

Curriculum Vitae et Studiorum

Simona Nisticò

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1 General Information

Nationality: Italian

Position: Research Fellow

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2 Positions Held

- Since February 2024, *Research Fellow*, SSD ING-INF/05, at DIMES, University of Calabria, Rende (CS), Italy, within the FAIR project. Research topic: “Green-Aware eXplainable Machine Learning”.
- From December 2022 to March 2023, *Visiting Researcher*, at Department of Data Science, Radboud Universiteit, Nijmegen, Netherlands.
- From November 2020 to February 2024, *Ph.D. Student in Information and Communication Technologies*, at DIMES, University of Calabria, Rende (CS), Italy.

3 Education and Training

- Ph.D. in Information and Communication Technologies, DIMES, University of Calabria, Rende (CS).

Time Period: 2020-2024

Thesis Title: “Deep Learning Techniques for Explaining Predictors and Abnormal Behaviours”

Supervisors: Prof. Fabrizio Angiulli, Prof. Fabio Fassetti

Final Mark: Excellent cum Laude

- Participation in the 2nd Mediterranean Machine Learning Summer School, Milano, Italy.

Orgaizer: AI Education Foundation

Date: 12-16 September 2022

- MSc. Degree in Computer Engineering, DIMES, University of Calabria, Rende (CS).

Time Period: 2018-2020

Thesis Title: “A ResNet and RNN based approach for the disfluencies detection”

Supervisors: Prof. Fabrizio Angiulli, Prof. Fabio Fassetti

Final Mark: Magna cum Laude

- BSc. Degree in Computer Engineering, DIMES, University of Calabria, Rende (CS).

Time Period: 2015-2018

Thesis Title: “An approach based on deep learning for the identification of episodes of disfluency”

Supervisors: Prof. Fabio Fassetti

Final Mark: Magna cum Laude

4 Teaching Activities

4.1 Thesis Supervision

During her career, she has co-supervised 10 bachelor theses and 6 master theses about Machine on Machine and Deep learning-related topics.

4.2 Academic Teaching

Simona Nisticò has been Teaching Assistant for the following courses:

- **Advanced Architecture of Processing and Programming Systems**, MSc in Computer Engineering, DIMES, Università della Calabria, Rende (CS).
Covered topics: Programming techniques exploiting hardware organization to improve performances, SSE and AVX Assembly language extensions and OpenMP framework.
Academic Years 2024-2025, 2023-2024.
- **Fundamentals of Programming I**, BSc in Computer Engineering, DIMES, Università della Calabria, Rende (CS).
Covered topics: Introduction to computer science and, in particular, to the algorithmic resolution of problems and to computer programming. Using the C (or Python) programming language, fundamental data structures such as strings, arrays, and matrices are introduced as well.
Academic Years 2024-2025, 2023-2024.
- **Theoretical Computer Science**, MSc in Computer Engineering, DIMES, Università della Calabria, Rende (CS).
Covered topics: Automata and formal languages theory, computability theory and complexity theory.
Academic Year 2023-2024.
- **Logic Circuits and Computer Organization**, BSc in Computer Engineering, DIMES, Università della Calabria, Rende (CS).
Covered topics: Techniques for the analysis and the synthesis of combinatorial and sequential logical circuits, the basic organization and functioning of computers and the assembly programming language.
Academic Years 2022-2023, 2021-2022, 2020-2021.

4.3 Nonacademic Teaching

- **2021-2022**, *Time Series Analysis*, PC Cube S.r.l.,
Topics covered: Apache Spark, Machine Learning techniques, Time-Series Analysis.

5 Professional Activities

5.1 Participation as Speaker at International Conferences

- *26th International Conference on Discovery Science (DS2023)* Porto, Portugal, October 9-11, 2023, presenting the following work: “Counterfactuals Explanations for Outliers via Subspaces Density Contrastive Loss” [6].
- *27th European Conference on Advances in Databases and Information Systems (ADBIS2023)* Barcellona, Spain, September 4-7 2023, presenting the following work: “Towards reliable machine learning” [7].
- *International Symposium on Methodologies for Intelligent Systems (ISMIS2022)* Cosenza, Italy, October 3-5 2022, presenting the following work: “A Semi-automatic Data Generator for Query Answering” [8].
- *22nd International Conference on Intelligent Data Engineering and Automated Learning (IDEAL2021)* Manchester, United Kingdom, November 25-27 2021, presenting the following work: “Finding local explanations through masking models” [11].
- *24th International Conference on Discovery Science (DS2023)* Halifax, Canada, October 11-13, 2021, presenting the following work: “Local interpretable classifier explanations with self-generated semantic features” [12].

