

Research Activities

Software Engineer

01/10/2025 - current

FONDAZIONE CHIPS-IT - CENTRO ITALIANO PER IL DESIGN DEI CIRCUIT INTEGRATI A SEMICONDUCTORE

ING-INF/01

- **Job Title:** Software Researcher – SoC Modeling and Runtime Systems.
- **Activity:** Develop and maintain software models and simulation environments for pre-silicon System-on-Chip (SoC) validation; Integrate and optimize deployment flows for neural network inference on custom SoC targets. Assist with the bring-up of FPGA-based and silicon prototypes. Contribute to activities related to European and Industrial projects as well as to dissemination activities including technical reports, academic publications, or conference presentations.

Fixed-term Researcher (Type A) under Italian Law 240/2010, art. 24(3)(a)

10/02/2023 - 30/09/2025

ALMA MATER STUDIORUM UNIVERSITY OF BOLOGNA - DEI

ING-INF/01

- **Project:** “Intelligent processing of data and signals from sensors”.
- **Supervisor:** Prof. Riccardo Rovatti
- **Funding source:** PNRR funds – PE Call – Project PE1 – FAIR, “Future Artificial Intelligence Research” – Code PE0000013
- **Activity:** Design and development of machine learning algorithms for the processing of sensor signals, either on embedded systems or at early stages of the data path toward the cloud (e.g., concentrators or edge-of-cloud devices). The work addresses both theoretical and applied aspects, as well as the co-design of algorithms and physical systems.

Postdoctoral Research Fellowship

01/11/2022 - 09/02/2023

ALMA MATER STUDIORUM UNIVERSITY OF BOLOGNA - ARCES

ING-INF/01

- **Project:** “Anomaly detection through statistical analysis and automatic learning”.
- **Supervisor:** Prof. Riccardo Rovatti
- **Activity:** study of methods based on statistical approaches and machine learning for anomaly detection in signals acquired from monitoring systems, such as those related to civil structures, biomedical applications, and satellite telemetry. Additionally, an investigation of the trade-off between signal compression and anomaly detection capability.

Research Fellowship

01/11/2017 - 31/10/2018

ALMA MATER STUDIORUM UNIVERSITY OF BOLOGNA - ARCES

ING-INF/01

- **Project:** “Data processing pipeline for structural health monitoring using big data platforms”.
- **Supervisor:** Prof. Luca Benini
- **Activity:** Collaboration with STMicroelectronics and Sacertis for data processing in monitoring systems for civil structures such as viaducts, bridges, and buildings. The project focused on signal processing at the sensor level for compression and anomaly detection, as well as on cloud platforms for long-term monitoring.

Education

PhD in Electronic Engineering, Telecommunications and Information Technologies

March 15, 2022

ALMA MATER STUDIORUM - UNIVERSITY OF BOLOGNA

Bologna

- PhD thesis title: "Algorithms and Systems for IoT and Edge Computing"
- Supervisor: Prof. Riccardo Rovatti

Master's Degree in Electronic Engineering

March 18, 2015

ALMA MATER STUDIORUM - UNIVERSITY OF BOLOGNA

Bologna

- Final grade: 110/110 cum laude
- Master's thesis title: "Compressed Acquisition of Surface Forearm EMG based on Compressed Sensing for Automatic Hand Movement Recognition"
- Supervisor: Prof. Riccardo Rovatti

Bachelor's Degree in Electronic Engineering and Telecommunications

October 3, 2011

ALMA MATER STUDIORUM - UNIVERSITY OF BOLOGNA

Bologna

- Final grade: 110/110 cum laude
- Bachelor's thesis title: "Experimental Evaluation of Descriptors for RGB-D Image Matching"
- Supervisor: Prof. Luigi Di Stefano

Teaching Activities

Lecturer – Security of Data and Neural Processing M

Academic Year 2025-26

ALMA MATER STUDIORUM - UNIVERSITY OF BOLOGNA | ELECTRONIC ENGINEERING, LM-29

Bologna

Course of the Master's in Electronic Engineering (code 6716), with 60 hours (6 ECTS), covering fundamentals of cryptography.

