

Ravi Ghadia

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Skills: Large Language Models | GPU Architecture | Deep Learning | Combinatorial Optimization | Statistics | Distributed Systems | Reinforcement Learning | LLVM | Compilers

Education

The University of Texas at Austin <i>Masters of Science in Electrical and Computer Engineering, CGPA: 4.0/4.0</i> Focus: Computer Architecture, Computer Systems and Embedded Systems	Aug'24 – Present
Indian Institute of Technology, Kharagpur <i>Bachelor of Technology in Electronics and Electrical Comms. Engg, CGPA: 9.35/10</i> Minor in Computer Science and Engineering	July'17 – June'21

Industry Experience

Spring Research Intern, Together.ai Manager : Max Ryabinin <i>Distributed/EP training, Mixture-of-Experts</i> • Identify potential system and kernel level optimizations for efficient fine-tuning of MoE architectures • Potential avenues: Kernel fusion techniques like SonicMOE; optimal expert placement strategies for better load balancing	Jan'26 – Present
GPU Kernels Intern, AMD Manager: Bragadeesh Natarajan <i>GEMM Kernels, ROCm, HipBLAS</i> • Working on the Tensile library team for generating efficient GEMM kernels, optimized at assembly level • Built an instruction level profiler to capture GPU runtime information during kernel execution. • Captures registers/shmem values for every instruction, allowing a global view for debugging at scale – for instance visualizing memory accesses when using swizzled layouts	Sept'25 - Dec'25
Summer Research Intern, Together.ai Manager : Max Ryabinin <i>Large Scale Distributed Training, Long-Context LLMs</i> • Enabling training of LLMs with context >1M tokens on distributed GPU clusters via context parallelism • Proposed a head-wise pipelining technique that significantly reduces activation memory during attention computation • Allows training of Llama-8B on a 8×H100 node with maximum context length of 5M tokens ; 25% higher than SOTA	May'25 – Aug'25
GPU Architect, NVIDIA Manager: Sivakumar Anandan <i>Machine Learning, GPU Architecture, Statistical Analysis</i> • Developed high-fidelity statistical Debug system at unit level to understand GPU inefficiencies • Built predictive ML models to project performance for compute workloads: HPC, LLMs, Recommender Systems • Designed statistical Monte-Carlo simulation environments for DGX-class systems to enable management/marketing with product road-map decisions on datacenter systems • Improved the runtime & resource complexity of highly intensive algorithms: MaxQ (using RL) and Bin-Optimization (using CNNs), enabling rapid turn-around for data requests	July'21 - Jul'24
Architecture Intern, NVIDIA Mentor: Sivakumar Anandan <i>Reinforcement Learning, GPU Architecture</i> • Used Reinforcement Learning to solve combinatorial optimization of the most energy-efficient GPU configuration • Developed proof-of-concept promising massive runtime benefits compared to the traditional brute-force solution • Follow-up work accepted as an Oral presentation at NTECH 2023, NVIDIA's internal Global Tech Conference	April'20 – July'20

Research Experience

Graduate Research Assistant, The University of Texas at Austin Advisor : Prof. Poulami Das <i>Large Language Models, Mixture of Experts</i> • Optimizing prefill-stage (TTFT) in MoE models on multi-GPU expert-parallelism, via optimal expert placement • Leveraging residual connection to estimate expert activation for the next layer and performing asynchronous placement	Aug'25 – Present
Research Assistant, H2Lab, University of Washington Advisor : Prof. Prithviraj Ammanabrolu <i>Large Language Models, Reinforcement Learning</i> • Used freeform linguistic feedback to train large language models via reward function learned on the feedback • Designed vectorized policy framework with localized rewards for incorporating multi-faceted feedback • Experimental runs showed better alignment with the feedback: improved Alignscore on Question-Answering	Nov'22 – Aug'24
Undergraduate Research Assistant, CNeRG CSE, IIT Kharagpur Advisor : Prof. Pawan Goyal <i>Large Language Models, Reinforcement Learning, Statistics</i> • Critically analyzed the shortcomings of Cross-Entropy Loss for training generative dialog models • Hypothesized the model artifact theory : For different inputs, model generates the same output response (which has almost no semantic relation to the input) • Proposed ranking based reward function to train LLMs in an RL setting - mitigates the shortcomings of CE-Loss	Sept'20 – Jun'21