5.2 Chairmanships and Participation to Program Committees

- **2024** *Publicity chair*, 1st Workshop on Green-Aware Artificial Intelligence.
- **2024**, *PC member*, European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD2024).
- **2024**, *PC member*, 27th International Conference on Discovery Science 2024 (DS2024).
- **2024**, *PC Member*, 1st Workshop on Biomedical Insights with NLP and Graph Analysis (BING2024).

5.3 Activity as a Reviewer

Simona Nisticò served as a Reviewer for several international journals, including:

- Machine Learning
- Journal of Big Data
- Scientific Report

- Ai Communication
- Computational and Structural Biotechnology

Simona Nisticò served as a Reviewer for several international conferences, including:

- ECML-PKDD: European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases
- IJCAI: International Joint Conference on Artificial Intelligence
- ICDM: IEEE International Conference on Data Mining
- SAC: Symposium on Applied Computing
- DS: International Conference on Discovery Science

5.4 Participation in Projects

- *FAIR: Future Artificial Intelligence Research*

Research Objective: Development of machine and deep learning techniques to support the advancement of human-centred, green and sustainable AI.

5.5 Honours, Awards and Scholarships

- **2022** Top students at the Mediterranean Machine Learning (M2L) Summer School.
- **2020** Italian qualification to practice as an Engineer, Section A - Field: Information Technology.

6 Research Activity

6.1 Description of the Research Activity

Her research interests fall into the Artificial Intelligence field by covering different topics such as Explainable Artificial Intelligence (xAI), Anomaly Detection (AD), Audio Super-resolution and Federated Learning.

Explainable AI

Concerning xAI, her work explores various perspectives to address challenges relating to the opaqueness of sub-symbolic AI systems.

Post-hoc explanation. Her research on post-hoc model explanation encompassed both textual and continuous data. Concerning textual data her work leveraged semantic neighbourhood generation, investigating both application-dependent [12] and LLM-based [5] approaches to produce richer local explanations. As for continuous data, her research work focused on designing more accurate explanations, even when dealing with data like images. In particular, a method based on building counterfactuals through masking models – which are neural networks specialized in transforming samples to change black-box model outcomes – has been developed [11]. Moreover, she has also looked at the study of the outcome sensitivity to feature modification to find features having similar behaviour as a way to extract interpretable features in a black-box-driven way [15].

Explainable Anomaly Detection. Her research efforts have also been invested in developing explainable by-design Anomaly Detection (AD) systems that assist decision-makers in taking effective actions. The bedrock of this research line is embedding the concept of explainability through an ad-hoc designed loss. The proposed loss is shaped to guide the network in accurately reconstructing normal features while intentionally poorly reconstructing the features that, according to the neural network, contribute to sample outlierness.

Outlier explanation

Her work also addressed the outlier explanation problem by introducing a new perspective in sample outlierness description based on transformation-based justifications. Unlike existing methods that focus on subspaces or feature ranking, this explanation shape is aimed at providing users with multifaceted explanations that enhance their understanding of sample outlierness. The transformation itself illustrates how to modify the sample to remove factors contributing to its outlierness, while its application provides the user with an example of a normal instance similar to the outlier. Furthermore, to capture different peculiarities of the analysed samples, the method is designed to generate diverse explanations for a single instance [10, 6]. The above-described approach has

been extended to handle groups of outliers, a less explored area in the literature. In this context, the method aims to identify a single transformation justifying all the outliers composing the group. Since groups are not known in advance, the method employs a hierarchical strategy in which outliers are grouped according to explanation fitness [1].

Audio Super-resolution

Another explored area has been the audio super-resolution, which focuses on restoring audio files with missing or corrupted information. The preliminary studies have primarily addressed the problem of missing high frequencies, which applies to scenarios where an inappropriate sampling rate or low-quality recording hardware results in the miss of information beyond a certain frequency threshold. To restore this data, a GAN-based approach has been designed to generate the missing frequency range by leveraging the information available from the lower frequencies [3, 9]. Within this field, her efforts are currently committed to facing a more general scenario in which the missing frequencies are unknown.