Lecturer – Elements of Applied Data Security M

Academic Years 2021-22 to 2025-26

ALMA MATER STUDIORUM - UNIVERSITY OF BOLOGNA | ELECTRONIC ENGINEERING, LM-29

Bologna

Course of the Master's in Electronic Engineering (code 0934), with 60 hours (6 ECTS), covering fundamentals of cryptography.

Lecturer – Introduction to Signals and Sensors for Automotive Applications

July 2023-2026

UNIVERSITY OF MODENA AND REGGIO EMILIA | HIGH SCHOOL ADVANCED ENGINEERING SUMMER PROGRAM – "ITALIAN MOTOR VALLEY EXPERIENCE"

Bologna

Delivered 2-hour lectures on sensor technology and signal analysis for the "Italian Motor Valley Experience" summer school by MUnER, offering high school students a 2-week program with university lectures and visits to top automotive companies.

Lecturer – Python for Data Management and Machine Learning in Automotive

November 2021-2025

UNIVERSITY OF BOLOGNA | MUNER HIGHER EDUCATION | SCHOOL IN AUTOMOTIVE FOR INTELLIGENT MOBILITY

Bologna

Delivered 4 hours of online teaching on Python for data analysis in automotive as part of MUnER's "Automotive for Intelligent Mobility" program, which includes 45 seminars totaling 90 hours.

Lecturer – Statistics and AI for Signal and Data Analysis

September 2019

UNIVERSITY OF BOLOGNA | $\mu\eta\chi\alpha\nu\eta$ – ADVANCED TRAINING SCHOOL IN HIGH PERFORMANCE ENGINEERING

Modena

Professional training within the University of Bologna and HPE-COXA agreement under the " $\mu\eta\chi\alpha\nu\eta$ – Advanced Training School in High Performance Engineering." Focus on statistics and AI for industrial data and signal analysis. Responsible for three of eight modules:

- Module 2 – Introduction to Data Analytics (8 hours);
- Module 3 – Low-level Signal Processing (12 hours);
- Module 4 – Machine Learning for Descriptive Analytics (12 hours).

Research Projects

Selected research projects funded by public or private institutions, with active contribution to key activities.

Competence centre for Access to DEsign Technology and Training Italy (CADETTI)

2026-2029

CHIPS JOINT UNDERTAKING (CHIPS JU)

Funded by the European Union, CADETTI is the Italian competence centre for semiconductor which acts as National gateway to European initiatives and as neutral facilitator in the European semiconductor landscape by supporting innovation, technology transfer and skills development. Responsibilities: Work Package 5 leader, in charge of the training, upskilling and reskilling activities of the Competence Centre.

Chiplet-based Hardware Architectures for Software-defined Vehicles (CHASSIS)

2025-2028

CHIPS JOINT UNDERTAKING (CHIPS JU)

Funded by the European Union, the project focuses primarily on pioneering chiplet-based architectures to overcome the limitations of traditional monolithic System-on-Chips (SoCs). Responsibilities: definition of the specifications and requirements of the automotive base die.

Intelligent Methods for On-board Remaining Useful Life Estimation (MISTERO)

2024-2025

ITALIAN SPACE AGENCY (ASI)

Project funded by ASI and awarded to a consortium led by the University of Bologna, with Thales Alenia Space Italia and Sapienza University of Rome as subcontractors. The project runs for 18 months starting in November 2024 and aims to explore the use of artificial intelligence for estimating the remaining useful life (RUL) of satellites in operation, based on telemetry data from subsystems. Activities include telemetry data analysis, development of RUL estimation models, and coordination among consortium partners.

Machine Learning-based On-board Autonomy, Failure Prognostics and Detection (FIORIRE2)

2024-2025

EUROPEAN SPACE AGENCY (ESA)

Project funded by ESA and awarded to a consortium led by Thales Alenia Space Italia, with the University of Bologna and Leonardo as subcontractors. The 18-month project, starting in November 2024, builds upon the work of the previous FIORIRE project, aiming to develop a telemetry-based anomaly detection and fault identification system for on-board satellite implementation. Responsibilities include telemetry processing and the design of the workflow for developing anomaly detection models.

