CarloAlberto**Barbano**

Summary

I am a postdoctoral researcher at the Computer Science Department of the University of Turin and a member of the ELLIS Society. My research is centered on deep learning, medical imaging, biases, and fairness, with a special focus on contrastive learning and neuroimaging. I received a double Ph.D. from the University of Turin, Italy, and Télécom Paris, IP Paris, France in December 2023. Since 2024, I am also a member of the Radiomics Lab of ASL TO3 hospital in Italy.

Positions

Visiting Researcher

INRIA Paris-Saclay
Jan. 2025 - Now

Visiting research period focused on regression of cognitive states from fMRIs using contrastive learning, at the INRIA MIND team with Prof. Demian Wassermann.

Postdoctoral Researcher, AI for Medical Imaging

University of Turin, Italy
Nov. 2023 - Now

My research focuses on learning generalizable and robust representations (e.g. foundation models, multi-modal learning, debiasing) for medical images. The investigation of brain health and mental disorders is one of the topics of interest.

Education

Ph.D. in Computer Science

Institut Polytechnique de Paris, France
Oct. 2020 - Dec. 2023

Collateral-Free Learning of Deep Representations: From Natural Images to Biomedical Applications. Double Ph.D. with the University of Turin and Télécom Paris. Supervisors: Margo Grangetto, Pietro Gori, Isabelle Bloch. Awarded with honors.

M.S. in Artificial Intelligence

University of Turin, Italy
2018 - 2020

Thesis: COVID-19 Diagnosis From Chest X-Rays Using Artificial Intelligence. Final grade: 110/110 with honors.

B.S. in Computer Science

University of Turin, Italy
2015 - 2018

Thesis: Deep Learning for Colorectal Polyps Diagnosis. Final grade 110/110.

Selected Publications

2023	**Unbiased supervised contrastive learning.**, C. A. Barbano, B. Dufumier, E. Tartaglione, M. Grangetto, and P. Gori. ICLR, 2023.	ICLR
2023	**Integrating Prior Knowledge in Contrastive Learning with Kernel**, B. Dufumier, C. A. Barbano, R. Louiset, E. Duchesnay, and P. Gori. ICML, 2023	ICML
2023	**Contrastive learning for regression in multi-site brain age prediction (Best poster award)**, C. A. Barbano, B. Dufumier, E. Duchesnay, M. Grangetto, and P. Gori. ISBI, 2023.	ISBI
2021	**End: Entangling and disentangling deep representations for bias correction.**, E. Tartaglione, C. A. Barbano, and M. Grangetto. CVPR, 2021.	CVPR
2021	**Unitopatho, a labeled histopathological dataset for colorectal polyps classification and adenoma dysplasia grading.**, C. A. Barbano, Daniele Perlo, E. Tartaglione, A. Fiandrotti, L. Bertero, P. Cassoni, and M. Grangetto. ICIP, 2021.	ICIP

Projects and Grants

Projects

2022 - 2023	**WP leader of datasets and neural models**, Co.R.S.A. - Covid Radiographic imaging System based on AI (18 months). PI: Marco Grangetto. Funded by Regione Piemonte. Budget: 550k € **Contributor**, DeepHealth, Deep-Learning and HPC to Boost Biomedical Applications for Health (18 months). Leader: NTT DATA SPAIN. Funded by EU, call H2020-ICT-2018-2. Budget: 14M €	Italy
2019 - 2021		EU

HPC Grants

2024	**CINECA ISCRA C Grant**, HP10CD6GAE (10,000 GPU hours, LEONARDO Supercomputer). MFM-BIA - Multimodal and Foundation Models for Biomedical Image Analysis (9 months). Role: PI.	Italy
2023	**CINECA ISCRA B Grant**, IsB28_HyGenAI (1,866,216 hours, LEONARDO Supercomputer). Hybrid Generative AI for Histopathology (12 months). Role: Co-PI.	Italy
2023	**GENCI-IDRIS Grant**, 2023-AD011013473R1 (30,000 GPU-hours, Jean Zay V100 Supercomputer). Approved renewal of previous grant AD011013473, focused on brain age modeling (12 months). Role: PI.	France
2022	**GENCI-IDRIS Grant**, 2022-AD011013473 (50,000 GPU-hours, Jean Zay V100 Supercomputer). Advanced deep learning methods for biomedical image and data analysis and debiasing (12 months). Role: PI.	France

