

MARZIO DE CORATO

Researcher - Post Doc (Incaricato di ricerca) UNIMI
Adjunct professor - contratto UNICATT and UNIMI

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RESEARCH INTERESTS

- **Cybersecurity:** Development of data-driven approaches for threat detection, malware analysis, and security assessment.
- **Artificial Intelligence and Explainable AI (XAI):** Design and analysis of machine learning models, with a particular focus on interpretability, transparency, and explainability of AI-driven decisions.
- **Classical and Quantum Information:** Entropy, coding, information transmission and quantum algorithms, with applications to optimization and machine learning.
- **Mathematical Modeling for Finance:** Application of mathematical and statistical models to financial markets, risk assessment, and quantitative analysis.
- **Educational Module Development in Systems Architecture:** Design and preparation of teaching modules, educational materials, and practical exercises focused on computer systems architecture, computational infrastructures, and hardware-software interactions.

EXPERIENCE

Postr Doc - Incaricato di ricerca

Università degli Studi di Milano - Dipartimento di informatica G. Degli Antoni

April 2025 – March 2026 | Milano, IT

Postdoc Representative

Università degli Studi di Milano - Dipartimento di informatica G. Degli Antoni

September 2023 – 2025 | Milano, IT

Post Doc (Assegno di ricerca B)

Università degli Studi di Milano - Dipartimento di informatica G. Degli Antoni

November 2022 – 2025 | Milano, IT

- Supervisor: Prof.Danilo Bruschi
- Cybersecurity
- Machine learning
- Big-data

Instructor of Mathematics, Physics, Chemistry, and Biology

Uni.ON Project – Unlock Your Future | Fondazione Don Gino Rigoldi – UniCredit Foundation

2024/2025 – 2025/2026 | Milan, Italy

"[Whymper] loved pitting his spirit against a formidable opponent - both physically and morally - to see who ended up winning. He then discovered that the mountains were harder than him, of a terrible hardness, and then he gave way. But, to arrive at this discovery, he had lived the most passionate years of his life" C.E.Engels

"It from bit. Otherwise put, every it—every particle, every field of force, even the space-time continuum itself—derives its function, its meaning, its very existence entirely—even if in some contexts indirectly—from the apparatus-elicited answers to yes-or-no questions, binary choices, bits. It from bit symbolizes the idea that every item of the physical world has at bottom—at a very deep bottom, in most instances—an immaterial source and explanation" John Archibald Wheeler

LANGUAGES

Italian
English

EDUCATION

M.Sc. in Data Science and Economics

Università degli Studi di Milano

Sept 2019 – Oct 2022

Thesis title: Epistemological foundations of data analysis A combined study through statistics, computer science and physics

Supervisor: prof. Salini Silvia; co-Supervisors: prof.Nicolò Cesa-Bianchi, prof.Alfio Ferrara
Grade: 110/110 cum laude

Ph.D. in Physics and Nano science

Università degli Studi di Modena e Reggio Emilia

Jan 2013 – Dec 2016

Thesis title: Vibrational and optical fingerprints in graphene-based nanostructures
Supervisor: prof. Alice Ruini; co-Supervisor: dr.Deborah Prezzi

M.Sc. in Physics

Università degli Studi di Milano - Bicocca

Nov 2009 – March 2012

Junior Data Scientist - Data Science 4Citizens

Respighi Scientific High School - supervisor prof.Silvia Salini

Oct 2021 – May 2022 Piacenza, IT

I taught Respighi Scientific High School students (Piacenza, IT) the basic techniques of analysing time series data with R Software. Within the project, climatic times series were considered and analysed. I explained how to implement data science techniques using R Software. The overall results and further details are available on this website. https://datascience4citizens.webnode.it/

Data Science Assistant

Università degli Studi di Milano - supervisor prof.Fabrizio Iacone

Oct 2020 – Feb 2021 Milano, IT

The project was focused on COVID-19 time series data. I have learned different advanced statistical methods for forecast evaluation. Moreover, I translated a MATLAB code in which these techniques were implemented into Python.

