

Alessio Mezzina

PhD Student in Computer Science — University of Catania

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Short Biography

I am Alessio Mezzina, a second-year Ph.D. student in Computer Science at the University of Catania. My research focuses on metaheuristics and Large Language Models (LLMs), and I am currently exploring how to effectively integrate the two fields. In parallel, I conduct industry-driven research in collaboration with **KOEXAI Srl**.

Education

Ph.D. in Computer Science

Oct 2024 – Present

University of Catania, Italy

- Research on Generative AI systems, Autonomous Systems, and Metaheuristics.
- Industrial collaboration with **KOEXAI Srl**.
- Visiting Ph.D. Researcher at **Leiden Institute of Advanced Computer Science (LIACS)**, Leiden University, the Netherlands, with Dr. Elena Raponi and Dr. Niki van Stein (sept 2026 - mar 2027).

Postgraduate Teaching Certificate (Computer Science)

Jun 2024 – Dec 2024

University of Catania, Italy

- Fully qualified to teach Computer Science and Information Technology at the high school / secondary level. Final mark: **10/10**.

M.Sc. in Computer Science (LM-18, Data Science track)

Oct 2022 – Jul 2024

University of Catania, Italy

- Thesis: “*Real Time Adaptive Metaheuristic for Handling Dynamic Optimisation Problems: A Case Study on the Dynamic Map Labeling Problem.*”
- Supervisor: Prof. Mario Francesco Pavone.
- Final grade: **110/110 cum laude** — conferred 25 Jul 2024.

B.Sc. in Computer Science (L-31, Systems & Applications track)

Oct 2019 – Dec 2022

University of Catania, Italy

- Thesis: “*Visual Sonar: An Underwater Acoustics Simulator and Sonar Systems.*” Field: Audio Processing.
- Supervisor: Prof. Filippo Luigi Maria Milotta.
- Final grade: **110/110 cum laude** — conferred 16 Dec 2022.

Working Experience

Visiting Ph.D. Researcher — Natural Computing

Sep 2026 – Present

Leiden Institute of Advanced Computer Science (LIACS), Leiden University, the Netherlands

- Research on language models and numerical optimization for automated metaheuristic design, with Dr. Elena Raponi and Dr. Niki van Stein. Research stay scheduled to continue until 5 Mar 2027.

Industrial Ph.D. Student — Semantic Generative AI
KOEXAI Srl, Catania, Italy

Oct 2024 – Present

- Industry-driven research on semantic generative AI engines fusing large language models with domain-specific ontologies and knowledge graphs.
- Design of controllable content-generation pipelines and evaluation of neural network optimisation techniques for real-time, production-grade systems.

Software Development Engineering Intern (SDE)

Feb 2023 – Dec 2023 (11 months)

STMicroelectronics, Catania, Italy — paid internship

- Built proof-of-concept workflows with *Microsoft Power Automate Desktop* and produced comprehensive documentation to streamline future PoC development.
- Daily collaboration with an engineering team in India, strengthening cross-cultural communication and distributed-team agile practices.

Teaching Experience

Teaching Contribution — DMI, University of Catania

15 Jan 2026 | 2 h

- Lecture on *Swarm Intelligence* within the *Artificial Intelligence* course.

Teaching Assistant — DMI, University of Catania

A.Y. 2025 | 8 h

- 4 hours of lectures in *Artificial Intelligence* and 4 hours in *Heuristics and Metaheuristics for Optimization and Learning*.

Teaching Assistant (Tutor — contract position)

A.Y. 2025 | 25 h

- Course: *Algorithms and Laboratory* — B.Sc. in Computer Science, DMI.

Teaching Assistant (Tutor — contract position)

A.Y. 2025 | 50 h

- Course: *Operating Systems* — B.Sc. in Computer Science, DMI.

Teacher Training Internship — Qualification Class A041

Oct 2024 – Dec 2024 | 180 h

- Liceo “E. Boggio Lera,” Catania. Classroom lessons and supplementary seminars under a supervising teacher.