Teaching

2025	**Collateral Learning in Neural Networks**, 4 hours, Lecturer, IANUA Advanced School	University of Genoa
2025	**Biological and diagnostic imaging and image analysis**, 4 hours, MSc in Artificial Intelligence for Biomedicine and Healthcare, Lecturer	University of Turin
2025	**Data preparation and AI for imaging**, 4 hours, II Level Master Course (AI applied to medicine, post-MSc), Lecturer	University of Turin
2025	**Software Development**, 62 hours / 9 ECTS, BSc in Computer Science, Adjunct Professor	University of Turin
2024	**Artificial Intelligence & Operative Research**, 8 hours, Lecturer (Secondary School)	IIS Copernico-Luxemburg
2023	**Programming II**, 24 hours / 3 ECTS, BSc in Computer Science, Adjunct Professor	University of Eastern Piedmont
2023	**Artificial Intelligence & Operative Research**, 8 hours, Lecturer (Secondary School)	IIS Copernico-Luxemburg
2022	**DeepHealth Winter School**, Lecturer	Virtual

Awards

2023	**Top Reviewer**, NeurIPS
2023	**Best Poster Award**, International Symposium on Biomedical Imaging (ISBI)
2021	**Best Poster Award**, Eastern European Machine Learning Summer School (EEML)
2018	**Weekly Kernel Award**, Kaggle

Seminars & Talks

April, 2025	**Towards foundation models of the brain with contrastive learning**, Invited Speaker, Machine Learning Genoa Center (MaLGa)	Genoa, Italy
Feb, 2025	**Current challenges and perspectives in Deep Learning**, Invited Speaker, Google Developer Group Torino (GDG)	Turin, Italy
Feb 2025	**Contrastive Learning and applications in neuroimaging: towards foundation models of the brain**, Invited Speaker, MIND, Inria-Saclay	Saclay, France
Feb 2025	**Contrastive Learning and applications in neuroimaging: towards foundation models of the brain**, Invited Speaker, Cognitive Neuroanatomy lab, Universitè Paris Citè	Paris, France
June 2024	**Possible Applications of Machine Learning Techniques to CNAO-based Applications**, Invited Speaker, Research Department, National Center of Adrotherapy Oncology (CNAO)	Pavia, Italy
May 2024	**Introduction to Machine Learning & Deep Learning for signal and data analysis**, Invited Speaker, Research Department, National Center of Adrotherapy Oncology (CNAO)	Pavia, Italy
May 2024	**Contrastive Learning and Applications in Neuroimaging**, Lecturer, Image Processing and Computer Vision course, Computer Science Department, University of Turin	Turin, Italy

Apr. 2024	**Current challenges and perspectives in Deep Learning**, Invited Speaker, Research Department, National Center of Adrotherapy Oncology (CNAO)	Pavia, Italy
Apr. 2024	**AI e imaging: verso nuove frontiere per le analisi di dati**, Invited Speaker, MorFuture, 1° congresso del Comitato giovani degli Amici della Morfologia, Neuroscience Department, University of Turin	Turin, Italy
Mar. 2024	**Trustworthy Deep Learning in critical applications: a biomedical imaging experience**, Invited Speaker, ASL TO3 Radiomics Lab Kick Off Meeting, ASL TO3 Radiomics Lab	Rivoli, Italy
Mar. 2023	**Artificial Intelligence vs Covid-19**, Invited Speaker, Co.R.S.A project presentation, ASL TO3	Pinerolo, Italy
Jan. 2022	**From H&E to pixels: digital pathology applications for colon cancer diagnosis**, Lecturer, DeepHealth Winter School 2022	Virtual
Oct. 2021	**Bridging the gap between debiasing and privacy for deep learning**, Oral Presentation, First International Workshop on Responsible Pattern Recognition and Machine Intelligence (R-PR&MI)	Virtual

Committees

2025	**Local Arrangements Co-chair**, Italian Conference on Big Data and Data Science (ITADATA) 2025 https://www.itadata.it/	Turin
2024	**Organizing Committee**, COMETE Ph.D. Workshop (Computer Science dept.) https://comete.di.unito.it/	Turin
2023		Turin
2022	**Organizing Committee**, First Workshop on ML, Law and Society (ECML PKDD 2023) https://sites.google.com/view/ws- ethics- ecml23/organization	Turin

Reviewing Service

Organizing Committee, COMETE Ph.D. Workshop (Computer Science dept.)
https://comete.di.unito.it/comete- phd- workshop- 2022/

- TopConferences: CVPR,ICCV,NeurIPS(TopReviewer2023),ICML,ICLR
- TopJournals: IEEETransactionsonPatternAnalysisandMachineIntelligence(TPAMI),IEEETransactionsonNeuralNetworksandLearning Systems (TNNLS), IEEE Transactions on Image Processing (TIP), PLOS ONE, IET Computer Vision.

