Alessio Tuscano

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Summary

Physics master's student (M.Sc. Physics of Data, University of Padova) with a strong background in computational physics, high-performance computing, and scientific software development. Experienced in accelerating and optimizing existing codebases for large-scale simulations (CPU/GPU), with solid theoretical foundations in statistical mechanics, complex systems, and data analysis. Skilled in parallel programming, numerical methods, and modern approaches to inference and modeling.

Work Experience

Research guest collaborator — INFN (FEROCE project) 2025–present

– Currently working on GPU accelerated data pipelines and computational kernels in containers, enabling easy scalability and deployment for FEROCE project, related proceeding: https://agenda.infn.it/event/44098/contributions/253504/.

Typesetter 2025–present

– Typesetting and related automations for academic publications and collaborations at SISSA-medialab for scientific journals such as JCAP.

Education & Languages

2024–present	M.Sc. Physics of Data, **University of Padova**	**Italian**	Native
2018–2024	B.Sc. Physics, **University of Padova**	**English**	Professional/Fluent

Projects

Bachelor thesis — Water's surface potential reproduction with Neural Network

Implemented numerical exact method (DFT) simulations in a distributed environment to create a dataset for a fine regression task with a Neural Network; code and thesis (in Italian only) available on GitHub.

N-body simulation

High-performance, modular C++/CUDA framework for astrophysical N-body simulations. Supports GPU acceleration, OpenMP parallelism, flexible initialization, and interactive visualization. Extensible codebase for research and experimentation; full documentation and code available on GitHub.

Fine–Grained Vehicle Recognition with CNNs https://gitl

Designed and trained CNN and Siamese models on the CompCars dataset for vehicle classification and verification under class imbalance. Compared Cross-Entropy, Focal, and Contrastive losses.

Hopfield Neural Network

Implemented a Hopfield neural network for pattern recognition and image reconstruction on synthetic 2D patterns and MNIST, evaluating performance under noise and alternative update rules.

Distributed K-Means with Dask https:/

Implemented and benchmarked a distributed K-Means parallel algorithm with Dask, extending the dask-ml implementation with weighted centroid updates. Configured VM clusters via SSH, optimized memory/thread allocation, and analyzed scalability on large datasets (KDD Cup 1999).

Simulation-Based Inference for a 2D random walk model

Applied simulation-based inference with neural posterior estimation to recover parameters of a stochastic 2D random walk, validated on an analytically solvable quartic model, and extended to a red blood cell model not accessible analytically. Optimized simulation performance with Numba to achieve C-like speed.

Bayesian Analysis of ARPAV time series https://github.com/tusca99/Bay

Conducted a Bayesian analysis of ARPAV temperature and precipitation time series using MCMC methods to estimate trends and assess model fit, and applied SARIMA models for time series forecasting.

Skills

Programming	C/C++, Python, CUDA, OpenGL, Bash, R, basic HDL (Verilog/VHDL)
HPC and parallelism	Asyncio, Dask, Numba, MPI, OpenMP
Tools and infra	Git, Docker, Kubernetes, Linux, FreeBSD

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