Camillo Maria Caruso

Curriculum Vitae

Personal Information

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Professional Experience

November 2024 – Today
Researcher, *University Campus Bio-Medico of Rome*, Rome, Italy.
Unit of Artificial Intelligence & Computer Systems (ArCo), Department of Engineering, University Campus Bio-Medico of Rome.
Multimodal and Generative AI solution for diagnosis, prognosis and treatment support.

Academic Years 2022-2025
Collaborating Professor, *University Campus Bio-Medico of Rome*, Rome, Italy.
Unit of Artificial Intelligence & Computer Systems (ArCo), Department of Engineering, University Campus Bio-Medico of Rome.
- Lecturer for the course on *Machine Learning & Big Data Analysis* in the Master's Degree in Biomedical Engineering (2024-2025).
- Lecturer for the course on *Statistics* in the Master's Degree in Medicine and Surgery (2022-2023, 2023-2024).

June 2021 – October 2021
Graduate Research Associate, *University Campus Bio-Medico of Rome*, Rome, Italy.
Collaborator of the Unit of Artificial Intelligence & Computer Systems (ArCo), Department of Engineering, University Campus Bio-Medico of Rome.

Education

November 2021 – December 2025
PhD in AI - **Health and life sciences**, *University Campus Bio-Medico of Rome*, Rome, Italy.
Unit of Artificial Intelligence & Computer Systems (ArCo), Department of Engineering, University Campus Bio-Medico of Rome.
Research Exchange: Department of Diagnostics and Intervention, Radiation Physics, Biomedical Engineering, Umeå University.

June 2021
Licence to practice as an industrial engineer.

October 2018 – May 2021
Master's Degree in Biomedical Engineering, *University Campus Biomedico of Rome*, Rome, Italy.
- Taught in Italian and English
- Curriculum "E-Health Systems"
- **Final grade**: 110/110 cum laude
- **Thesis title**: "Analysis and classification of relevant interventions to the National Fire Corps"
- Thesis Subject: Machine Learning and Big Data Analysis
- **Relevant Modules**: Machine Learning & Big Data Analysis, IoT System Design, Telematic Applications, Industrial Informatics, Image Processing.

September 2014 – May 2018	**Bachelor's Degree in Industrial Engineering**, *University Campus Bio-Medico of Rome*, Rome, Italy.

o Taught in Italian
o **Final grade**: 100/110
o **Thesis title**: "Analysis and classification of satellite images using Machine Learning techniques"
o Thesis subject: Machine Learning
o **Relevant Modules**: Modular Programming, Signal Processing, Fundamentals of Informatics.

September 2009 – June 2014	**High School Diploma**, *Liceo Classico Dante*, Florence, Italy.

Post-master courses

Jun. 10-14, 2023	**ACDL 2023: 6th Advanced Course on Data Science & Machine Learning**, Castiglione della Pescaia (Grosseto), Directors: Giuseppe Nicosia and Panos Pardalos.
Sept. 4-8, 2023	**International Summer School on Machine Vision (VISMAC) 2023**, Padova, Directors: Lamberto Ballan, Giovanni Maria Farinella, Sebastiano Vascon.
Sept. 26-30, 2022	**PhD School of the National PhD in Artificial Intelligence, Health and life sciences area 2022**, Roma, Directors: Eugenio Gugliemelli and Paolo Soda.

Personal Grants

2021	**Grant for the XXXVII Italian National PhD Program in Artificial Intelligence**, *Università Campus Bio-Medico di Roma*, Duration: 3 years.

Research Activities

Research Interests	My research activity concerns artificial intelligence, particularly its application in the biomedical field. We are indeed witnessing a widespread diffusion of artificial intelligence, and recent advancements in deep learning should allow for improvements in diagnosis, prognosis, and treatment decisions in healthcare. To have a complete picture of the phenomenon under consideration, deep learning models must combine information from different sources, as doctors do daily. For this reason, my research seeks to advance multimodal deep learning, studying how deep neural networks can learn shared representations between different modalities. Among the various available modalities, my research has mainly focused on analyzing tabular (J1-J3, J5-J7, S1) and imaging data (J1, C3, S2). Both have their complexities: the former are usually composed of multiple types of information and may have missing values; the latter show strong dependencies on the parameters and machines with which they are acquired. For these reasons, both modalities require specific preprocessing and analysis.

