# Federico **Cocchi**

NATIONAL PHD STUDENT IN ARTIFICIAL INTELLIGENCE @ AIMAGELAB (UNIMORE)

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## Summary

I am a second year PhD student based at AImageLab (UNIMORE) exploring multimodal aspects of GenAI. My research focuses on the intersection of vision and language, with particular emphasis on Multimodal Large Language Models and the integration of Multimodal Retrieval Augmented Generation techniques, taking into account reasoning and understanding capabilities. Moreover, I regularly utilize an HPC cluster for multi-node training to perform my research experiments.

I actively leverage AI in my daily activities to introduce breakthroughs and resolve in an innovative and disruptive way new and old problems.

## Education

### National PhD in Artificial Intelligence

*Modena, Italy*

UNIVERSITY OF PISA - (UNIPI)

*March 2023 - Present*

- Scholarship title: *Exploring Multimodal Challenges in Generative AI*.
- Supervisor: *Prof. Rita Cucchiara* and *Dr. Marcella Cornia*.
- Research topics: Generative AI - Multimodal Large Language Models - Deepfake detection.
- Scholarship in collaboration with UNIMORE and based in Modena at the AImageLab.

### M.Sc. in Computer Science - curriculum in Artificial Intelligence

*Modena, Italy*

UNIVERSITY OF MODENA AND REGGIO EMILIA - (UNIMORE)

*Oct. 2020 - Feb. 2023*

- Thesis title: Perceptual and Semantic Detection of Deep Fakes.
- Supervisor: *Prof. Rita Cucchiara* and *Dr. Lorenzo Baraldi*.
- Grade: 110 cum laude / 110.

### B.Sc. in Automation Engineering

*Bologna, Italy*

UNIVERSITY OF BOLOGNA - (UNIBO)

*Sept. 2016 - Oct. 2020*

- Thesis title: Anomaly prediction with temporal convolutional networks and data augmentation in high performance computing systems.
- Supervisor: *Prof. Michela Milano*.

### High School Degree in Scientific of Applied Sciences

*Imola (BO), Italy*

F.LLI ALBERGHETTI

*End: 2015 - 16*

## Experience

### Research Internship

*Modena, Italy*

UNIVERSITY OF MODENA AND REGGIO EMILIA (UNIMORE) @ AIMAGELAB

*Sept. 2022 - Feb. 2023*

- During my internship, I developed a synthetic COCO dataset using a text-to-image model and implemented a machine learning architecture to detect deepfakes based on correlations and semantic meaning.
- Supervisor: *Prof. Rita Cucchiara*, *Dr. Lorenzo Baraldi* and *Dr. Marcella Cornia*.

### Research Internship

*Bologna, Italy*

UNIVERSITY OF BOLOGNA (UNIBO) @ EEES LAB

*Feb. 2020 - Oct. 2020*

- Developing state of the art algorithms and metrics for the analysis of data from CINECA's HPC system, with a focus on predicting anomalies.
- Supervisor: *Prof. Luca Benini*.

## Participation to National and European Projects

### FAIR PNRR Project

*Italy*

FUTURE ARTIFICIAL INTELLIGENCE RESEARCH

*Jan. 2024 - Present*

- FAIR is a national scale, multidisciplinary project designed to rethink and develop new multimodal large-scale foundational models.
- Incorporating retrieved external knowledge into multimodal models to address complex questions.
- *Project output*: LLaVA-MORE is the first open model in the LLaVA family, enhancing Visual Instruction Tuning with LLaMA 3.1.

**ELSA European Project**                                              *Europe*

EUROPEAN LIGHTHOUSE ON SECURE AND SAFE AI                    *Feb. 2023 - Present*

- ELSA is a virtual center of excellence that will spearhead efforts in foundational safe and secure artificial intelligence (AI) and is funded by the European Union with the Horizon Program.
- I am currently involved in the multimedia use case, focusing on Deepfake detection employing techniques to tackling disinformation.
- *Project output*: publicly release dataset and evaluation benchmarks to challenge the research community.