Predictive Analytics Aimed at Exploiting Data Generated by Spacecraft

2021

THALES ALENIA SPACE ITALIA (TASI)

Project funded by Thales Alenia Space Italia and assigned to the Department of Electrical, Electronic, and Information Engineering at the University of Bologna. The 3-month project, starting in January 2021, focused on exploring machine learning techniques for detecting anomalous events in telemetry data from an operational satellite. Activities included telemetry data analysis and the development of anomaly detection methods.

Implementation of Statistical Methods for Data and Signal Processing

2021

HPE COXA

Project funded by HPE S.r.l. (VAT ID IT 02872520362) and assigned to the Advanced Research Center in Electronic Systems (ARCES) at the University of Bologna. The 3-month project, starting in November 2021, aimed to compare and implement predictors based on Gaussian processes and deep neural networks in the context of Computational Fluid Dynamics (CFD) and Magnetic Resonance Imaging (MRI). Responsibilities included the implementation of Gaussian process-based predictors and direct interaction with the industrial partner.

Predictive Algorithms for Catenary Wear Monitoring

2020-2022

RETE FERROVIARIA ITALIANA (RFI)

Project funded by Rete Ferroviaria Italiana (RFI) and assigned to the Advanced Research Center in Electronic Systems (ARCES) at the University of Bologna, on behalf of the National Inter-University Consortium for Informatics (CINI). The 18-month project, starting in June 2020, focused on the hardware and software design of a monitoring system for overhead contact lines (catenary), aiming to assess wear conditions, detect anomalous events, and support post-failure analysis. The demonstrator (TRL 5) consists of a sensor node to be installed on the cantilever arm and the associated data analysis methods. Responsibilities included scenario modeling and the development of signal analysis techniques for wear assessment and anomaly detection.

Advanced Cloud and Near-Sensor Processing Techniques for Structural Health Monitoring

2017-2020

STMICROELECTRONICS AND SACERTIS

Project funded by STMicroelectronics and Sacertis and assigned to the Department of Electrical, Electronic and Information Engineering at the University of Bologna. The project focused on the development of innovative techniques and systems for monitoring civil structures, including the redesign of smart sensor nodes and the design of cloud platforms for data management and processing. Activities included the analysis of data aggregation techniques at the sensor level and the optimization of computing resources for downstream data processing.

