Matteo Cacioppo

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ML researcher

WORK EXPERIENCE

ENEA   **09/2025 - Present**
Research Fellowship   **Frascati, Italy**
Developing an agentic Retrieval-Augmented Generation (RAG) system that combines knowledge-graph retrieval, vector search, and function-routing orchestration to answer complex queries over scientific documents.

EDUCATION

Master of Science in Physics
La Sapienza University • GPA: 110/110 cum laude   Rome, Italy • 10/2022 - 01/2025

- Thesis: LSTM Neural Network for Real-Time Motion Artefact Correction in MRS Scans
- Advisor: Prof. S. Giagu

Bachelor of Science in Physics
La Sapienza University   Rome, Italy • 10/2015 - 11/2022

- Thesis: Spettroscopia Raman nel dominio delle frequenze ed in trasformata di Fourier
- Advisor: Prof. T. Scopigno

Scientific High School Diploma
Liceo Scientifico   Italy • 09/2010 - 06/2015

PROJECTS

Agentic RAG   09/2025
ENEA

- Developed an agentic Retrieval-Augmented Generation (RAG) system for answering complex queries over scientific documents.
- Designed a hybrid retrieval pipeline combining knowledge-graph navigation, vector similarity search, and cross-reference linking.
- Implemented structured PDF parsing and semantic chunking to extract and index text, tables, and equations.
- Built a function-routing orchestrator capable of dynamically selecting retrieval, reranking, and specialized processing tools.
- Enabled context-aware multi-step reasoning, improving accuracy and robustness on noisy or highly structured technical content.
- Integrated reranking and tool orchestration strategies to enhance result interpretability and response quality.

Research on machine learning for Artefact Correction in MRS   01/2024

- Implemented an LSTM-based neural network to predict patient movement based on navigator data.
- Utilized affine transformation parameters to correct spatial misalignment in MRS signals.
- Designed a deep learning pipeline for real-time motion prediction to improve scan quality.
- Evaluated the model on patient data to assess its effectiveness in noise reduction and artefact correction.

- Contributed to the RECENTRE project, aiming to enhance the robustness of high-resolution MRS imaging.

LIS Gesture Classification using LSTM and Feature Fusion 01/2025

- Developed an LSTM-based neural network to classify 126 Italian Sign Language gestures.
- Extracted features from RGB and radar modalities using pre-trained and custom CNNs.
- Implemented late fusion to combine multimodal features before temporal modeling.
- Handled variable-length videos through padding and packed sequences for efficient training.
- Explored different fusion strategies and evaluated the model on the official test set using accuracy and best epoch metrics.

Graph Coloring with Graph Neural Networks 01/2023

- Implemented a Graph Neural Network (GNN) using the Deep Graph Library (DGL) to solve Graph Coloring Problems (GCPs).
- Designed a model where each node is assigned a probability distribution over colors via a one-hot encoding and softmax normalization.
- Employed mean aggregation and ReLU activation in the message-passing layers to update node features.
- Defined a physics-inspired loss function based on the Hamiltonian of the Potts model to encourage distinct color assignments among adjacent nodes.
- Added an auxiliary metric to count incorrect color assignments for evaluation during inference.
- Applied dropout regularization and trained the model using PyTorch's backpropagation; final color predictions are obtained with argmax over output vectors.

PUBLICATIONS

Real-Time Motion Correction in Magnetic Resonance Spectroscopy: a complete overview of the reconstruction process. 10/2025

Poster presented at *The XIV Workshop of the International School on Magnetic Resonance and Brain Function (ISMRBF)*, Erice, Italy.

Real-Time Motion Correction in Magnetic Resonance Spectroscopy: AI solution inspired by fundamental science 06/2025

arXiv:2509.24676 (2025);
Poster presented at EuCAIFCon, Cagliari, Italy.

SKILLS

Programming: C, C++, LATEX – basic, Python, PyTorch - ADVANCED

Communication: English (high level), Italian (native)

Other: Docker, Git, GitHub, Linux, React