



Barbara Toniella Corradini

Personal Information

First Name(s)	Barbara Toniella
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Relevant Skills

- **PhD in Smart Computing (Doctor Europaeus):** Earned through a joint program between the University of Florence and the University of Siena, with a thesis on deep generative models. The research focused on computer vision, generative architectures, and vision-language models, explored in both zero-shot and supervised learning settings.
- **Generative Models:** Worked with GANs, diffusion models, and encoder-decoder architectures for tasks such as image segmentation and open-vocabulary generation. Published work analyzing their training dynamics and semantic structure.
- **Deep Learning Models:** Hands-on experience with GNNs and Transformers applied to scientific tasks such as natural products molecular representation.
- **Programming and Frameworks:** Proficiency in Python (PyTorch, OpenCV and TDA libraries). Familiar with TensorFlow, Keras, and HuggingFace.
- **Publications and Reporting:** Author of peer-reviewed papers in journals and conferences (e.g., Neurocomputing, IJCNN, ESANN). Experienced in presenting and documenting research data.
- **Teamwork and Interdisciplinarity:** Worked with engineers, biologists, and clinicians on cross-domain projects. Comfortable integrating into collaborative, multidisciplinary research teams.
- **Soft Skills:** Highly motivated and able to manage priorities independently. Fluent in English (spoken and written, B2), with experience teaching and collaborating in international environments.

Academic Service and Conference Activities

Sep 2025 **Member, Local Organizing Committee, 21st Conference of the Complex Systems Society (CCS 2025), Italy**

- Contribution to the organization of the XIX International Workshop on Artificial Life and Evolutionary Computation (WIVACE 2025).
- Conference website: <https://sites.google.com/unisi.it/wivace2025/home>

Jul 2025 **Session Chair, International Joint Conference on Neural Networks (IJCNN) 2025, Rome, Italy**
Session Chair for the track on “Neural Networks for Image and Video Processing”.

2021 – Present **Peer-Reviewer, International Conferences and Journals**

- International Joint Conference on Neural Networks (IJCNN)
- European Symposium on Artificial Neural Networks (ESANN)
- European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECMLPKDD)
- International Conference on Artificial Neural Networks (ICANN)
- Neurocomputing (Elsevier Journal)
- Soft Computing (Springer Journal)

Education

1 Nov 2021 – **PhD in Smart Computing (Doctor Europaeus)**, *University of Florence & University of Siena*, 31 Oct 2024 Siena, Italy

- Joint PhD Program, co-financed by the Universities of Florence, Pisa, and Siena, and by Regione Toscana under the European Social Fund. Two National Research Council institutes (ISTI and IIT) are supporting partners (<https://smartcomputing.unifi.it/>).
- Focus on Deep Learning Generative Models for Computer Vision.
- Thesis title: “*Generative models from the Inside: a Journey through Properties and Applications*”.
- Awarded with distinction on 04 April 2025.

Feb 2023 – **Semester of Study at Institut Systèmes Intelligents et de Robotique (ISIR) Lab, Sorbonne Université**, Paris 5ème, France

- Focus on generative Vision-Language Models (Diffusion- and ViT-based multimodal models) in zero-shot setup for image segmentation downstream task.

2018 – 2021 **Master's Degree in Computer and Automation Engineering**, *University of Siena*, Siena, Italy

- Thesis title: “*Trucks as Sensors: Classification and Mapping of Abandoned Waste by Deep Learning*”.
- Grade: 110 cum laude.
- Awarded on 09 April 2021

2013 – 2018 **Bachelor's Degree in Computer and Information Engineering**, *University of Siena*, Siena, Italy

- Thesis title: “*Metodi statistici di feature selection per il rilevamento di armi ceramiche ed esplosivi nascosti*”.
- Grade: 98/110
- Awarded on 26 April 2018

Projects and Research Experience

Dec 2025 – **Postdoctoral Researcher, Istituto Italiano di Tecnologia (IIT)**, Genoa, Italy

Now

- Part of the AI for Good (AIGO) Research Unit.

Feb 2025 – **Research Fellow, University of Siena**, Siena, Italy

Nov 2025

- Project Title: “*Segmentation and analysis of DICOM images for the automatic reconstruction of 3D models of human organs and their visualization in Virtual Reality applications*”.
- Funded by SAIHUB Foundation of Monte dei Paschi di Siena Foundation (<https://fondazionesaihub.fondazionemps.it/>).

Dec 2024 **Consulting on Deep Learning-based applications for 3D Object Recognition**, *Nuovo Pignone Baker Hughes*, Siena, Italy

- Exploration of state-of-the-art methods for 3D object detection in the context of autonomous navigation in hazardous environments.

Oct 2023 – **Software Development**, *Zucchetti S.p.A.*, Lastra a Signa (FI), Italy

Nov 2023

- Engineering and development of a software for robot autonomous navigation.

Dec 2022 **Software Development**, *AOUS*, Siena, Italy

- Engineering and development of a web application to monitor lung transplant patient care.
- Published in the gold open-access journal JHLT Open [8].

Oct 2019 – **Web App Development**, *GSK*, Siena, Italy

Nov 2019

- Engineering and development of a paperless parental leave management application.