Participation in national or international research projects

2026-2030	**LUCIA: Lung Cancer Holistic Care via Interactive AI Agents**, *EU PathFinder Challenge Proposal*, (submitted).
2025-2026	**MedCoDi+: Dalla Fondazione del Modello al Prototipo Operativo per la Generazione Multimodale di Immagini e Referti Medici**, *within the call "Bando Interno al Progetto Fair per il Finanziamento di Attività di Trasferimento Tecnologico" part of the project FAIR PE0000013 – CUP B533D22000980006*.
2023-2026	**FAIR: Future Artificial Intelligence Research**, *funded by MUR.*, Specifically contributing to Spoke 3 "Resilient AI" and Work Package 3.5 "Resilient Multimodal Systems", focusing on developing resilient AI systems capable of handling diverse and multimodal data sources to enhance system robustness and adaptability.

2023-2026 **IDEA: AI-powered digital Twin for next-generation lung cancEr cAre**, *Internal Call 2023.*, The Project aims to develop digital twin for non-small cell lung cancer, combining this technology with artificial intelligence in order to improve diagnosis and optimize therapy.

2023-2026 **PICTURE: Pathological response AI-driven prediCTion after neoadjUvant theRapiEs in NSCLC**, *funded by European Union, NextGenerationEU, Ministro dell'Università e della Ricerca, for the call "PRIN: Progetti di Ricerca di Rilevante Interesse Nazionale – Bando 2022 PNRR".*, Role in the project: development of multimodal deep learning models for the prediction of pathologic complete response of patients affected by non-small cell lung cancer.

2023-2026 **AIDA: Explainable Multimodal Deep Learning for Personalized Oncology**, *founded by PRIN call 2022.*, This research explores new multimodal deep learning approaches to integrate radiomic, pathomic, and clinical report data for precision oncology, aiming to predict prognosis in patients with non-small cell lung cancer.

2023-2024 **Trustworthy AI-driven next generation precision medicine in COVID-19**, *supported by the Italian Ministry of Foreign Affairs and International Cooperation.*, Role in the project: development of multimodal deep learning algorithms to detect signatures for the risk of severe outcome in patients affected by COVID-19.

2021-2023 **CoLIAborative multi-sources Radiopathomics approach for personalized Oncology in non-small cell lung cancer (CLARO)**, *project funded by the University Campus Bio-Medico carried out in collaboration with the radiology, radiotherapy and pathological anatomy units of the University Polyclinic.*, Role in the project: development of algorithms for radiomic analysis of multimodal data of patients with lung cancer.

List of scientific publications

International Journals

J7 Cortellini A, et al. "Long-term outcomes from pembrolizumab monotherapy in patients with advanced NSCLC, PD-L1 expression$\geq$50%, and poor performance status: Transformer-based AI to characterize prognostic complexity." Lung Cancer. 2025 Oct 16:108799. `https://doi.org/10.1016/j.lungcan.2025.108799`.

J6 Cortellini A, et al. "Transformer-based AI approach to unravel long-term, time-dependent prognostic complexity in patients with advanced NSCLC and PD-L1$\geq$50%: insights from the pembrolizumab 5-year global registry." Journal for Immunotherapy of Cancer. 2025 Sep 13.9 e012423. `https://doi.org/10.1136/jitc-2025-012423`.

J5 Caruso CM, Soda P, Guarrasi V. "MARIA: a Multimodal Transformer Model for Incomplete Healthcare Data". Computers in Biology and Medicine. 2025 Sep 1;196:110843. `https://doi.org/10.1016/j.compbiomed.2025.110843`.