Teaching Assistant (Tutor — contract position)

A.Y. 2024 | 50 h

- Course: *Algorithms and Laboratory* — B.Sc. in Computer Science, DMI.

Teaching Assistant (Tutor — contract position)

A.Y. 2024 | 20 h

- Course: *Applied Informatics* — B.Sc. in Biological Sciences (DIPBIOGEO).

Thesis Supervision

- **Daniele Spampinato** — M.Sc. in Building Engineering & Architecture, 2026 (co-supervision).
- **Alberto Bocchieri** — M.Sc., co-supervision in progress; graduation expected april 2027.
- **Andrea Filippo Salemi** — M.Sc., 2026 (co-supervision).
- **Angelo Spadola** — B.Sc., “*Integrating Machine Learning into Meta-Heuristics for Runtime Adaptive Tuning*,” 2025 (co-supervision).

Publications

Journal Articles

- M. Pavone, M. Brancaforte, M. Cassia, A. Mezzina, C. Crespi. *When Information Does Not Deliver: The Service-Capacity Cost of Rigid Roles in Energy-Constrained Multi-Agent Foraging*. **Computers**, MDPI, 15(10):684, 2026 (early access).
mdpi.com/2073-431X/15/10/684
- A. Mezzina, M. Pavone. *A Comprehensive Review of Metaheuristics for the Modern Traveling Salesman Problem and Drone-Assisted Delivery*. **Algorithms**, MDPI, 19(4):278, 2026.
doi.org/10.3390/a19040278
- F. Spampinato, V. Del Zoppo, G. Puglisi, A. Mezzina, M. Cataldo, J. M. Christille, M. Calabrese, L. Naso, C. Carbone. *HALOS: Hierarchical Aggregation Learning for Overdensity Search*. **Astronomy and Computing**, Elsevier, 56, Art. 101114, 2026 — joint work with KOEXAI S.R.L.
doi.org/10.1016/j.ascom.2026.101114
- A. C. Grasso, V. Del Zoppo, A. Mezzina, M. Cataldo, G. Puglisi, F. Spampinato, S. P. Cosentino, M. L. Pumo, L. Naso. *A dual AI framework for the automatic characterisation of low-interacting H-rich SNe within the ASTRAI (Advanced Supernova Transient Research with Artificial Intelligence) project*. **Astronomy and Computing**, Elsevier, 56, Art. 101116, 2026 — joint work with KOEXAI S.R.L.
doi.org/10.1016/j.ascom.2026.101116
- G. Puglisi, V. Del Zoppo, F. Spampinato, A. Mezzina, M. Cataldo, G. Verza, M. Calabrese, J. M. Christille, L. Naso, C. Carbone. *3D YOLO-like Detector for Cosmic Voids: A Multi-Scale Deep Learning Approach to Large-Scale Underdense Structures*. **Astronomy and Computing**, Elsevier, 57, Art. 101152, 2026 — joint work with KOEXAI S.R.L.
doi.org/10.1016/j.ascom.2026.101152

