Luca **Lombardo**

Mathematics · Computer Science

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Experience

System Administrator

Pisa, Italy

University of Pisa, Department of Mathematics, PHC

January 2024 - Present

- Created and maintain servers and services for the department of mathematics
- SysOps tasks and recently also DevOps tasks, such as setting up CI/CD pipelines for the department's open-source projects.

Teaching Assistant: Parallel Computing from the Infrastructure to the Mathematics

Pisa, Italy

University of Pisa, Department of Mathematics

April 2023 - June 2023

- Assembled, configured and maintained a 20-node HPC cluster for course use
- Mentored students on parallel algorithms (C/C++/Julia, OpenMPI) and parallel environment setup (Linux, Slurm)

Content Editor & Writer

Italy (Remote)

MoreThanTech

June 2020 - July 2022

- Wrote more than 50 articles on open-source software, learning Linux, fixing Windows and mechanical keyboards.
- Managed a small team of writers, providing feedback and editing to ensure high-quality content.

Projects

[1] Compressed Integer Vector Library

Rust, Bit Manipulation, Succinct Data Structures

A **Rust library** that provides space-efficient, in-memory representations for integer vectors.

[2] A Cache Efficient, Low Memory, Lanczos Algorithm

Rust, Numerical Linear Algebra, Cache Optimization

Two-pass Lanczos with $O(n)$ memory; exploits **cache locality** to outperform standard $O(nk)$ implementations on large sparse systems.

[3] An exact and fast algorithm for computing top-k closeness centrality

Graph Algorithms, Multi-Threading, Optimization, C++

Multi-threaded C++ algorithm to compute top-k centrality efficiently on very large graphs.

[4] Efficient Succinct Data Structures on Directed Acyclic Graphs

Bachelor Thesis in Mathematics

A **novel succinct data structure** for DAGs that efficiently support queries while maintaining space usage below the entropy of the underlying graph.

Scientific Interests

Algorithm Engineering

- Succinct data structures; strong foundation in algorithm design and analysis.
- Translating abstract algorithmic ideas into low-level, performance-predictable code.
- Bit-level optimization: sub-word access, cache-aware layouts, space-time trade-off analysis.

Systems Programming

- Memory-aware programming: ownership models, manual memory management, unsafe Rust for zero-copy operations.
- Performance profiling: benchmarking, flame graphs, cache-miss analysis.
- Hardware-aware optimization: reasoning about memory latency, branch prediction, and generated assembly.

High Performance Computing

- High-performance linear algebra: efficient and low-level implementations of numerical algorithms.
- Experience with parallel programming paradigms and development of distributed algorithms.
- Currently working on GPU-accelerated implementations of succinct data structures.

Education

BSc in Mathematics

University of Pisa, Italy

University of Pisa (Thesis: Efficient Succinct Data Structures on DAGs)

May 2025

MSc in Computer Science

University of Pisa, Italy

University of Pisa

May 2026 (Expected)

Skills

Programming Rust, C/C++, Python, Julia, Matlab/Octave, Lean4, F#

Tools & Frameworks Git, perf, MPI, OpenMP, Docker, Ansible, Puppet, Prometheus