**ITSERR PNRR Project**                                                *Italy*

ITALIAN STRENGTHENING OF THE ESFRI RI RESILIENCE              *Mar. 2023 - Present*

- I am involved in the project as a PhD student, where I work on creation of Large Language Models for ancient languages.
- *Project output*: LatinGPT is the first Large Language Model trained from scratch using latin data.

# Honors & Awards

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|---|---|---|
| 2023 | **Winner,** ELLIS Summer School Project on Large-Scale AI for Research and Industry | *Modena, Italy* |
| 2024 | **Oral presentation,** Summer School on Signal Processing (S3P) | *Capri, Italy* |

# Publications

**Augmenting Multimodal LLMs with Self-Reflective Tokens for Knowledge-based VQA**     *Conference*

IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (**CVPR**)           *2025*

- Authors: **F. Cocchi**\*, N. Moratelli\*, M. Cornia, L. Baraldi, R. Cucchiara

**The (R)Evolution of Multimodal Large Language Models: A Survey**     *Conference*

FINDINGS ON ANNUAL MEETING OF THE ASSOCIATION FOR COMPUTATIONAL LINGUISTICS (**ACL**)     *2024*

- Authors: D. Caffagni\*, **F. Cocchi**\*, L. Barsellotti\*, N. Moratelli\*, S. Sarto\*, L. Baraldi\*, L. Baraldi, M. Cornia, R. Cucchiara

**Wiki-LLaVA: Hierarchical Multimodal Retrieval Augmented Generation**     *Conference*

IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION WORKSHOPS (**CVPR W**)     *2024*

- Authors: D. Caffagni\*, **F. Cocchi**\*, N. Moratelli\*, S. Sarto\*, L. Baraldi, M. Cornia, R. Cucchiara

**Safe-CLIP: Removing NSFW Concepts from Vision-and-Language Models**     *Conference*

EUROPEAN CONFERENCE ON COMPUTER VISION (**ECCV**)     *2024*

- Authors: S. Poppi\*, T. Poppi\*, **F. Cocchi**\*, M. Cornia, L. Baraldi, R. Cucchiara

**Contrasting Deepfakes Diffusion via Contrastive Learning and Global-Local Similarities**     *Conference*

EUROPEAN CONFERENCE ON COMPUTER VISION (**ECCV**)     *2024*

- Authors: L. Baraldi\*, **F. Cocchi**\*, M. Cornia, L. Baraldi, A. Nicolosi, R. Cucchiara

**Adapt to Scarcity: Few-Shot Deepfake Detection via Low-Rank Adaptation**     *Conference*

27TH INTERNATIONAL CONFERENCE ON PATTERN RECOGNITION (**ICPR**)     *2024*

- Authors: S. Cappelletti\*, L. Baraldi\*, **F. Cocchi**\*, M. Cornia, L. Baraldi, R. Cucchiara

**Unveiling the Impact of Image Transformations on Deepfake Detection: An Experimental Analysis**     *Conference*

22ND INTERNATIONAL CONFERENCE ON IMAGE ANALYSIS AND PROCESSING (**ICIAP**) - **ORAL**     *2023*

- Authors: **F. Cocchi**\*, L. Baraldi\*, S. Poppi, M. Cornia, L. Baraldi, R. Cucchiara

# Reviewer

I had the privilege of serving as a reviewer for several prestigious conferences. Below is a partial list.

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|---|---|---|
| Conf. | **Reviewer,** CVPR 2025; ECCV 2024; ACM 2024; ACM 2023; ICIAP 2023 | - |
| Conf. | **Workshop Reviewer,** ECCV W 2024; CVPR W 2024; ICCV W 2023; ICIAP W 2023 | - |
| Journ. | **Reviewer,** CVIU 2024 | - |

# Mentorship Activities

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| 2024 | **M.Sc. Thesis Correlator,** Silvia Cappelletti; Luisa Bottiglieri. | - |
| 2024 | **Project Tutor,** Computer Vision and Cognitive Systems exam. | - |