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photo.jpg

Alessandro Pedone
Curriculum Vitae

PERSONAL DATA

Date of Birth	01/10/2002
Nationality	Italian
Place of Birth	Milan, Italy

CURRENT POSITION

Politecnico di Milano	Pursuing Master's Degree in Mathematical Engineering, with a focus on Computational Science and Computational Learning

AREAS OF INTEREST

Scientific Machine Learning
Numerical Analysis
Partial Differential Equations (PDEs)
Mathematical Analysis

EDUCATION

2024 - Current **Master's Degree in Mathematical Engineering, Politecnico di Milano**

2021 - 2024 **Bachelor's Degree in Mathematical Engineering, Politecnico di Milano**
Final grade: 110/110 cum laude
Thesis: The Cauchy-Kowalevski theorem and some of its consequences
Keywords: PDEs, characteristics method, analyticity/holomorphy, power series, method of majorants, Cauchy-Kowalevski, Holmgren and Cartan-Kähler theorems
Supervisor: Prof. Maurizio Grasselli

EXPERIENCE

27/10/2025 - 31/10/2025 **Scientific Machine Learning and Numerical Methods - Autumn School**
Admitted (as a Master's student) to a highly selective PhD program organized by CWI (Centrum Wiskunde & Informatica), primarily comprising PhD candidates.
Topics:
- Differential equations and data-driven modeling
- Optimization for inverse problems
- Probabilistic numerical methods
- Physics-informed machine learning
- Stochastic processes and computational efficiency

23/06/2025 - 27/06/2025 **Theorical Foundations of Machine Learning 2025**

Admitted (as a Master's student) to a highly selective PhD program organized by MaLGa (Machine Learning Genoa Center) at the University of Genoa, with an acceptance rate of approximately 10%, primarily comprising PhD candidates.

Topics:

- Statistical learning theory framework
- Kernel methods and neural networks
- Empirical risk minimization and regularization
- Reproducing kernel Hilbert spaces (RKHS)
- Optimization techniques: convex analysis, gradient methods, stochastic optimization, splitting methods, backpropagation
- Theoretical analysis: concentration inequalities, empirical process theory, spectral calculus, operator theory

HONOURS AND AWARDS

25/01/2023 **Premio Migliori Matricole aa 21-22 Classe L 8 Fondo Giovani**

Best Freshmen Award, academic year 2021–2022, Class L-8, Fondo Giovani — granted upon completion of the first year of enrollment, based on academic performance, including GPA and the number of ECTS credits earned.

MEMBERSHIPS

2025 - Current SIAM (Society for Industrial and Applied Mathematics)

2021 – Current AIM (Associazione Ingegneri Matematici)

VOLUNTEERING

2020 - Current Blood donor

2018 ABCDigital: Liceo Scientifico Elio Vittorini promoted a project to organize a free course for senior citizens, consisting of 10 weekly lectures (2 hours each), aimed at improving their digital skills, device usage, and online awareness.

LANGUAGES

Italian	Native speaker
English	C1 (IELTS 7.5)

SKILLS

Programming Languages	Python, C/C++, MATLAB, R, LaTeX
Libraries	NumPy, SciPy, scikit-learn, TensorFlow, Keras, Pandas, Matplotlib, Seaborn, MIP, FEniCS, FEniCSx
Operating Systems	Linux (Ubuntu), Windows
Additional Software	Notion

PROJECTS

04/2025 - Current **Coupling CGA-DL-ROM with traditional solver for multiphysics problem**

Reference: 🔗

Objective: perform simulation of a simplified MEMS dynamics.

Dataset: 1000 meshes with the corresponding solutions of the problem.

Methodology:
1. Built the meshes making 3 geometric parameters of the domain vary.
2. Use traditional FEM solver to obtain the solution (of the electrical part of the problem) for each case.
3. Train a neural network (GCA-DL-ROM) as a surrogate model for this problem.
4. Couple this efficient ROM with a traditional solver (for the mechanical part of the problem) to obtain the motion inside the MEMS.

04/2025 - Current

Coupling MPE and Stokes' equations for cerebrospinal fluid flow and tissue motion

Reference: 🔗

Objective: study cerebrospinal fluid (CSF) flow, inside brain ventricles and subarachnoid space, with a focus on modeling the latter and exploiting already existing results.

Dataset: not publicly available.

Methodology:
1. *Implementation challenges:* segmenting the geometry (obtained from MRI) and creating the mesh of the subarachnoid space.
2. *Mathematical model:* coupling of MPE for brain tissue poromechanics Stokes' equations for cerebrospinal fluid flow.
3. *Numerical tools:* high order discontinuous Galerkin method on polytopal meshes for spatial discretization.

03/2025 - 05/2025

C++ Scientific Computing Projects

1. Some optimization methods for real-valued functions (Gradient Descent, Heavy Ball, Nesterov, ADAM...)
2. Parallel implementations of two kind of solvers for the Poisson equation in the unit square (Schwarz method)
3. Implementation of a matrix class, particularly suited for sparse matrices (CSR/CSC formats and modified formats)

12/2024

Mars Terrain segmentation

Objective: segment Mars terrain images into five classes: Background, Soil, Bedrock, Sand, and Big Rock.

Dataset: 2,615 grayscale images (64x128 resolution), filtered to 2,505 images.

Methodology:
1. Built an initial encoder-decoder architecture as benchmark.
2. Added layer for Edge Detection, Thresholding and others methods of computer vision.
3. Implemented a dual UNet architecture (Global and Local perspectives).
4. Designed custom loss functions and loss schedules.
5. Applied data augmentation and fine-tuned optimization hyperparameters.

11/2024

Blood Cell Classification

Objective: perform an 8-class classification task on blood cells images.

Dataset: 13,759 RGB images (96x96 resolution), filtered to 11,959 images after preprocessing.

Methodology:
1. Built an initial CNN architecture with regularization and augmentation as benchmark.
2. Implemented Transfer Learning (TL) and Fine Tuning (FT).
3. Deployed an ensemble of the best-performing models.

04/2024 – 06/2024

Statistical Inference for Math Performance

Objective: build a linear regression model for math perfomance of italian high school students.

Dataset: OECD PISA 2022 survey.

Methodology:
1. Non-parametric ANOVA (Kruskal-Wallis and Dunn's test).
2. Removal of influential points (outliers and leverages).
3. Cross-validation.
4. Prediction and confidence intervals.