

# Charlie Ruan

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## EDUCATION

**Carnegie Mellon University, Computer Science Department**

**Pittsburgh, PA | Aug 2023 - May 2025**

*M.S., Computer Science*

GPA: 4.17/4.33

**Cornell University, College of Engineering**

**Ithaca, NY | Aug 2019 - May 2023**

*B.S., Computer Science and Operations Research*

GPA: 4.0/4.3; *Summa Cum Laude*

## PUBLICATIONS & MANUSCRIPTS

(\* denotes equal contribution)

- **Charlie F. Ruan**, Yucheng Qin, Xun Zhou, Ruihang Lai, Hongyi Jin, Yixin Dong, Bohan Hou, Mengshun Yu, Yiyan Zhai, Sudeep Agarwal, Hangrui Cao, Siyuan Feng, Tianqi Chen. “WebLLM: A High-Performance In-Browser LLM Inference Engine.” *Will submit to JMLR (MLOSS)*
- Hongyi Jin\*, Ruihang Lai\*, **Charlie F. Ruan\***, Yingcheng Wang\*, Todd Mowry, Xupeng Miao, Zhihao Jia, Tianqi Chen. “A System for Microserving of LLMs.” *Under submission.*
- Yixin Dong, **Charlie F. Ruan**, Yaxing Cai, Ziyi Xu, Yilong Zhao, Ruihang Lai, Tianqi Chen. “XGrammar: Flexible and Efficient Structured Generation Engine for Large Language Models.” *Under submission.* <https://arxiv.org/abs/2411.15100>
- Siyuan Feng\*, Jiawei Liu\*, Ruihang Lai, **Charlie F. Ruan**, Yong Yu, Lingming Zhang, Tianqi Chen. “Productive Deployment of Emerging Models on Emerging Platforms: A Top-Down Approach.” *Under submission.* <https://arxiv.org/abs/2404.09151>
- Xun Zhou, **Charlie Ruan**, Zihe Zhao, Tianqi Chen, Chris Donahue. “Local Deployment of Large-Scale Music AI Models On Commodity Hardware.” *ISMIR 2024 (LBD session).* <https://arxiv.org/abs/2411.09625>
- A. Feder Cooper\*, Wentao Guo\*, Khiem Pham\*, Tiancheng Yuan, **Charlie F. Ruan**, Yucheng Lu, Christopher De Sa. “CD-GraB: Coordinating Distributed Example Orders for Provably Accelerated Training.” *NeurIPS 2023.* <https://arxiv.org/abs/2302.00845>
- **Charlie Ruan**. “Approximating Martingale Process for Variance Reduction in Deep Reinforcement Learning with Large State Space.” *On arXiv November 2022.* <https://arxiv.org/abs/2211.15886>

## OPEN-SOURCE PROJECTS

**MLC-LLM** *Core Contributor*  [GitHub](#) ★ 19.3k 🍏 1.6k (#4 contributor)

**Pittsburgh, PA | Jun 2023 – Present**

PI: [Prof. Tianqi Chen](#)

- Enabling universal native deployment of LLMs through machine learning compilation techniques including TVM, supporting non-conventional backends like AMD (ROCm kernels) and Apple (Metal kernels); building an LLM serving system on top of it

**WebLLM** *Project Lead*  [GitHub](#) ★ 14.0k 🍏 906 (#1 contributor)

**Pittsburgh, PA | Jun 2023 – Present**

PI: [Prof. Tianqi Chen](#)

- Deploying LLMs locally in web browsers with WebGPU for GPU acceleration and WebAssembly for performant CPU computation
- Paving the way for on-device agents to automate daily in-browser tasks (e.g. drafting emails, editing documents, booking tickets)
- Widely recognized in the JavaScript/Web community ([talk at Google WebAI Summit '24](#))

## RESEARCH EXPERIENCE

**Sky Computing Lab** *Research Assistant* (GPU Programming, Kernel Language/Compiler)

**Berkeley, CA | Aug 2024 – Present**

PI: [Prof. Ion Stoica](#)

- Working on a GPU kernel language/compiler for automating grid-level optimizations; extensively worked with Triton and MLIR

**Catalyst Group** *Research Assistant* (Distributed Systems, LLM Serving)

**Pittsburgh, PA | Mar 2024 – Present**

PI: [Prof. Tianqi Chen](#), [Prof. Zhihao Jia](#)