Thesis supervision

2024	**Anatomical Foundation Models with Contrastive Learning for Neuroimaging**, Master's Thesis, Matteo Brunello	University of Turin
2024	**Generative augmentation for colorectal polyps diagnosis with contrastive learning**, Master's Thesis, Roberto Craparotta	University of Turin
2024	**Detecting coronary artery calcium from chest X-ray using knowledge distillation**, Master's Thesis, Matteo Di Leo	University of Turin
2023	**Deep Learning on Histopathological Images for Colorectal Cancer grading**, Master's Thesis, Alessandro Caputo	University of Turin
2022	**Effect of windowing on Chest X-ray images**, M2 Stage, Zhang Xingjian	Télécom Paris
2022	**Predizione del calcio coronarico da radiografie basata sul Deep Learning**, Master's Thesis, Francesco Iodice	University of Turin
2022	**Detection of Ovarian Cancer from Ultrasound Detection of Ovarian Cancer from Ultrasound Ready-to-Use Medical Dataset (Best Thesis Award)**, Master's Thesis, Pio Raffaele Fina	University of Turin
2022	**Generative Adversarial Networks for Histopathological Image Synthesis and Augmentation**, Master's Thesis, Desislav Nikolaev Ivanov	University of Turin
2021	**Semantic segmentation of histopathological tissue with Deep Learning**, Master's Thesis, Davide Di Luccio	University of Turin
2021	**Generation of histopathological tissue with Generative Adversarial Network**, Master's Thesis, Davide Rubinetti	University of Turin
2021	**Rilevamento di COVID-19 da radiografia toracica attraverso Deep Learning**, Master's Thesis, Giuseppe Stallone	University of Turin

Extra

Software

2022 **swarm-cpupin**, automatic CPU pinning for docker swarm based GPU HPC cluster https://github.com/carloalbertobarbano/swarm- cpupin

2021 **simplify**, pytorch-compatible software library for simplifying pruned model, to accelerate inference and training times https://github.com/EIDOSLAB/simplify

2020 **torchstain**, popular stain normalization library for histological analysis and computational pathology compatible with PyTorch, TensorFlow and NumPy https://github.com/EIDOSLAB/torchstain

2020 **TranscriberBot**, popular Telegram bot for speech to text, with more than 500k active users https://github.com/charslab/TranscriberBot/

Since 2021 I manage and maintain a local research cluster for my lab, composed of 4 nodes × 8 NVIDIA A40 GPUs. The cluster stack is built on top of

HPC Skills

Docker Swarm, customized for deep learning loads, and comprises a 15TB high-performance network filesystem built with GlusterFS to share data between the nodes. I also mantain a Docker registry for my lab, providing reproducible environments for scientific computation. Additionally, I developed a custom centralized repository to provide seamless access to all of our machines to the members of my lab (e.g. keys synchronization).

I also have experience, as a user, in working on large HPC clusters, such as Jean-Zay (France) and Leonardo (Italy, 2nd European largest cluster).

Relevant Skills

I have strong experience in deep learning research, with modern tools and frameworks such as Pytorch. My main expertise areas comprise computer vision, deep learning for biomedical image analysis (with a focus on neuroimaging), representation learning (self-supervised, weakly- supervised, contrastive learning), and debiasing. I am also proficient with HPC tools and clusters, with hands-on experience with the main Euro- pean HPC clusters (i.e. Jean-Zay, Leonardo). I have published in top-tier conferences such as CVPR, ICLR, and ICML.

All Publications

Preprints

- Knowledge Transfer Across Modalities with Natural Language Supervision. C. A. Barbano, L. Molinaro, E. Aiello, M. Grangetto. Submitted to CVPR 2024. arXiv preprint arXiv:2411.15611.
- AnatomicalFoundationModelsforBrainMRIs.C.A.Barbano,M.Brunello,B.Dufumier,M.Grangetto.SubmittedtoCVPR2024.arXivpreprint arXiv:2408.07079.
- SayMyName:aModel'sBiasDiscoveryFramework.,M.Ciranni,L.Molinaro,C.A.Barbano,A.Fiandrotti,V.Murino,V.P.Pastore,E.Tartaglione. (2024). arXiv preprint arXiv:2408.09570.
- UnsupervisedContrastiveAnalysisforSalientPatternDetectionusingConditionalDiffusionModels. C.Patrício,C.A.Barbano,A.Fian- drotti, R. Renzulli, M. Grangetto. L. F. Teixeira, J. C. Neves. arXiv preprint arXiv:2406.00772.