May 2018 – **Internship (Bachelor's Degree)**, SAIMA Sicurezza S.p.A., Arezzo, Italy

- Engineering and development of a portable device to detect explosives and dangerous objects hidden under clothing.

Teaching Activities

28 Oct 2022 – **Lectures on Data Representation and SQL Language**, DIGI-SKILLS, Siena, Italy

- 3 Nov 2022
 - Role: Course Instructor.
 - Language: Italian.
 - Teaching sessions with a final exam, totaling 11 hours, as a part of a training and job placement project promoted by the Tuscany Region — *DIGI-SKILLS – Competenze strategiche per l'innovazione digitale cod. 298630*.

Feb 2023 **Lecture on Data Analysis and Computer Networks**, Siena, Italy

- Role: Guest Lecturer.
- Language: Italian.
- A 6-hour lecture as part of the Lean Healthcare Management master's program (8th edition).

Mar 2024 **Lecture on Artificial Intelligence for Museum Management**, ITS Vita, Grosseto, Italy

- Role: Guest Lecturer.
- Language: Italian.
- 6-hour training for museum directors on topics related to Artificial Intelligence.

May 2024 – **Lectures on Fundamentals of Artificial Intelligence**, ITS Vita, Siena/Grosseto/Volterra,

June 2024 Italy

- Role: Guest Lecturer.
- Language: Italian.
- Teaching sessions totaling 15 hours, as part of a training and job placement project promoted by the Tuscany Region — *Sviluppo del sistema di formazione professionale terziaria (ITS) "Potenziamento dell'offerta formativa degli Istituti Tecnologici Superiori "ITS Academy" Attività B.2 – Orientamento formativo - Percorsi di gruppo – Codice CUP: I64D23001850006*.

Jan 2025 – **Course on Programming Fundamentals**, FISM Education, Firenze, Italy

- June 2025
 - Role: Module Instructor.
 - Language: Italian.
 - 50-hour course as part of a training and job placement project promoted by the Tuscany Region.

Jan 2025 – **Course on Database and Data Analysis**, CET Siena Study Abroad, Siena, Italy

- May 2025
 - Role: Course Instructor.
 - Language: English.
 - 96-hour course aimed at undergraduate students from American universities.
 - School website: <https://cetacademicprograms.com>.

July 2025 **Course on Artificial Intelligence**, ITS Prodigì, Arezzo, Italy

- Role: Module Instructor.
- Language: Italian.
- Teaching sessions (32 hours) as a part of a training and job placement project promoted by the Tuscany Region — *"Transizione 5.0: sviluppo di software integrati con strumenti di Intelligenza Artificiale" -Machine Learning-ML.Net-*.

Research Topics

The research activity is primarily dedicated to the development and analysis of deep learning methods tailored to scientific applications, with a particular focus on large generative and multimodal architectures. Key areas of investigation include:

- **Deep Generative Models:** Study of GANs, diffusion models, and encoder-decoder architectures for open-vocabulary segmentation [5], novel recursive GAN architectures [11], and topological analysis of training dynamics [4].
- **Vision-Language and Multimodal Learning:** Investigation of zero-shot segmentation and cross-modal representations using pre-trained diffusion-based vision-language models (e.g., CLIP, BLIP), also within the framework of a research period at Sorbonne Université [5].
- **Applications in Chemistry and Biology:** Use of GNNs for metabolites classification and evaluation of

domain-specific language models for natural product discovery [7, 3].

- **Model Evaluation and Interpretability:** Analysis of the semantic consistency and internal structure of generative models through persistent homology and statistical techniques [9, 10, 4].

Skills

Programming Languages Python, C++, Matlab, Java, HTML, Javascript, SQL, PHP

Frameworks and Libraries Pytorch, Tensorflow, Keras, OpenCV, HuggingFace Transformers

Languages Italian, English (B2 certificate), Français (A2)

References

- **Prof. Franco Scarselli**, Department of Information Engineering and Mathematics, University of Siena, Italy
francoscarselli@gmail.com
- **Prof. Monica Bianchini**, Department of Information Engineering and Mathematics, University of Siena, Italy
monica.bianchini@unisi.it