Engineer Sales

Hamamatsu Photonics Italia

October 2016 – October 2019 Arese, IT

- Qualified seller for optoelectronic devices

Research Fellow

CNR - NANO

November 2012 – January 2013 Modena, IT

- Research on the optical properties of carbon nanostructures

PROJECTS

MUSA- Multilayered Urban Sustainability Action

PNRR - EU

STRENGTHS

Strong scientific background
Strong data analysis background | Problem solving
Story-telling of complex issues | Multidisciplinary approach

SKILLS

Statistical Analysis | Machine Learning | Econometrics
Bayesian analysis | Probabilistic modelling
Text mining | Solid state physics | Ab-initio calculations
Cybersecurity analyst

PROGRAMMING LANGUAGES

R | Python | C++ | Java | Fortran

Thesis title: Topological versus physical and chemical properties of carbon nanostructures
Supervisor: prof. Giorgio Benedek; co-Supervisors: prof.Marco Bernasconi, dr.Ottorino Ori Grade: 110/110 cum laude

B.Sc. in Physics

Università degli Studi di Milano - Bicocca

Oct 2005 – July 2009

Thesis title: Dinamica e termodinamica delle schwarziti di carbonio Supervisor: prof. Giorgio Benedek
Grade: 101/110

Scientific High School diploma

Fondazione Sacro Cuore - Milan

2005

TEACHING

Adjunct professor - contratto (24 h) - Mathematics I and Information Tecnology

Geological Sciences - Università degli Studi di Milano

2025/2026

Adjunct professor - contratto (28 h) - Advanced calculus and stochastic processes

Actuarial sciences, risk and data analysis - Università Cattolica del Sacro Cuore

2024/2025; 2025/2026

Teaching assistant (10 h) - Statistical theory and Mathematics - mathematics, dr.Benfenati

Università degli Studi di Milano - Department of Economics, Management and Quantitative Methods - Master degree in Data Science for Economics

2024

Teaching assistant (20 h) - Mathematical Methods for Finance, dr.Alessandro Doldi

Università degli Studi di Milano - Department of Economics, Management and Quantitative Methods - Master degree in Finance and Economics

2024

Teaching assistant (15 h) - Statistics - prof.Salini

Università degli Studi di Milano - Department of Economics, Management and Quantitative Methods - Bachelor degree in International Politics, Law and Economics

2024/2025

Teaching assistant (10 h) - Mathematics - prof.Liuzzi

Università degli Studi di Milano - Department of Economics, Management and Quantitative Methods - Bachelor degree in International Politics, Law and Economics

2023

Teaching assistant (10 h) - Statistical theory and Mathematics - mathematics, prof.Liuzzi

Università degli Studi di Milano - Department of Economics, Management and Quantitative Methods - Master degree in Data Science for Economics

2023

Teaching assistant (20 h) - Mathematical Methods for Finance, prof.Liuzzi

Università degli Studi di Milano - Department of Economics, Management and Quantitative Methods - Master degree in Finance and Economics

2023

Teaching assistant (30 h) - Statistics crash course, prof.Salini

Università degli Studi di Milano - Department of Economics, Management and Quantitative Methods

2023

Teaching assistant - General Physics, prof.Calandra

Università di Modena e Reggio Emilia - Physics department - Bachelor degree in Physics

2013

Teaching assistant - Quantum mechanics, prof.Jacoboni

Università di Modena e Reggio Emilia - Physics department - Bachelor degree in Physics

2013

THESIS CO-SUPERVISOR

"Rilevamento di ransomware usando intelligenza artificiale spiegabile: analisi di caratteristiche di basso livello" - Mattia Falgari - Bachelor degree Computer Systems and Networks Security - UNIMI

Supervisor prof.Danilo Bruschi

2025

"Malware detection tramite explainable artificial intelligence: analisi delle feature di sistema low-level" - Davide Cesare Rossi- Bachelor degree Computer Systems and Networks Security - UNIMI

Supervisor prof.Danilo Bruschi

2025

"Dinamiche e invarianti linguistici nei testi: un'analisi dell'evoluzione semantica con word2vec, grafi e indici topologici" - Stefano Vallodoro - Bachelor degree in Computer Science - UNIMI

