(**MPC**) systems.
  - Achieved **5.9x** speedup with BERT-LARGE with the same ML performance on the IMDb dataset; Achieved **2.2x** speedup with ROBERTA-BASE on the GLUE benchmark with 97% the ML performance .
- Activation compression in model-parallel training (Project Co-lead)** Apr 2022 - Present
- (Supervisor: [Prof. Shivaram Venkatarman](#))

- Conducted the first empirical study with *160* settings on the utility of activation compression in model parallelism, on **pruning**-based, **learning**-based and **quantization**-based compression algorithms.
- Developed a performance analysis and proposed a list of desirable properties on compression algorithms, training hyper-parameters and hardware when using communication compression to speed up model-parallel training.

#### Dual Contradistinctive Autoencoders (Project Co-Lead)

Feb 2020 - Nov 2020

[CVPR 2021 Paper](#) / [Code](#) (Supervisor: Prof. [Zhuowen Tu](#))

- Developed a general-purpose Variational Autoencoder model (**VAE**) by intergrating a set-level objective (**Generative Adversarial** loss) and an instance-level objective (**contrastive learning**).
- Achieved State-of-the-art(SOTA) Fréchet Inception Distance, Inception score, and perceptual distance in Cifar-10 and CelebA dataset; Achieved SOTA image editing and latent space interpolation quality in CelebA dataset.

## OPEN-SOURCE CONTRIBUTIONS

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#### NCCL backend for collective operations in Ray

[Code](#) (Collaborator: [Prof. Hao Zhang](#))

- Developed the **NCCL** backend for all-to-all and P2P **collective** operations with multi-GPU and multi-stream support.
- The code has been intergrated in [Ray](#) (a popular ML training framework with **22.6k** stars), and has been widely used as the default GPU implementation for collective operation calls in distributed ML training.

#### Distributed training implementation in Spacy

[Code](#) (Collaborator: [Prof. Hao Zhang](#))

- Implemented data-parallel ML training using the above developed NCCL backend in [Spacy](#).
- Achieved **5.22x** speedup when scaled to 16 workers compared to the native Spacy implementation.

#### Resource scheduling policy support for AdaptDL

Collaborator: [Dr. Aurick Qiao](#)

- Developed a speedup constraint that reduces the re-allocation frequency by **75%**. ([Code](#))
- Developed an asynchronous job detector to shorten the user waiting time by up to **60** seconds. ([Code](#)).
- Integrated with [AutoDist](#), a single-job optimization system to enable job-level and cluster-level co-optimization. Demonstrated a running demo to the [CASL](#) open source community ([Code](#)).
- Codes have been intergaeted in [AdaptDL](#) (OSDI'2021 best system winner)

## START-UP

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#### AILink Technology Corporation

Feb 2019 - Sep 2020

[Link](#) (Co-founder)

- Developed the **recommender system** backend using ML-based methods , e.g., clustering and collaborative filtering.
- Deployed the system in our Android App, UniLink, which has been used by more than **200** real students to find roommates.
- Co-founded the company AiLink and raised **\$100k** funding.

## TEACHING EXPERIENCE

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#### Undergraduate Teaching Assistant

Sep 2019 - Mar 2020

- Fall 2019 CSE 158 - Recommender Systems (with [Prof. Julian McAuley](#)), UC San Diego
- Spring 2020 CSE 30 - Data Structure and algorithms (with [Prof. Marina Langlois](#)), UC San Diego

## TECHNICAL STRENGTH

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- Programming Languages: Python, Java, C++, R, Matlab, Haskell;
- ML frameworks: PyTorch, Tensorflow, DeepSpeed, Megatron-LM, Ray, Spacy, HuggingFace, Autodist, AdaptDL.
- BigData+Database: sklearn, Scipy, NumPy, Pandas, Jupyter, AWS EC2, Kubernetes, Docker, MongoDB,
- Web+Mobile: React Native, HTML/CSS/JS, Android.