Emanuele Zangrando

L'Aquila, Italy | emanuele.zangrando@gssi.it | Personal Website ⬈ | Google Scholar ⬈ | Orcid ⬈

Academic Interests

My main area of interest is numerical optimization methods for deep learning, with a particular focus on Riemannian and bilevel methods. I also have a strong interest in implicit biases of optimization, global guarantees for non-convex optimization through hidden convexity methods, mechanisms of feature learning in deep neural networks, and Hessian-free methods.

Education

- **Gran Sasso Science Institute**, PhD program in Mathematics.   2022-2026 (Expected)
  - Four-year PNRR scholarship on low-parametric and energy-efficient machine learning.
  - Scientific Advisor: Prof. Dr. Francesco Tudisco, in collaboration with Dr. Gianluca Ceruti.
  - Mandatory courses: Numerical Analysis, Computational fluid-dynamics, Statistical mechanics, Continuum mechanics.

- **University of Padova**, MSc in Data Science (Mathematics of Data Science curriculum).   2020 - 2022
  - Thesis title: "Dynamical low-rank training of neural networks", advised by Prof. Dr. Francesco Rinaldi and Prof. Dr. Francesco Tudisco.

- **University of Padova**, BSc in Mathematics.   2016 - 2020
  - Thesis title: "Modeling attention dynamics in social networks", advised by Prof. Dr. Marco Formentin.

Experience

Visiting period, University of Edinburgh, UK   September - January 2024

- Working on implicit biases of common optimization methods in deep learning and Riemannian methods for large-scale optimization.

Visiting period, University of Innsbruck, Austria.   April - July 2024

- Investigating the efficiency of classical time-dependent variational principles coupled with neural network representations to approximate the solution of evolutionary PDEs for plasma physics problems.

Master thesis internship, Gran Sasso Science Institute, Italy.   January - June 2022

- Working on variational methods to efficiently train low-rank compressed neural networks.

Publications

GeoLoRA: Geometric integration for parameter efficient fine-tuning ⬈	ICLR 2025
S. Schotthöfer *E. Zangrando*, G. Ceruti, F. Tudisco, and J. Kusch	
dEBORA: Efficient Bilevel Optimization-based low-Rank Adaptation ⬈	ICLR 2025
E. Zangrando, S. Venturini, F. Rinaldi, and F. Tudisco	
Geometry-aware training of factorized layers in tensor Tucker format ⬈	NeurIPS 2024
E. Zangrando, S. Schotthöfer, G. Ceruti, J. Kusch, and F. Tudisco	
Robust low-rank training via approximate orthonormal constraints ⬈	NeurIPS 2023
D. Savostianova, *E. Zangrando*, G. Ceruti, and F. Tudisco	
HIJACK: Learning-based Strategies for Sound Classification Robustness to Adversarial Noise ⬈	IEEE SMARTCOMP 2023
D. Sweet, *E. Zangrando*, F. Meneghello	

Low-rank lottery tickets: finding efficient low-rank neural networks via matrix differential equations ⌕

NeurIPS 2022

S. Schotthöfer, *E. Zangrando*, J. Kusch, G. Ceruti, and F. Tudisco

Preprints

Provable Emergence of Deep Neural Collapse and Low-Rank Bias in L^2-Regularized Nonlinear Networks ⌕

ArXiv 2025

E. Zangrando, P. Deidda, S. Brugiapaglia, N. Guglielmi, and F. Tudisco

Low-rank adversarial PGD attack ⌕

ArXiv 2024

D. Savostianova, *E. Zangrando*, and F. Tudisco

Talks, seminars and Posters

- "Emergence and Stability of Deep Neural Collapse", YAMC, Padua, September 2025.

- "GeoLoRA: Geometric integration for parameter efficient fine-tuning", ICLR poster presentation, Singapore, April 2025.

- "dEBORA: Efficient bilevel optimization-based low-rank adaptation", ICLR poster presentation, Singapore, April 2025.

- "Deep learning for model order reduction in partial differential equations", GIMC-SIMAI young workshop, Naples, July 2024.

- "Online low-rank neural network compression", GIMC-SIMAI young workshop, Naples, July 2024.

- "Dynamical low-rank training of neural networks", SIAM Conference on Applied Linear Algebra (LA24), Paris, May 2024.

- "Robust low-rank training via approximate orthonormal constraints", NeurIPS poster presentation, New Orleans (USA), December 2023.

- "Dynamical low-rank training of neural networks", 2gg Algebra Lineare Numerica, L'Aquila, May 2023.

- "Low-rank lottery tickets: finding efficient low-rank neural networks via matrix differential equations", NeurIPS poster presentation, New Orleans (USA), December 2022.

- "Dynamical low-rank training of neural networks",Sciences - Computing - Data - Mathematics Seminar (SCDM), Karlsruhe Institute of Technology (Germany), November 2022.

- "Dynamical low-rank training of neural networks", GIMC-SIMAI young workshop, University of Pavia (Italy), September 2022.

Awards

NeurIPS 2025 top reviewer, NeurIPS 2023 scholar award, NeurIPS 2022 scholar award.

Professional Service

- Reviewing for ICML, ICLR, NeurIPS, AISTATS, AAAI, Scientific Reports, SIAM Journal on Optimization.

- Organization of events: MS in SIAMLA (Paris, May 2024), MS in YAMC (Padua, September 2025).

Technologies

Languages: Python, R, Wolfram Mathematica, Matlab. Basic amatorial knowledge of C. As Markup, good knowledge of LateX.

Technologies: Torch, JaX, Keras, Tensorflow and TensorFlow Probability, Bash, HPC, Git.