Supervisor prof.Alfio Ferrara

2025

"Studio e analisi sul ruolo dell'Intelligenza Artificiale nella creazione e analisi dei Malware" - Ciro Mariano Esposito - Bachelor degree in Computer Science - UNIMI

Supervisor prof.Danilo Bruschi

2024

"Studi e analisi di tecniche ia generativa per malware detection" - Massimiliano Capparuccia - Bachelor degree in Computer Science - UNIMI

Supervisor prof.Danilo Bruschi

2024

PUBLICATIONS

Books

- D. Bruschi, A. Ferrara, M. De Corato, and S. Castano, *L'Intelligenza Artificiale negli enti locali*. Milano University Press, 2025, vol. 3, ISBN: 979-12-5510-345-5. DOI: 10.54103/meiec.265.
- D. Bruschi, A. Ferrara, and M. Corato, *La Cybersecurity negli enti locali*. Oct. 2024, ISBN: 979-125-510-185-7. DOI: 10.54103/meiec.197.

Journal Articles

- D. Bruschi, M. De Corato, A. Ferrara, and S. Salini, “Ransomware detection using sample entropy and graphical models: A methodology for explainable artificial intelligence (xai) in cybersecurity,” *Applied Stochastic Models in Business and Industry*, vol. 41, no. 6, e70061, 2025.
- N. Cavani, M. De Corato, A. Ruini, *et al.*, “Vibrational signature of the graphene nanoribbon edge structure from high-resolution electron energy-loss spectroscopy,” *Nanoscale*, vol. 12, no. 38, pp. 19 681–19 688, 2020.
- Y. Hu, P. Xie, M. De Corato, *et al.*, “Bandgap engineering of graphene nanoribbons by control over structural distortion,” *Journal of the American Chemical Society*, vol. 140, no. 25, pp. 7803–7809, 2018.
- I. A. Verzhbitskiy, M. De Corato, A. Ruini, *et al.*, “Raman fingerprints of atomically precise graphene nanoribbons,” *Nano letters*, vol. 16, no. 6, pp. 3442–3447, 2016.
- M. De Corato, C. Cocchi, D. Prezzi, M. J. Caldas, E. Molinari, and A. Ruini, “Optical properties of bilayer graphene nanoflakes,” *The Journal of Physical Chemistry C*, vol. 118, no. 40, pp. 23 219–23 225, 2014.
- M. De Corato, G. Benedek, O. Ori, and M. V. Putz, “Topological study of schwarzitic junctions in 1d lattices,” *Int. J. Chem. Model*, vol. 4, no. 2-3, pp. 105–113, 2012.

Conference Proceedings

- M. De Corato, A. Monzani, and D. Bruschi, “Estimating shortcut learning and inductive bias in multi-view behavioural trace classification,” in *IAPR Workshop on Artificial Neural Networks in Pattern Recognition*, Springer, 2026, pp. 89–101.
- M. Corato, S.Salini, A.Ferrara, and C. Vello, “Hazardous asteroids forecast via markov random fields: A case study for explainable artificial intelligence (xai),” in *110 Congresso Nazionale Società Italiana di Fisica*, 2024.
- M. De Corato, A. Ferrara, and S. Salini, “Interpretability of machine learning algorithms: How these techniques can correctly guess the physical laws?” In *Proceedings of the Statistics and Data Science Conference*, EGEA, 2023 May, 2023, ISBN: ISBN 978-88-6952-170-6.
- M. De Corato and G. Benedek, “Dynamics and spectral properties of free-standing negatively-curved carbon surfaces,” in *Epioptics-11*, World Scientific, 2012, pp. 114–131.

Book chapters

- M. De Corato, M. Bernasconi, L. D’Alessio, O. Ori, M. V. Putz, and G. Benedek, “Topological versus physical and chemical properties of negatively curved carbon surfaces,” in *Topological Modelling of Nanostructures and Extended Systems*, Springer, 2013, pp. 105–136.
- M. De Corato, D. M. Proserpio, M. Bernasconi, and G. Benedek, “Two c 28 clathrates,” in *Diamond and Related Nanostructures*, Springer, 2013, pp. 75–89.
- M. V. Putz, M. De Corato, G. Benedek, J. Sedlar, A. Graovac, and O. Ori, “Topological invariants of moebius-like graphenic nanostructures,” in *Topological Modelling of Nanostructures and Extended Systems*, Springer, 2013, pp. 229–244.

