Rui Pan

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EDUCATION

University of Wisconsin-Madison   Madison, WI, USA
B.S. in Computer Science and Applied Mathematics   *Sep 2018 – Dec 2021 (Expected)*
- GPA: 3.96/4.00

RESEARCH INTERESTS

I am broadly interested in big data systems (Machine Learning Systems, Cloud Computing, Distributed Systems, Networks). For now, I am doing research on **Machine Learning Systems**, with a focus on optimizing systems for training Deep Neural Networks.

RESEARCH EXPERIENCE

Undergraduate Research Assistant w/ Prof. Shivaram Venkataraman   Madison, WI, USA
Project 1: Fair and Efficient Resource Allocation for DNN Workloads in GPU Clusters   *Mar 2021 – Present*
- In this work, we develop a resource allocation framework for fair and efficient scheduling/resource allocation of dynamic deep learning training workloads in large-scale multi-tenant GPU clusters.
- I worked on the implementation and integration of our novel scheduling policy into Gavel (OSDI '20), an existing scheduling framework.
- I implemented and applied dynamic optimizations (Accordion from MLSys '21 & Gradient Noise Scale from arXiv '18) to common DNN training workloads to speed up training without loss of accuracy.

Project 2: How Structured Backpropagation Pruning Improves Deep Learning Clusters   *Jun 2020 – Feb 2021*
- In this work, we systematically control the amount of backpropagation at individual workers in distributed DNN training. This technique, Structured Backpropagation Pruning, simultaneously reduces network bandwidth, compute utilization, and memory use while preserving model quality.
- I developed an iteration-level cluster scheduler based on existing frameworks (PyTorch Elastic, BytePS from OSDI '20) to support fine-grained scheduling, frequent checkpointing, different master-worker topology (all_reduce/parameter server), and constant worker migration with a low overhead in order to capitalize on the resources saved by Structured Backpropagation Pruning.

Undergraduate Research Assistant w/ Prof. Michael Ferris   Jan 2020 – Mar 2021
Advisors: Dr. Steven Wangen and Prof. Michael Ferris   *Madison, WI, USA*
- In this work, we propose Dairy Brain, an analytics platform for evaluating and predicting the performance of dairy cows by aggregating large quantities of dairy data.
- I developed, deployed and maintained the Agricultural Data Hub (AgDH), a warehouse-scale computing infrastructure for the collection, storage, homogenization, and distribution of dairy farm's feeding, milking, and management data in a series of PostgreSQL data marts.
- I hosted poster sessions at the 3rd WID Research Symposium and presented in outreach meetings for the local dairy industry.

PUBLICATIONS

[**1**] [Paper] Shockwave: Efficient and Fair Resource Allocation for Dynamic Adaption. Pengfei Zheng, **Rui Pan**, Shivaram Venkataraman, Aditya Akella. 2021. *In submission.*

[**2**] [Poster] AgDH: A System for Gathering and Distributing Dairy Data. **Rui Pan**, Steven R. Wangen, Michael C. Ferris. 2020. *Presented at the 3rd Annual WID Symposium.*

Professional Experience

Tutor in Computer Science and Math
Undergraduate Learning Center @ College of Engineering, UW-Madison

Sep 2019 – May 2020

Madison, WI, USA

- Held weekly drop-in and by-appointment tutoring sessions to help students with understanding concepts and debugging programming assignments.
- Tutored students in 8 core introductory computer sciences and 5 math courses.
- Helped a total of ~100 students.

Subtitle Translator
Coursera

May 2019 – May 2020

Online

- Volunteered in translating English subtitles to Simplified Chinese subtitles in multiple courses (An Introduction to Programming, Building Web Applications in PHP, Neural Networks and Deep Learning).

Student Instructor
Research and Development Center @ High School Afiiliated to Shanghai Jiao Tong University

Sep 2017 – Aug 2018

Shanghai, China

- Designed two introductory computer science courses (Intro to AP CS & Data Analysis with Python).
- Adapted course material from CS61A & CS61B @ Berkeley and CS50 @ Harvard.
- Gave lectures to 10+ students.

Relevant Courses

Graduate-level: Advanced Operating Systems, Big Data Systems (I/P), High Performance Computing
Undergraduate CS: Algorithms, Artificial Intelligence, Bioinformatics, Computer Architecture, Computer Vision, Database Systems, Data Analysis, Networking, Operating Systems, Theory of Computing
Undergraduate Math: Calculus, Combinatorics, Discrete Math, Mathematical Data Science (I/P), Numerical Linear Algebra, Probability
Coursera: Cloud Computing (I/P), Deep Learning, Software Engineering, Front-end Web Design, Back-end Web Applications, Cryptography

Technical Skills

Languages: Python, Java/C#, C/C++, SQL, JavaScript, HTML/CSS, R
Frameworks and Tools: PyTorch, Git, Docker, PostgreSQL, CUDA, OpenMP, MPI, Apache Spark

References

Shivaram Venkataraman
Assistant Professor

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University of Wisconsin-Madison

- Advisor for my undergraduate research in Machine Learning Systems

Michael Ferris
Professor

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University of Wisconsin-Madison

- Advisor for the Dairy Brain project

Steven Wangen
Postdoctoral Associate @ WID, Data Scientist @ American Family Insurance

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University of Wisconsin-Madison

- Advisor for the Dairy Brain project