Published Papers

- Detectionofsubclinicalatherosclerosisbyimage-baseddeeplearningonchestx-ray:aretrospectivemodeldevelopmentandvalida- tion study. G. Gallone, A. Presta, F. Iodice, D. Tore, O. D. Filippo, M. Visciano, C. A. Barbano, A. Serafini, W. G. Marra, J. Hughes, M. Iannacone, P. Fonio, A. Fiandrotti, A. Depaoli, M. Grangetto, G. M. D. Ferrari, F. D'Ascenzo. European Heart Journal - Digital Health, 2025.
- Unsupervised learning of unbiased visual representations. C. A. Barbano, E. Tartaglione, and M. Grangetto. IEEE Transactions on Artificial Intelligence(TAI),2024.https://doi.org/10.1109/TAI.2024.3514554
- Detection and Prioritization of COVID-19 Infected Patients from CXR Images: Analysis of AI-assisted diagnosis in clinical settings. C. A. Barbano, L. Berton, R. Renzulli, D. Tricarico, O. Rampado, D. Basile, M. Busso, M. Grosso, M. Grangetto. Computational and Structural Biotechnology Journal (CSBJ), 2024. https://doi.org/10.1016/j.csbj.2024.11.045
- Multi-targetstainnormalizationforhistologyslides.D.Ivanov,C.A.Barbano,M.Grangetto.MedicalOpticalImagingandVirtualMicroscopy Image Analysis: Second International Workshop (MOVI 2024), MICCAI, 2024. https://doi.org/10.1007/978-3-031-77786-8_4
- AI-Assisted Diagnosis for Covid-19 CXR Screening: From Data Collection to Clinical Validation. C. A. Barbano, R. Renzulli, M. Grosso, D. Basile, M. Busso, M. Grangetto. International Symposium on Biomedical Imaging (ISBI), 2024. https://doi.org/10.1109/ISBI56570.2024.10635324.
- Unbiased supervised contrastive learning. C. A. Barbano, B. Dufumier, E. Tartaglione, M. Grangetto, and P. Gori. International Conference on Learning Representations (ICLR), 2023. https://openreview.net/forum?id=Ph5cJSfD2XN
- IntegratingPriorKnowledgeinContrastiveLearningwithKernel B.Dufumier,C.A.Barbano,R.Louiset,E.Duchesnay,andP.Gori. International Conference on Machine Learning (ICML), 2023. https://arxiv.org/abs/2206.01646
- Contrastive learning for regression in multi-site brain age prediction C. A. Barbano, B. Dufumier, E. Duchesnay, M. Grangetto, and P. Gori. International Symposium on Biomedical Imaging (ISBI), 2023. https://doi.org/10.1109/ISBI53787.2023.10230733 (Best poster)
- Simplify:Apythonlibraryforoptimizingprunedneuralnetworks.A.BragagnoloandC.A.Barbano.SoftwareX,2022.https://doi.org/10.1016/J.SOFTX.2021.100907
- A two-step radiologist-like approach for Covid-19 computer-aided diagnosis from chest X-ray images. C. A. Barbano, E. Tartaglione, C. Berzovini, M. Calandri, and M. Grangetto. International Conference on Image Analysis and Processing (ICIAP), 2022. https://doi.org/10.1007/978- 3- 031- 06427- 2_15

- End: Entangling and disentangling deep representations for bias correction. E. Tartaglione, C. A. Barbano, and M. Grangetto. Conference on Computer Vision and Pattern Recognition (CVPR), 2021. https://doi.org/10.1109/CVPR46437.2021.01330
- Bridgingthegapbetweendebiasingandprivacyfordeeplearning.C.A.Barbano,E.Tartaglione,andM.Grangetto.InternationalConference on Computer Vision Workshops (ICCVW), 2021. https://doi.org/10.1109/ICCVW54120.2021.00424
- Unitopatho, a labeled histopathological dataset for colorectal polyps classification and adenoma dysplasia grading. C. A. Barbano, Daniele Perlo, E. Tartaglione, A. Fiandrotti, L. Bertero, P. Cassoni, and M. Grangetto. International Conference on Image Processing (ICIP), 2021. https://doi.org/10.1109/ICIP42928.2021.9506198
- Unveilingcovid-19fromchestx-raywithdeeplearning:Ahurdlesracewithsmalldata.E:Tartaglione,C.A.Barbano,C.Berzovini,M.Calandri, and M. Grangetto. International Journal of Environmental Research and Public Health, 2020. https://doi.org/10.3390/IJERPH17186933