Federated Learning

Her research interests also extended to the area of Federated Learning, for which a broad study has been carried out to analyse its issue in controlled environments. Currently, her research in this area is focusing on client clustering as a means to improve the aggregation of model weight updates.

6.2 List of Publications

Journals

- [1] Fabrizio Angiulli, Fabio Fasseti, Simona Nisticò, and Luigi Palopoli. “Explaining outliers and anomalous groups via subspace density contrastive loss”. In: *Machine Learning* (2024), pp. 1–25.
- [2] Jamsher Bhanbhro, Simona Nisticò, and Luigi Palopoli. “Issues in federated learning: some experiments and preliminary results”. In: *Scientific Reports* 14.1 (2024), pp. 1–15.
- [3] Simona Nisticò, Luigi Palopoli, and Adele Pia Romano. “Audio super-resolution via vision transformer”. In: *Journal of Intelligent Information Systems* (2023), pp. 1–15.

Book Chapters

- [4] Francesco Scarcello, Simona Nisticò, and Luigi Palopoli. “Artificial Intelligence”. In: *Reference Module in Life Sciences*. Elsevier, 2024.

Conferences

- [5] Fabrizio Angiulli, Francesco De Luca, Fabio Fasseti, and Simona Nisticò. “Large Language Models-Based Local Explanations of Text Classifiers”. In: *International Conference on Discovery Science*. Springer. 2024, pp. 19–35.
- [6] Fabrizio Angiulli, Fabio Fasseti, Simona Nisticò, and Luigi Palopoli. “Counterfactuals Explanations for Outliers via Subspaces Density Contrastive Loss”. In: *International Conference on Discovery Science*. Springer Nature Switzerland Cham. 2023, pp. 159–173.
- [7] Simona Nisticò. “Towards reliable machine learning”. In: *European Conference on Advances in Databases and Information Systems*. Springer Nature Switzerland Cham. 2023, pp. 631–638.
- [8] Fabrizio Angiulli, Alessandra Del Prete, Fabio Fasseti, and Simona Nisticò. “A Semi-automatic Data Generator for Query Answering”. In: *International Symposium on Methodologies for Intelligent Systems*. Springer International Publishing Cham. 2022, pp. 106–114.
- [9] Simona Nisticò, Luigi Palopoli, and Adele Pia Romano. “Audio super-resolution via vision transformer”. In: *International Symposium on Methodologies for Intelligent Systems*. Springer International Publishing. 2022, pp. 378–387.

- [10] Fabrizio Angiulli, Fabio Fassetti, Simona Nisticò, and Luigi Palopoli. “Outlier explanation through masking models”. In: *European Conference on Advances in Databases and Information Systems*. Springer International Publishing Cham. 2022, pp. 392–406.
- [11] Fabrizio Angiulli, Fabio Fassetti, and Simona Nisticò. “Finding local explanations through masking models”. In: *International Conference on Intelligent Data Engineering and Automated Learning*. Springer International Publishing Cham. 2021, pp. 467–475.
- [12] Fabrizio Angiulli, Fabio Fassetti, and Simona Nisticò. “Local interpretable classifier explanations with self-generated semantic features”. In: *International Conference on Discovery Science*. Springer International Publishing Cham. 2021, pp. 401–410.
- [13] Fabio Fassetti, Ilaria Fassetti, and Simona Nisticò. “Stream analysis for detecting stuttering episodes”. In: *ExLing 2019* 25 (2019), p. 77.
- [14] Fabio Fassetti, Ilaria Fassetti, and Simona Nisticò. “Learning and detecting stuttering disorders”. In: *IFIP International Conference on Artificial Intelligence Applications and Innovations*. Springer International Publishing Cham. 2019, pp. 319–330.

Workshops

- [15] Luca Ferragina, Simona Nisticò, et al. “A Clustering-based Approach for Interpreting Black-box Models”. In: *Proceedings of the 32nd Symposium on Advanced Database Systems, Villasimius, Italy, June 23rd to 26th, 2024, CEUR WORKSHOP PROCEEDINGS*. Vol. 3741. 2024, pp. 595–603.