J4 Guarrasi V, Aksu F, Caruso CM, Di Feola F, Rofena A, Ruffini F, Soda P. "A Systematic Review of Intermediate Fusion in Multimodal Deep Learning for Biomedical Applications". Image and Vision Computing. 2025 Mar 25:105509. `https://doi.org/10.1016/j.imavis.2025.105509`.

J3 Caruso CM, Guarrasi V, Ramella S, Soda P. "A deep learning approach for overall survival prediction in lung cancer with missing values". *Computer Methods and Programs in Biomedicine*. 2024 Sep 1;254:108308. `https://doi.org/10.1016/j.cmpb.2024.108308`.

J2 Caruso CM, Soda P, Giammichele C, Rotilio F, Sicilia R. "A Cascade of Learners for Firemen' Emergency Events Classification". *IEEE Access*. 2023 Oct 26;11:122399-410. `https://doi.org/10.1109/ACCESS.2023.3327913`.

J1 Caruso CM, Guarrasi V, Cordelli E, Sicilia R, Gentile S, Messina L, Fiore M, Piccolo C, Beomonte Zobel B, Iannello G, Ramella S. "A multimodal ensemble driven by multi-objective optimisation to predict overall survival in non-small-cell lung cancer". *Journal of Imaging*. 2022 Nov 2;8(11):298. `https://doi.org/10.3390/jimaging8110298`.

Conferences	**C3** Caruso CM, Bruni R, Guarrasi V. "Mask-Aware Transformers Enable Robust Learning from Incomplete Volumetric Medical Imaging". In: Rodolà E, Galasso F, Masi I. (eds) Image Analysis and Processing - ICIAP 2025 Workshops. ICIAP 2025. Lecture Notes in Computer Science, vol 16169. Springer, Cham.
	C2 Aksu F, Bria A, Caragliano AN, Caruso CM, Chen W, Cordelli E, Coser O, Francesconi A, Furia L, Guarrasi V, Iannello G. "Towards AI-driven Next Generation Personalized Healthcare and Well-being". In *Ital-IA 2024*, *4th National Conference on Artificial Intelligence*, organized by CINI, Naples, Italy, May 29-30, 2024 (pp. 360-365). CEUR-WS.
	C1 Guarrasi V, Tronchin L, Caruso CM, Rofena A, Manni G, Aksu F, Paolo D, Iannello G, Sicilia R, Cordelli E, Soda P. "Building an AI-enabled metaverse for intelligent healthcare: opportunities and challenges". In *Ital-IA 2023*, *Italia Intelligenza Artificiale Thematic Workshops*, co-located with the 3rd CINI National Lab AIIS Conference on Artificial Intelligence (Ital IA 2023), Pisa, Italy, May 29-30, 2023 (pp. 134–139). CEUR-WS.
Submitted Works	**S2** Molino D, Caruso CM, Ruffini F, Soda P, Guarrasi V. "Text-to-CT Generation via 3D Latent Diffusion Model with Contrastive Vision-Language Pretraining." Submitted in July 2025. Available at `https://doi.org/10.48550/arXiv.2506.00633`.
	S1 Caruso CM, Soda P, Guarrasi V. "Not Another Imputation Method: A Transformer-based Model for Missing Values in Tabular Datasets". Submitted in April 2025. Available at `https://doi.org/10.48550/arXiv.2407.11540`.

Languages

Italian	Native
English	o Understanding (Listening/Reading) C1
	o Speaking B2
	o Writing B2

Computer skills

Python	Intermediate knowledge
MATLAB	Intermediate knowledge
C++	Basic knowledge
Word processor	o LaTeX: Intermediate knowledge
	o Microsoft Word: Intermediate knowledge
Presentations	o Beamer: Intermediate knowledge
	o Microsoft PowerPoint: Intermediate knowledge

Certifications & Training

2011	**First Certificate in English (FCE)**, *University of Cambridge ESOL Examinations*.

Activities and Interests

Boy Scouts	Team leader, Procurement management for scout camps