Alessandro Pietro Serra

PhD Student

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Education

PhD: Theoretical and Scientific Data Science, *SISSA*   10/2024 – Present │ Trieste, Italy
- *Research Interests:* Interpretability, Causality, AI Safety

MSc: Data Science and Scientific Computing,   10/2021 – 03/2024 │ Trieste, Italy
University of Trieste
- *Curriculum*: Foundations of AI and ML.
- *Thesis*: "The representation landscape of few-shot learning and fine-tuning in large language models" @ **NeurIPS2024**
- *Final mark:* 110/110 with Honors

BSc: Mathematics for Engineering, *Polytechnic of Turin*   10/2018 – 10/2021 │ Turin, Italy

Professional Experience

Research Intern, *Area Science Park*   10/2023 – 10/2024 │ Trieste, Italy
- Investigated the effects of *fine-tuning* and *in-context learning* on the geometry of activations in LLama-family models, leading to a **NeurIPS 2024 publication**
- **Characterized** at multiple scales the geometry of internal representations, applying clustering and intrinsic dimensionality estimators for macroscopic structure and nearest-neighbor analysis for local behavior.

Machine Learning Engineer Intern, *Aindo*   03/2023 – 05/2023 │ Trieste, Italy
- Adapted, trained, and deployed a transformer-based model for tabular synthetic data generation.
- Extended the company's core library by implementing a survival analysis module to validate synthetic data quality.

Data Analyst, *Espereal Technologies*   01/2021 – 03/2021 │ Turin, Italy
- Developed and integrated Python-based data analysis and visualization tools for IoT data into the company's main web platform.

Publications

The Narrow Gate: Localized Image-Text Communication in Native Multimodal Models, *Advances in Neural Information Processing Systems (NeurIPS 2025)*   2025
Alessandro Serra*, Francesco Ortu*, Emanuele Panizon*, Lucrezia Valeriani, Lorenzo Basile, Alessio Ansuini, Diego Doimo, Alberto Cazzaniga

The representation landscape of few-shot learning and fine-tuning in large language models., *Advances in Neural Information Processing Systems (NeurIPS 2024)*   2024
Diego Doimo, **Alessandro Serra**, Alessio Ansuini, Alberto Cazzaniga

Skills

Python | C++ | C | R | SQL | Git | Bash | Docker | PyTorch | Pandas | MPI | OpenMP | Slurm

Awards

Scholarships "Training the Specialists of the Future", 01/03/2023
MSc Data Science and Scientific Computing

Workshops & Talks

Workshop: Interpretability in LLMs using Geometric and Statistical Methods 05/2025 | Amsterdam, Netherlands
Presenter, "*Localized Image-Text Communication in VLMs" at* University of Amsterdam