JOURNAL

- F. Martinini, M. Mangia, **A. Marchioni**, G. Setti, and R. Rovatti
2025 "Incremental Undersampling MRI Acquisition with Neural Self Assessment". In: Signal Processing, vol. 228, Mar. 2025, DOI: 10.1016/j.sigpro.2024.109746
- A. Enttsel, S. Onofri, **A. Marchioni**, M. Mangia, G. Setti, and R. Rovatti
2024 "A General Framework for the Assessment of Detectors of Anomalies in Time Series". In: IEEE Transactions on Industrial Informatics, Jun. 2024, DOI: 10.1109/TII.2024.3413359
- A. Marchioni**, A. Enttsel, M. Mangia, R. Rovatti and G. Setti
2024 "Anomaly Detection Based on Compressed Data: An Information Theoretic Characterization". In: IEEE Transactions on Systems, Man, and Cybernetics: Systems, vol. 54, no. 1, pp. 23-38, Jan. 2024, DOI: 10.1109/TSMC.2023.3299169
- A. Marchioni**, L. Prono, M. Mangia, F. Pareschi, R. Rovatti and G. Setti
2023 "Streaming Algorithms for Subspace Analysis: Comparative Review and Implementation on IoT Devices". In: IEEE Internet of Things Journal, vol. 10, no. 14, pp. 12798-12810, Jul. 2023, DOI: 10.1109/JIOT.2023.3256529
- C. Paolino, A. Antolini, F. Zavalloni, A. Lico, E. Franchi Scarselli, M. Mangia, **A. Marchioni**, F. Pareschi, R. Rovatti, G. Setti, M. L. Torres, M. Carissimi, M. Pasotti
2023 "Decoding Algorithms and HW Strategies to Mitigate Uncertainties in a PCM-Based Analog Encoder for Compressed Sensing". In: Journal of Low Power Electronics and Applications, vol. 13, no. 1, 2023, DOI: 10.3390/jlpea13010017
- F. Martinini, M. Mangia, **A. Marchioni**, R. Rovatti, and G. Setti
2022 "A Deep Learning Method for Optimal Undersampling Patterns and Image Recovery for MRI Exploiting Losses and Projections". In: IEEE Journal of Selected Topics in Signal Processing, vol. 16, no. 4, pp. 713–724, Apr. 2022, DOI: 10.1109/JSTSP.2022.3171082
- A. Burrello, **A. Marchioni**, D. Brunelli, S. Benatti, M. Mangia, and L. Benini
2021 "Embedded Streaming Principal Components Analysis for Network Load Reduction in Structural Health Monitoring", In: IEEE Internet of Things Journal, vol. 8, no. 6, pp. 4433–4447, Mar. 2021, DOI: 10.1109/JIOT.2020.3027102
- L. Prono, M. Mangia, **A. Marchioni**, F. Pareschi, R. Rovatti, and G. Setti
2020 "Deep Neural Oracle With Support Identification in the Compressed Domain". In: IEEE Journal on Emerging and Selected Topics in Circuits and Systems, vol. 10, no. 4, pp. 458–468, Dec. 2020, DOI: 10.1109/JETCAS.2020.3039731
- A. Marchioni**, M. Mangia, F. Pareschi, R. Rovatti and G. Setti
2020 "Subspace Energy Monitoring for Anomaly Detection @Sensor or @Edge". In: IEEE Internet of Things Journal, vol. 7, no. 8, pp. 7575-7589, Aug. 2020, DOI: 10.1109/JIOT.2020.2985912
- M. Mangia, L. Prono, **A. Marchioni**, F. Pareschi, R. Rovatti and G. Setti
2020 "Deep Neural Oracles for Short-Window Optimized Compressed Sensing of Biosignals". In: IEEE Transactions on Biomedical Circuits and Systems, vol. 14, no. 3, pp. 545-557, Jun. 2020, DOI: 10.1109/TBCAS.2020.2982824
- M. Mangia, **A. Marchioni**, F. Pareschi, R. Rovatti and G. Setti
2019 "Chained Compressed Sensing: A Blockchain-Inspired Approach for Low-Cost Security in IoT Sensing". In: IEEE Internet of Things Journal, vol. 6, no. 4, pp. 6465-6475, Aug. 2019, DOI: 10.1109/JIOT.2019.2910402
- M. Mangia, **A. Marchioni**, F. Pareschi, R. Rovatti and G. Setti
2019 "Administering Quality-Energy Trade-Off in IoT Sensing Applications by Means of Adapted Compressed Sensing". In: IEEE Journal on Emerging and Selected Topics in Circuits and Systems, vol. 8, no. 4, pp. 895-907, Dec. 2018, DOI: 10.1109/JETCAS.2018.2846884

CONFERENCES

- L. Manovi, A. Leboffe, **A. Marchioni**, E. Mariotti, M. Mangia, F. Corallo, D. Di Ienno, I. Pinci, R. Rovatti, C. Ciancarelli, and G. Furano
2024 "Onboard AI for Enhanced FDIR: Revolutionizing Spacecraft Operations with Anomaly Detection" In: The First Joint European Space Agency / IAA Conference on AI in and for Space (SPAICE)
- A. Enttsel, **A. Marchioni**, L. Manovi, R. Nikpali, G. Ravaglia, G. Setti, R. Rovatti, and M. Mangia
2024 "Anomaly Detection-Reconstruction Trade-off in Autoencoder-based Compression" In: 32nd European Signal Processing Conference (EUSIPCO), 2024

S. Onofri, **A. Marchioni**, G. Setti, M. Mangia, and R. Rovatti

2024 “Multi-class Similarity-based Approach for Remaining Useful Life Estimation” In: IEEE International Instrumentation and Measurement Technology Conference (I2MTC), May 2024

