Systems Engineering Monograph · 16 Native C++20 / PyTorch Engines Across 50 Open-Source Repositories

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1. Abstract & Multiplicative Verification Invariant

As 76% of engineering teams generate AI code and agent tool invocations faster than human reviewers can verify them, production reliability obeys a strict multiplicative law: Confidence = Intent x Guardrails x Independent Verification x Evidence.

This monograph documents clean-room C++20 and PyTorch 2.x reference implementations authored by Nagarjuna Reddy Kamireddy across 50 public repositories on github.com/nagarjunak-pixel, replacing opaque framework wrappers with mathematically verifiable kernels, compilers, solvers, and runtime gates.

2. Core Reference Systems & Verified Benchmarks

1. VeritasRL (github.com/nagarjunak-pixel/veritas-rl): Critic-free GRPO & asymmetric-clipping DAPO RLVR post-training (8.0x Pass@1 lift), DoRA weight decomposition, 2D Ring-Attention + Tensor Parallelism (<1.5e-6 autograd parity), and step-level PRM Best-of-N reranking.

2. AxiomZero & TokenDiet (axiom-zero, tokendiet): Lossless C++20 speculative decoding (4.00x target pass reduction), Top-K Sparse Autoencoder steering ($R^2 = 0.9855$), 1-UIP CDCL SAT RUP proof checker, and C++20 salience knapsack context compression (70.25% token reduction).

3. Syntara & TraceGit (syntara, tracegit): Byte-level pruned DFA + Earley CFG constrained decoding (141.7x mask speedup, 20/20 valid tool payloads) paired with Wagner-Fischer C++20 trajectory alignment and SHA-256 Merkle DAG bisection.

4. WeaveGraph, Vecta, AetherCompiler & NexusVerity: Tarjan SCC + Fiduccia-Mattheyses multi-agent AST merge verification, bit-exact C++20 HNSW/IVF-PQ/RaBitQ vector search, SSA tensor compiler with H100 tile cost modeling, and cross-fitted Double ML + C++20 doubly-robust off-policy evaluation.