Publications

- [1] Andreini, P., Bonechi, S., Bianchini, M., Scarselli, F., Manni, F., Quercioli, M., **Corradini, B. T.**, "A comparison on Cross-Domain Representation Learning for Skin-Lesion Classification". In: *XIX International Workshop on Artificial Life and Evolutionary Computation*. Accepted for publication. 2025.
- [2] Bonechi, S., Andreini, P., **Corradini, B. T.**, "Who Made This? Fake Detection and Source Attribution with Diffusion Features". In: *XIX International Workshop on Artificial Life and Evolutionary Computation*. Accepted for publication. 2025.
- [3] **Corradini, B. T.**, Bianchini, M., Scarselli, F., Nigi, L., Sali, V., Prete, A. L., "Comparing General and Domain-Specific Pre-trained Language Models for Natural Product Classification". In: *XIX International Workshop on Artificial Life and Evolutionary Computation*. Accepted for publication. 2025.
- [4] **Corradini, B. T.**, Cullen, B. W. G., Gallegati, C., Marziali, S., D'Inverno, G. A., Bianchini, M., Scarselli, F., "Training Dynamics of GANs Through the Lens of Persistent Homology". In: *Neurocomputing* (2025). under review.
- [5] **Corradini, B. T.**, Shukor, M., Couairon, P., Couairon, G., Scarselli, F., Cord, M., "FreeSeg-Diff: Training-Free Open-Vocabulary Segmentation with Diffusion Models". In: *International Joint Conference on Neural Networks (IJCNN)*. Accepted for publication. 2025.
- [6] Melacci, S., Nunziati, G., **Corradini, B. T.**, De Magistris, G., Fiorucci, M., Schillaci, G., "Mixed 2D-3D Object Recognition for Autonomous Inspection in Industrial Environments". In: *2025 5th International Conference on AI-ML-Systems (AIMLSystems)*. Accepted for publication. IEEE. 2025, pp. 1–6.
- [7] Prete, A. L., **Corradini, B. T.**, Costanti, F., Scarselli, F., Bianchini, M., "Leveraging Molecular Graphs for Natural Product Classification". In: *Computers in Biology and Medicine*. Under review. IEEE. 2025, pp. 1–6.
- [8] Bennett, D., Fanetti, M., Messina, M., **Corradini, B. T.**, Bendjedou, A., Ferrari, S., Perillo, F., Luzzi, L., Paladini, P., Marchini, E., "A novel web-based tool for lung transplant patients undergoing extracorporeal photopheresis". In: *JHLT Open* 5 (2024). Under review, p. 100106.
- [9] Bonechi, S., Andreini, P., **Corradini, B. T.**, Scarselli, F., "An Analysis of Pre-trained Stable Diffusion Models through a Semantic Lens". In: *Neurocomputing* 5 (2024). In press, p. 100106.
- [10] Bonechi, S., Andreini, P., **Corradini, B. T.**, Scarselli, F., "DiffProps: Is Semantics Preserved within a Diffusion Model?". In: *Proceedings of the 28th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems (KES 2024)*. Vol. 5. In press. IEEE. Siena, Italy: Elsevier, 2024, p. 100106.

- [11] **Corradini, B. T.**, Andreini, P., Hagenbuchner, M., Scarselli, F., Tsoi, A. C., "Exploring the Role of Recursive Convolutional Layer in Generative Adversarial Networks". In: *International Conference on Artificial Neural Networks*. Vol. 5. In press. Springer. Siena, Italy: Elsevier, 2023, pp. 53–64.
- [12] Intravaia, M., Fort, A., Landi, E., Mugnaini, M., Bianchini, M., **Corradini, B.**, Scarselli, F., Tanfoni, M., Spinelli, F., "A MobileNet Neural Network Model for Fault Diagnosis in Roller Bearings". In: *Proceedings of IEEE I2MTC 2023 Conference*. Vol. 5. In press. IEEE. Siena, Italy: Elsevier, 2023, pp. 53–64.
- [13] Landi, E., Spinelli, F., Intravaia, M., Mugnaini, M., Fort, A., Bianchini, M., **Corradini, B. T.**, Scarselli, F., Tanfoni, M., "A mobilenet neural network model for fault diagnosis in roller bearings". In: *2023 IEEE International Instrumentation and Measurement Technology Conference (I2MTC)*. Vol. 5. In press. IEEE. Siena, Italy: Elsevier, 2023, pp. 01–06.
- [14] Addabbo, T., Fort, A., Mugnaini, M., Vignoli, V., Intravaia, M., Tani, M., Bianchini, M., Scarselli, F., **Corradini, B. T.**, "Smart gravimetric system for enhanced security of accesses to public places embedding a mobilenet neural network classifier". In: *IEEE Transactions on Instrumentation and Measurement* 71 (2022). In press, pp. 1–10.
- [15] Andreini, P., Pancino, N., Costanti, F., Eusepi, G., **Corradini, B. T.**, "A Deep Learning approach for oocytes segmentation and analysis.". In: *ESANN*. Vol. 71. In press. IEEE. Siena, Italy: IEEE, 2022, pp. 1–10.
- [16] Addabbo, T., Fort, A., Mugnaini, M., Vignoli, V., Intravaia, M., Tani, M., Bianchini, M., Scarselli, F., **Corradini, B. T.**, "Smart gravimetric system based on Deep Learning for enhanced safety of accesses to public places". In: *2021 IEEE International Instrumentation and Measurement Technology Conference (I2MTC)*. Vol. 71. In press. IEEE. Siena, Italy: IEEE, 2021, pp. 1–6.

Declaration of Truthfulness

The undersigned **Barbara Toniella Corradini**, born in **Termoli (CB)** il **10/09/1994**, residing in **Petacciato (CB), CAP 86038** in **Via Mediterraneo, 52**,

aware of the criminal penalties provided for false statements or the use of false documents, pursuant to Articles 46 and 47 of Presidential Decree 445 of December 28, 2000,

declares

that all the information provided in this curriculum vitae is true and provided under her own responsibility.