A. Enttsel, **A. Marchioni**, G. Setti, M. Mangia, and R. Rovatti

2024 “Enhancing Anomaly Detection with Entropy Regularization in Autoencoder-based Lightweight Compression” In: 6th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS), Apr. 2024

L. Manovi, L. Capelli, **A. Marchioni**, F. Martinini, G. Setti, M. Mangia, and R. Rovatti

2024 “SVD-based Peephole and Clustering to Enhance Trustworthiness in DNN Classifiers” In: 6th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS), Apr. 2024

F. Martinini, A. Enttsel, **A. Marchioni**, M. Mangia, R. Rovatti, and G. Setti

2023 “Structured Pruning in Deep Neural Networks with Trainable Probability Masks” In: IEEE 66th International Midwest Symposium on Circuits and Systems (MWSCAS), Aug. 2023, pp. 1020-1024, DOI: 10.1109/MWSCAS57524.2023.10405945

S. Onofri, A. Enttsel, L. Manovi, **A. Marchioni**, S. Cagnetta, F. Corallo, C. Ciancarelli, M. Mangia, R. Rovatti, and G. Setti

2023 “Autoencoder-based Features Extraction for the Health Monitoring in the Space domain” In: IEEE 66th International Midwest Symposium on Circuits and Systems (MWSCAS), Aug. 2023, pp. 458-462, DOI: 10.1109/MWSCAS57524.2023.10406124

A. Enttsel, F. Martinini, **A. Marchioni**, M. Mangia, R. Rovatti and G. Setti

2023 “Second-Order Statistic Deviation to Model Anomalies in the Design of Unsupervised Detectors” In: IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Jun 2023, pp. 1-5, DOI: 10.1109/ICASSP49357.2023.10095287

A. Marchioni, F. Martinini, L. Manovi, S. Cortesi, R. Rovatti, G. Setti, and M. Mangia

2023 “Adapted Compressed Sensing with Incremental Encoder and Deep Performance Predictor for Low-Power Sensor Node Design” In: IEEE International Instrumentation and Measurement Technology Conference (I2MTC), May 2023, pp. 1-6, DOI: 10.1109/I2MTC53148.2023.10175954

F. Martinini, A. Enttsel, **A. Marchioni**, M. Mangia, F. Pareschi, R. Rovatti, and G. Setti

2022 “Training Binary Layers by Self-Shrinking of Sigmoid Slope: Application to Fast MRI Acquisition” In: IEEE Biomedical Circuits and Systems Conference (BioCAS), Oct. 2022, pp. 665-669, DOI: 10.1109/BioCAS54905.2022.9948688

F. Martinini, A. Enttsel, **A. Marchioni**, M. Mangia, R. Rovatti, and G. Setti

2022 “Binary Compressed Sensing of ECG by Neural Matrix Optimization and Support Oracle” In: IEEE Biomedical Circuits and Systems Conference (BioCAS), Oct. 2022, pp. 660-664, DOI: 10.1109/BioCAS54905.2022.9948666

C. Ciancarelli, F. Corallo, S. Cagnetta, E. Mariotti, L. Manovi, M. Mangia, **A. Marchioni**, R. Rovatti, F. Pareschi, G. Setti

2022 “New Concepts Of Automated Anomaly Detection In Space Operations Through ML-Based Techniques” In: 73rd International Astronautical Congress (IAC), Sep. 2022

C. Ciancarelli, E. Mariotti, F. Corallo, S. Cagnetta, L. Manovi, **A. Marchioni**, M. Mangia, R. Rovatti, and G. Furano

2022 “Innovative ML-based methods for automated on-board spacecraft anomaly detection” In: 2nd International Conference on Applied Intelligence and Informatics (AII), Sep. 2022

L. Prono, **A. Marchioni**, M. Mangia, F. Pareschi, R. Rovatti, and G. Setti

2021 “An MCU Implementation of PCA/PSA Streaming Algorithms for EEG Features Extraction” In: IEEE Biomedical Circuits and Systems Conference (BioCAS), Oct. 2021, pp. 01-05, DOI: 10.1109/BioCAS49922.2021.9645035

