RUDRA PRATAP SINGH

ML Systems • LLM Optimization • OS Development • eBPF Verification

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EDUCATION

Indian Institute of Technology Gandhinagar (IITGN) *Gandhinagar, India*
B.Tech in Artificial Intelligence *2023 - 2027*

PROJECTS

LLM Layer Fusion Alpha Optimization

ML Systems Research • Supervisor: Dr. Mayank Singh • GitHub Link *Aug. 2025 – Nov. 2025*

- **Engineered** a 13-layer fusion pipeline for Llama3-8B; **achieved** 0.6489 MMLU accuracy via Bayesian optimization, outperforming heuristic baselines (0.6471) at identical compression rates.
- **Analyzed** learned α weights (range 0.30–0.71), demonstrating only moderate correlation (0.560) to similarity scores and refuting standard linear merging hypotheses.
- **Integrated** neural alignment protocols, boosting MMLU accuracy by **+0.0864** (0.6334 vs 0.5470) while maintaining a strict 12.5% model compression ratio.

DynVer: Dynamic Verification of File Systems

Systems & Verification • Supervisors: Dr. Yuvraj Patel & Dr. Abhishek Bichhawat • GitHub Link *Aug. 2025 – Nov. 2025*

- **Architected** 'DynVer', a runtime verification framework for Linux 'ext4' using eBPF; enforced strict inode/superblock accounting invariants with negligible overhead under high load.
- **Benchmarked** system performance, maintaining **~0.06 ms** open/create latency and **3–20 ms** write throughput while capturing 4KB granular state deltas.
- **Developed** a Python telemetry agent to correlate kernel-space probe data with user-space workloads in real-time, effectively bridging kernel events with application latency.

Rustoz: Toy OS for Raspberry Pi 5

Bare Metal OS Dev • Supervisor: Dr. Abhishek Bichhawat • GitHub Link *Aug. 2025 – Nov. 2025*

- **Built** a monolithic 64-bit kernel from scratch for Raspberry Pi 5 (AArch64); **implemented** EL1 exception vectors, trap handling, and timer interrupts on bare metal hardware.
- **Engineered** a Unix-compliant process scheduler supporting 'fork'/'exec' and piping, successfully enabling multitasking and process isolation.
- **Deployed** a custom shell ('rsh') and on-disk file system, allowing execution of user-space binaries directly from the kernel interface.

ACHIEVEMENTS AWARDS

- **Gold Medal, INOI 2023** *Feb 2023*
  Ranked in the **Top 10 nationally** in the Indian National Olympiad in Informatics (CodeChef), awarded for algorithmic excellence.
- **IOITC Finalist** *Feb 2023*
  Selected as **1 of 35 students** nationwide for the International Olympiad in Informatics Training Camp.
- **IIT Gandhinagar Admission (Olympiad Route)** *Aug 2023*
  Secured undergraduate admission via the prestigious Olympiad route, reserved for national-level medalists.
- **Zonal Computing Olympiad (ZCO) Qualified** *Jan 2023*
  Qualified for INOI by scoring in the top percentile among 300+ regional candidates.

OPEN SOURCE CONTRIBUTIONS

CCExtractor

Contributor • PR #1674

- **Resolved** critical OCR integration bug (Issue #1162); **restored** Tesseract functionality for subtitle extraction pipelines used by global accessibility tools.

SKILLS

Languages: Python | Rust | C | C++ | JavaScript | Assembly | Verilog | Shell

ML Frameworks: PyTorch | TensorFlow | TF Lite | scikit-learn | TSFEL

Systems & Tools: Git | Linux | eBPF/bpftrace | Makefiles | Linker Scripts | NumPy | Pandas

RELEVANT COURSEWORK

Computer Science: *Operating Systems, Machine Learning, NLP, Multiagent Systems, Data Structures, Theory of Computing, Digital Systems.*
Foundations: *Probability & Statistics, Math Foundations for AI, Signals & Systems, Linear Algebra, Calculus, Numerical Methods.*