

Satnam Singh

GPU Programming and High-Performance Computing

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TECHNICAL SKILLS

Languages: C, C++, CUDA, Python, SQL

GPU / Systems: CUDA, Nsight Systems, Nsight Compute, ptxas, warp-level programming, memory coalescing, shared-memory tiling, kernel profiling

Tools: Git, Docker, Linux, FastAPI, PostgreSQL

ML Frameworks (applied to GPU workloads): PyTorch, PyTorch Geometric

PROJECTS

Custom CUDA Matrix Multiplication Kernels

05/2026 – Present

CUDA, C++, C

- Optimized custom CUDA SGEMM kernels toward cuBLAS-class performance, progressing from naive GEMM to coalesced global-memory access and 32x32 shared-memory tiled designs.
- Improved FP32 GEMM throughput from 169.6 to 1052.9 GFLOPS on an RTX 4060 (6.5x speedup) through warp-aware thread mapping and memory coalescing.
- Profiled and validated correctness using CUDA events, Nsight Systems, Nsight Compute, and ptxas; extending the work with register blocking, warp tiling, Tensor Core / WMMA paths, and mixed-precision benchmarking against cuBLAS.

Graph Neural Network for Financial Fraud Ring Detection (NodeGuard)

09/2026

PyTorch Geometric, Python

- Trained a 2-layer graph convolutional network over a transaction graph to detect coordinated fraud rings from network structure, handling severe class imbalance (approximately 4.5% positive class) with stratified sampling and class-weighted loss.
- Identified and corrected a validation-metric selection flaw in the training pipeline (recall-only checkpointing converging on a degenerate low-precision solution); replaced with F1-optimized checkpointing and early stopping.
- Built a reproducible evaluation pipeline (precision, recall, F1, confusion matrix) and an error-analysis tool tracing model errors to feature-level and graph-topological causes. Submitted to the Razorpay AI Buildathon.

RISC-V Database System

06/2026

PostgreSQL, Python, YAML, JSON, Git

- Built a Python ETL pipeline extracting RISC-V's official ISA specification from 1,700+ YAML files into a normalized PostgreSQL database with enforced referential integrity across 8 relational tables, covering 1,351 instructions and 396 control/status registers.

RESEARCH

Graph Neural Networks for Defect-Site-Resolved p-type Dopant Viability in $\beta\text{-Ga}_2\text{O}_3$

08/2026 – Present

Centre of Excellence for Frontier Materials Research, Christ University

- Designing a defect-site-resolved graph representation to predict formation energy and ionization level for p-type dopants, training on a DFT-derived dataset of approximately 15,000 defect structures. Abstract under review, IIM ATM 2026.

EDUCATION

Christ University, Bengaluru – B.Tech, Computer Science and Engineering (AI/ML)

05/2025 – 06/2029

CGPA: 3.79/4.0 (First Year)

Indian Institute of Technology Madras – B.S., Data Science and Applications (Online, concurrent)

07/2025 –

07/2029