M. Mangia, **A. Marchioni**, L. Prono, F. Pareschi, R. Rovatti, and G. Setti

2020 “Low-power ECG acquisition by Compressed Sensing with Deep Neural Oracles” In: 2nd IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS), Aug. 2020, pp. 158-162, DOI: 10.1109/AICAS48895.2020.9073945

L. Prono, M. Mangia, **A. Marchioni**, F. Pareschi, R. Rovatti, and G. Setti

2020 “Low-Power Fixed-Point Compressed Sensing Decoder with Support Oracle” In: IEEE International Symposium on Circuits and Systems (ISCAS), May 2020, pp. 1-5, DOI: 10.1109/ISCAS45731.2020.9180502

L. Prono, **A. Marchioni**, M. Mangia, F. Pareschi, R. Rovatti, and G. Setti

2019 “A High-level Implementation Framework for Non-Recurrent Artificial Neural Networks on FPGA” In: 15th Conference on Ph.D Research in Microelectronics and Electronics (PRIME), Jul. 2019, pp. 77-80, DOI: 10.1109/PRIME.2019.8787830

M. Mangia, **A. Marchioni**, F. Pareschi, R. Rovatti, and G. Setti

2019 "Chained Compressed Sensing for IoT Node Security" In: IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), May 2019, pp. 7580-7584, DOI: 10.1109/ICASSP.2019.8683303

A. Burrello, **A. Marchioni**, D. Brunelli, and L. Benini

2019 "Embedding principal component analysis for data reduction in structural health monitoring on low-cost IoT gateways" In: 16th ACM International Conference on Computing Frontiers (CF '19), Apr. 2019, pp. 235-239, DOI: 10.1145/3310273.3322822

M. Mangia, L. Magenta, **A. Marchioni**, F. Pareschi, R. Rovatti, and G. Setti

2018 "Projected-Gradient-Descent in Rakeness-Based Compressed Sensing with Disturbance Rejection" In: New Generation of CAS (NGCAS), Nov. 2018, pp. 78-81, DOI: 10.1109/NGCAS.2018.8572115

A. Marchioni, M. Mangia, F. Pareschi, R. Rovatti, and G. Setti

2018 "Rakeness-based Compressed Sensing of Surface ElectroMyoGraphy for Improved Hand Movement Recognition in the Compressed Domain" In: IEEE Biomedical Circuits and Systems Conference (BioCAS), Oct. 2018, pp. 1-4, DOI: 10.1109/BIOCAS.2018.8584763

A. Marchioni, C. H. Pimentel-Romero, F. Pareschi, M. Mangia, R. Rovatti, and G. Setti

2018 "Resource Redistribution in Internet of Things applications by Compressed Sensing: A Survey" In: IEEE International Symposium on Circuits and Systems (ISCAS), May 2018, pp. 1-5, DOI: 10.1109/ISCAS.2018.8351891

A. Marchioni, M. Mangia, F. Pareschi, R. Rovatti, and G. Setti

2018 "Disturbance Rejection With Rakeness-based Compressed Sensing: Method and Application to Baseline/Powerline Mitigation in ECGs" In: IEEE International Symposium on Circuits and Systems (ISCAS), May 2018, pp. 1-5, DOI: 10.1109/ISCAS.2018.8351170

A. Marchioni, M. Mangia, F. Pareschi, R. Rovatti, and G. Setti

2017 "Low-complexity greedy algorithm in compressed sensing for the adapted decoding of ECGs" In: IEEE Biomedical Circuits and Systems Conference (BioCAS), Oct. 2017, pp. 1-4, DOI: 10.1109/BIOCAS.2017.8325143

A. Marchioni, M. Mangia, F. Pareschi, R. Rovatti, and G. Setti

2017 "Sparse sensing matrix based compressed sensing in low-power ECG sensor nodes" In: IEEE Biomedical Circuits and Systems Conference (BioCAS), Oct. 2017, pp. 1-4, DOI: 10.1109/BIOCAS.2017.8325155