- Proposed an LLM microserving architecture that enables dynamic reconfiguration of various disaggregation and coordination patterns, including balanced prefill/decode disaggregation, KV transfer, and distributed prefix cache
- Explored other disaggregated strategies such as attention/non-attention, and long request/short request; built a distributed system that supports point-to-point remote attention with CUDA kernels and the NVSHMEM communication library
- Paper under submission

**RelaxML Lab** *Research Assistant* (Distributed Machine Learning)

Ithaca, NY | Sep 2022 – May 2023

PI: [Prof. Christopher De Sa](#)

- Investigated finding provably better data permutations in distributed training with decentralized data, using recently proposed example-ordering algorithm Gradient Balancing (GraB)
- Built a distributed training system in a decentralized fashion to analyze bounds on convergence rate and consensus error
- Paper accepted by *NeurIPS 2023*: <https://arxiv.org/abs/2302.00845>

**Variance Reduction for Reinforcement Learning** *Research Assistant* (RL)

Ithaca, NY | Dec 2021 – Sep 2022

PI: [Prof. Jim Dai](#)

- Used reinforcement learning (RL) to optimize the algorithm of matching drivers and customers on ride-hailing systems like Uber
- Formulated the application of variance-reduction method approximating martingale-process (AMP) in proximal policy optimization (PPO) when state space is large and state transitions are uncertain; experimented on ride-hailing and multiclass queueing networks
- Manuscript available: <https://arxiv.org/abs/2211.15886>

## INDUSTRY EXPERIENCE

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**Google Core ML** *Software Engineer Intern* (TensorFlow, Python)

Sunnyvale, CA | Jun 2023 – Aug 2023

- Worked on TensorFlow's Distributed Runtime team; optimized TensorFlow's asynchronous checkpoint in Keras, offloading model checkpointing to an asynchronous thread to reduce wasted TPU cycles
- Received a return offer; contributed 1700+ LOC to <https://github.com/tensorflow>

**Google Cloud** *Software Engineer Intern* (Platform Engineering, Linux, C++)

Sunnyvale, CA | Aug 2022 – Oct 2022

- Worked on TechInfra team to deploy GPUs in data centers; implemented Linux daemons to provide GPU firmware updates and monitor GPU health with D-Bus and I2C using OpenBMC; worked with pre-production hardware with limited debugging support
- Received a spot bonus and a return offer

**Amazon Robotics** *Software Engineer Intern* (Full-Stack, Kotlin, Java)

Greater Boston, MA | May 2022 – Jul 2022

- Worked on robots for warehouse automation solutions; implemented a full-stack configuration portal on Amazon Robotics's HCI software, allowing warehouse workers to personalize their interaction with the autonomous warehouse robots
- Received return offer for a full-time position

**XPeng Motors** *Software Engineer Intern* (Sensor Fusion, Python, C++)

Shanghai, China | Jun 2021 – Aug 2021

- Worked on the Sensor Fusion team for XPeng's self-driving cars; processed and fused various sensor data (e.g. radars, cameras) of XPeng's self-driving cars to provide a reliable perception result

**Morgina Information Technology** *Software Engineer Intern* (C/C++, Embedded)

Shanghai, China | Jun 2020 – Jul 2020

- Optimized the multi-object tracking algorithm of millimeter-wave radars installed in intersections that monitor traffic information

## STUDENT ACTIVITIES

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**Cornell Electric Vehicles** *Software Engineer* (Python, ROS, Linux)

Ithaca, NY | Aug 2019 – Mar 2022

- Designed the ROS (Robot Operating System) for the vehicle's autonomy system; engineered a platform for communications between sensors (e.g. LIDAR, IMU) and algorithms, as well as among algorithms (e.g. vision, localization)

## TEACHING EXPERIENCE

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**Intro to Engineering Stochastic Processes** *Teaching Assistant*

Ithaca, NY | Jan 2023 – May 2023

- Topics include: discrete-time/continuous-time Markov chain, Poisson process, queueing theory, Markov decision process
- Was the sole TA in charge of the design and office hours for a project that compares Monte Carlo simulation with neural networks

**Intro to Machine Learning** *Teaching Assistant*

Ithaca, NY | Aug 2021 – Dec 2021

- Topics include: decision trees, support vector machine, kernels, neural networks, statistical learning theory, online learning, boosting

## AWARDS & HONORS

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Cornell Engineering Dean's Honor List (for all semesters)

2019 – 2023

Omega Rho Honor Society for Operations Research

May 2023

Undergraduate Summer Research Funding, School of Operations Research (five students selected in total)

May 2022

Tau Beta Pi Engineering Honor Society

Mar 2022