- M. V. Putz, O. Ori, M. De Corato, *et al.*, “Introducing “colored” molecular topology by reactivity indices of electronegativity and chemical hardness,” in *Topological Modelling of Nanostructures and Extended Systems*, Springer, 2013, pp. 265–286.
- G. Benedek, M. Bernasconi, E. Cinquanta, L. D’Alessio, and M. De Corato, “The topological background of schwarzite physics,” in *The Mathematics and Topology of Fullerenes*, Springer, 2011, pp. 217–247.

CONFERENCES

Estimating Shortcut Learning and Inductive Bias in Multi-View Behavioural Trace Classification

ANNPR 2026 - 12th IAPR TC3 Workshop on Artificial Neural Networks in Pattern Recognition

10/2026 Milan, Italy

Invited Talk: Classical and quantum perspectives on software behavior

IFCS 2026 - 19th Conference of the International Federation of Classification Societies

07/2026 Milan, Italy

Detection via Library Calls using Markov Random Fields: a XAI-Driven Approach to Cybersecurity

Statistics and Data Science Conference - Specialized Session

04/2025 Milan, Italy

Detection via Library Calls using Markov Random Fields: a XAI-Driven Approach to Cybersecurity

Statistics and Data Science Conference - Specialized Session

04/2025 Milan, Italy

Hazardous asteroids forecast via Markov Random Fields: A case study for Explainable Artificial Intelligence (XAI)

110° Congresso Nazionale Società Italiana di Fisica - Oral Communication

13/09/2024 Bologna, Italy

Interpretability of Machine Learning algorithms: how these techniques can correctly guess the physical laws?

Statistics and Data Science Conference - Invited talk

28/05/2023 Pavia, Italy

Raman fingerprints of atomically precise graphene nanoribbons: insights from ab-initio simulations

GraphITA 2015

14-18/9/2015 Bologna, Italy

Raman characterization of cove-shape graphene nanoribbons: a first principles study

Vibrations at Surfaces - Poster

22-26/6/2015 Donostia-San Sebastián, Spain

Optical properties of bilayer graphene nanoflakes

International Winterschool on Electronic Properties of Novel Materials - Poster

07-14/03/2015 Kirchberg, Austria

Vibrational properties of cove-shape edged graphene nanoribbons

100° Congresso Nazionale Società Italiana di Fisica - Oral Communication

22-26/09/2014 Pisa, Italy

Topological thermodynamics and the physics of the local Wiener index

Carbon topology - Ettore Majorana Foundation Centre for Scientific Culture - Oral Talk

17-22/06/2013 Erice, Italy

Topological versus physical and chemical properties of carbon nanostructures

98° Congresso Nazionale Società Italiana di Fisica - Oral Communication

17-21/09/2012 Napoli, Italy

From graphene bilayer to the planar schwarzite $(C38)_2$: structure and optical vibrations

Epioptics 2012 - Ettore Majorana Foundation Centre for Scientific Culture - Oral Talk

24-29/07/2012 Erice, Italy

Topological versus physical and chemical properties of carbon nanostructures

Invited Seminar - Istituto Nanoscienze CNR-S3

18/07/2012 Modena, Italy

Topological versus physical and chemical properties of carbon nanostructures

Invited Seminar - Universitatea de Vest din Timisoara

24/11/2011 Timisoara, Italy

Theory of carbon schwarzite growth

96° Congresso Nazionale Società Italiana di Fisica - Oral Communication

09/2010 Bologna, Italy

Dynamics and thermodynamics of free-standing negatively curved carbon surfaces

Epioptics 11 Ettore Majorana Foundation Centre for Scientific Culture - Poster

19-25/07/2010 Erice, Italy

Growth thermodynamics of Carbon Schwarzites

TransAlp'Nano 2010 - Poster

3-5/05/2010 Como, Italy

OTHER ACTIVITIES

- Yoga (Vinyasa Krama, Ashtanga Vinyasa, Yin Yoga)
- Hiking and Climbing

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