Published Conference Papers

- A. Mezzina, M. Pavone. *Evolved Micro-Neural Networks for Per-Ant Behavioral Modulation in Ant Colony Optimization*. ALIFE 2026 — The 2026 Conference on Artificial Life, MIT Press, 2026.
doi.org/10.1162/ISAL.a.1021
- A. Mezzina, C. Crespi, V. Cutello, M. Pavone. *An Autonomous Navigation Framework for Item Retrieval in Unknown Environments*. LION 20 — 20th Learning and Intelligent Optimization Conference, 2026. Accepted and presented; proceedings forthcoming.
- A. Mezzina, L. Naso, M. Pavone. *Retrieval Augmented Generation with Iterative Critique: A Framework for Structured Task Solving*. DSA-ISC 2025 (Decision Sciences), Lecture Notes in Computer Science, vol. 16405, pp. 183–196, Springer, 2026.
doi.org/10.1007/978-3-032-21811-7_13
- V. Cutello, A. Mezzina, M. Pavone, F. Zito. *A Weighted Binary String Benchmark to Assess the Efficiency of Stochastic Search Processes*. Proc. 16th International Conference on Swarm Intelligence (ICSI 2025), Yokohama, Japan. LNCS, vol. 16011, pp. 116–127, Springer, 2026
doi.org/10.1007/978-981-95-0982-9_10
- V. Cutello, A. Mezzina, M. Pavone, F. Zito. *A Real-Time Adaptive Tabu Search for Handling Zoom In/Out in Map Labeling Problem*. LION 18 — 18th Learning and Intelligent Optimization Conference, Ischia, Italy. LNCS, vol. 14990, pp. 108–122, Springer, 2025.
doi.org/10.1007/978-3-031-75623-8_9

Submitted Works (Under Review)

- **Journal** — A. Bocchieri, A. Mezzina, C. Crespi, M. Pavone. *Toward Energy-Conscious Intelligent Systems: Decision-Driven Context Selection for CPU-Only Multi-Hop RAG Pipelines*. Submitted to *Soft Computing*, Springer.

Manuscripts Under Revision

- A. Mezzina, C. Crespi, V. Cutello, M. Pavone. *POLARIS: Neural Map Prediction and Synchronization-Aware Planning for Energy-Constrained Multi-Agent Exploration*. Revision in progress following peer review at *Knowledge-Based Systems*, Elsevier. Earlier version available as an SSRN preprint (2026).

Drafts & Work in Progress

- C. Crespi, V. Cutello, A. Mezzina, M. Pavone, A. D. Stefan. *Optimal Navigation Strategies for Exploring Unknown Environments Using Autonomous Agents: Analysis and Comparisons*.

Awards

- **Best Student Paper Award** — ICSI 2025, 16th International Conference on Swarm Intelligence, Yokohama, 11–15 July 2025.
Paper: *A Weighted Binary String Benchmark to Assess the Efficiency of Stochastic Search Processes*.
Authors: V. Cutello, A. Mezzina, M. Pavone, F. Zito.

Invited Talks & Oral Presentations

2026

- *Evolved Micro-Neural Networks for Per-Ant Behavioral Modulation in Ant Colony Optimization* — oral presentation, ALIFE 2026, Waterloo, Ontario, Canada, 17–21 Aug 2026.
- *An Autonomous Navigation Framework for Item Retrieval in Unknown Environments* — oral presentation, LION 20, Milan, Italy, 15–19 Jun 2026.

2025

- *A Weighted Binary String Benchmark to Assess the Efficiency of Stochastic Search Processes* — oral presentation, ICSI 2025, Kanagawa University, Yokohama, Japan, 12 Jul 2025.
- *Augmented Decision Making with Large Language Models* — oral presentation, ISC 2025 International Summer Conference “Intelligent Systems & Decision Making — Human Insights in the Era of AI,” University of Catania, Dept. of Economics and Business, 21 Jun 2025.
- *AI and Machine Learning: When Data Make Decisions* — outreach seminar for senior high school students, Liceo Scientifico “E. Boggio Lera,” Catania, 8 Apr 2025. **(invited)**

2024

- *Dynamic Metaheuristics: Enhancing Real-Time Problem Solving with Machine Learning Integration* — oral presentation, MESS 2024, 3rd International Metaheuristics Summer School, University of Catania, 17 Jul 2024.

2023

- *Visual Sonar: An Underwater Acoustics Simulator and Sonar Systems* — invited seminar for the “Audio Processing” course, B.Sc. in Computer Science, DMI, University of Catania, 14 Dec 2023. **(invited)**

Scientific Roles

2025 – Present

- **Ph.D. Student Representative** — Quality-Assurance Board, Ph.D. Program in Computer Science, University of Catania.