Publications and Preprints

Dialogue Without Limits: Constant-Sized KV Caches for Extended Responses in LLMs

Ravi Ghadia, Avinash Kumar, Gaurav Jain, Prashant Nair, Poulami Das

Accepted to ICML 2025 | Arxiv [preprint]

- Implemented MorphKV: a dynamic token selection algorithm with constant KV cache usage for LLM inference
- Our approach saves **53% more memory** while improving accuracy by 18% on avg. compared to SOTA methods

MaxQ Optimization using Reinforcement Learning

Ravi Ghadia, Vamsi Krishna, Karthik Prakash, Sivakumar Anandan, Raghavendra Bhat

Accepted for Oral Presentation at NTECH US 2023 (NVIDIA-Internal Global Conference, acceptance 18%)

- Implemented RL based solution achieving the MaxQ configuration of a GPU (optimal configuration with best Performance per Watt)
- Delivered ~2000x runtime and resource benefits as compared to the conventional brute force approach

CORAL: Contextual Response Retrievability Loss Function for Training Dialog Generation Models

Bishal Santra, Ravi Ghadia, Manish Gupta, Pawan Goyal

Bachelor's Thesis | Arxiv[preprint]

- Proposed retriever based loss function that considers context to assign loss for the generated output
- Achieved state-of-the-art on relevance metrics like MauDe/DeB against several strong pretrained baselines

Perf Activity Driven Instantaneous Power Projection

Ravi Ghadia, Sivakumar Anandan, Raghavendra Bhat

Accepted to NTECH India 2022 (NVIDIA-Internal Conference, acceptance rate 22%)

- Built a framework that allowed high precision energy analysis and helped isolate inefficient regions in the graphics pipeline

Teaching Experience

Teaching Assistant: Advanced Machine Learning

Aug'24 - Present

Instructor : Prof. Joydeep Ghosh, McCombs School of Business, UT Austin

- Advanced course on ML covering Predictive modeling for practical business applications scaling on big data
- Facilitated interactive teaching sessions for a class with a highly diverse set of students from different backgrounds

Certified Instructor | NVIDIA Deep Learning Institute

Dec'21 - Jul'24

- Served as an instructor for courses on **Transformer based NLP applications** and **LLM Inference Optimizations**
- Conducted sessions during NVIDIA GTC and assisted other instructors as TA during related courses

Technical Strengths

- **Programming Languages:** Python, C/C++, MATLAB, LC-3b
- **Frameworks:** Pytorch, Tensorflow, LLVM, Django, Streamlit
- **Libraries:** HuggingFace, OpenAI Gym, RL4LMs, stable-baselines
- **Profilers:** NVIDIA Nsight, Radeon Graphics Profiler
- **Utilities:** Docker, Perforce, Git, Bash, Linux

Selected Academic Projects / Competitions

Maverick 2.0 Hackathon | AB InBev

April'21 - May'21

National Finalists (top 8 out of 750+ teams Pan India) | Machine Learning

- Developed an application to recommend customized discounts basis product data across various sectors
- Implemented pipelining for real-time request processing | Applauded by the panelists for outstanding design

Secure Authentication via user-behaviour

Aug'20 - Nov'20

Advisor : Dr. Sudipta Mukhopadhyay | Machine Learning, Statistics

- Authenticated users based on their usage profile for mouse activity | click-time, pause-time, cursor-velocity etc.
- Used self-organizing maps for feature-extraction | Prevented unauthorised access with an 83% recall

Extracurricular Activities

- **Volunteered as a Mentor** at Mentor Together, a Non-Profit Organization aiming to assist underprivileged young-minds in their student-to-professional transition
- Served as the Hall Alumni Committee head, orchestrating alumni funds to initiate annual donation drive for Ambassadors Children Home, an orphanage near the IIT Kharagpur campus