2026

- **Special Session Organiser, Technical Program Committee Member & Reviewer** — LION 20, 20th Learning and Intelligent Optimization Conference, Milan, Italy, 15–19 Jun 2026. Special session: “*Learning and Optimization under Uncertainty for Dynamic Autonomous Navigation*.” lion20.org
- **Local Organising Committee Member** — MESS 2026 (4th Metaheuristics Summer School), “*Emerging Computing Paradigms for Optimization: from Quantum to Neuromorphic*.” ants-

2025

- **Track Chair & Local Organising Committee Member** — DSA-ISC 2025, Decision Science Alliance International Summer Conference, Catania, Italy, 19–20 Jun 2025. Track: “*Machine Learning for Decision Science*.” decisionsciencesummit.com/catania
- **Publicity Chair & Organising Committee Member** — WBO 2025. ants-lab.it/wbo2025

2024

- **Local Organising Committee Member** — MESS 2024 (3rd Metaheuristics Summer School), “*Automated Deep Learning Meets High-Performance Computing*.” ants-lab.it/mess2024

Peer-Review Activities

- *Applied Soft Computing* (Journal, Elsevier)
- *Soft Computing* (Journal, Springer)
- LION 20 (Conference)
- ISC 2025 (Conference)
- WBO 2025 (Conference)

International Summer Schools & Conference Participation

2026

- **ALIFE 2026** — The 2026 Conference on Artificial Life, University of Waterloo, Waterloo, Ontario (Canada), 17–21 Aug 2026. 2026.alife.org
- **MESS 2026** — 4th Metaheuristics Summer School, University of Catania, Dept. of Economics and Business, Catania (Italy), 6–10 Jul 2026. ants-lab.it/mess2026
- **LION 20** — 20th Learning and Intelligent Optimization Conference, Milan (Italy), 15–19 Jun 2026. lion20.org

2025

- **ICSI 2025** — 16th International Conference on Swarm Intelligence, Kanagawa University, Yokohama (Japan), 11–15 Jul 2025. iasei.org/icsi2025
- **DSA-ISC 2025** — Decision Science Alliance International Summer Conference, University of Catania, Dept. of Economics and Business, 19–20 Jun 2025. decisionsciencealliance.org/isc-2025

2024

- **MESS 2024** — 3rd Metaheuristics Summer School, University of Catania, Dept. of Economics and Business, Catania (Italy), 15–18 Jul 2024. ants-lab.it/mess2024

Languages

- **Italian** — Native.
- **English** — C1. CLA, University of Catania (C1, 2025); EF SET Certificate — overall 68/100, C1 Advanced (Reading 68/100, Listening 67/100), 27 Jun 2024; MaltaLingua Certificate of Studies — B1+ Intermediate, 2016; Cambridge English Flyers — Reading & Writing 3/5, Listening 5/5, Speaking 5/5, 2014.

Certificates

- **AWS Certified Cloud Practitioner (CLF-C02)** — Amazon Web Services Training and Certification.
[Credly credential](https://www.credly.com/credentials/aws-certified-cloud-practitioner)
- **IBM Generative AI Engineering** (16 courses) — IBM, 25 Mar 2025.
- **Data Analysis with R Programming** — Google, 22 Dec 2023.
- **Dataiku Developer Certificate** — Dataiku, 02 Oct 2023.
- **Dataiku Advanced Designer Certificate** — Dataiku, 22 Sep 2023.
- **Dataiku ML Practitioner Certificate** — Dataiku, 12 Sep 2023.

- **Dataiku Core Designer Certificate** — Dataiku, 11 Sep 2023.
- **Using Databases with Python** — University of Michigan, 09 Jun 2020.
- **Capstone: Retrieving, Processing, and Visualizing Data with Python** — University of Michigan, 07 Jun 2020.
- **Using Python to Access Web Data** — University of Michigan, 02 Jun 2020.
- **Python Data Structures** — University of Michigan, 20 May 2020.