Diego Pennino

Personal Data

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Work Experience

Dec 2025 - *Today* — Co-founder and Board Member of the start-up "HuMoving Srl", Viterbo

Deep-tech academic spin-off building scalable AI-based platforms for motion analysis, biomechanical modeling, and human–machine interaction. Technologies integrate sensor systems, intelligent algorithms, and 3D engines to deliver inclusive digital solutions for healthcare, sport, education, and accessibility markets.

Apr 2024 - *Today* — Partner and Board Member of the start-up "Tech4All Srl", Viterbo

Innovative start-up developing AI-driven digital platforms for educational support and inclusive learning solutions targeting students with special educational needs.

Mar 2023 - *Today* — Assistant Professor (RTD-A) at University of Tuscia, Viterbo

Research activities in blockchain, distributed systems, cybersecurity, and AI, with a focus on scalability, decentralization, on-chain authentication, and applications in IoT, supply chain, and predictive analytics.

Sep 2021 - Feb 2023 — Postdoctoral Researcher in Computer Science at University of Roma Tre, Rome

Project *LazioChain*: blockchain and decentralization for the Agrifood sector (POR FESR Lazio 2014–2020, Project Code POR A0375E0116).

Nov 2020 - Aug 2021 — Postdoctoral Researcher in Computer Science at University of Roma Tre, Rome

Research on data integrity in distributed (Cloud) and decentralized (Blockchain) systems, focusing on *Authenticated Data Structures (ADS)* and scalability challenges.

Mar 2017 - Sep 2017 — Research Scholarship at Ministry of Justice, Rome

Analysis of critical aspects of information systems in the penal sector.

Nov 2016 - Feb 2017 — Collaboration Contract at University of Roma Tre, Rome

Research activity within the European project *PREEMPTIVE* on Industrial Control Systems (ICS) security, including the design and implementation of optimized Merkle Hash Trees for integrity and security applications.

Education

Oct 2017 - Oct 2020 — PhD in Computer Science at Engineering University of Roma3, Rome

Thesis title: Data Integrity and Scalability in Cloud-Based and Blockchain-Based Systems.

Final exam: April 16^{th} 2021

October 2016 — Master's Degree in Engineering

105/110 *Computer Science Specialization*, **University of Roma3**, Rome

Promiscuous use of USB devices in critical systems:
checking the integrity of files by the use of authenticated data structures

Advisor: Maurizio Pizzonia

July 2014 — Bachelor's Degree. in Engineering

95/110 *Computer Science Specialization*, **University of Roma3**, Rome

Integration of a SAAS Crawler into a web data extraction system

Advisor: Paolo Merialdo

Projects participation

Agritech: Participation in the national project Agritech – National Research Centre for Agricultural Technologies, funded under the Italian NRRP MUR – Mission 4, Component 2, Investment 1.4. Within Spoke 5, focused on sustainable productivity and mitigation of environmental impact in livestock systems, and specifically within Task 5.3.8, I contributed to the development of a software tool for CO_2 emission prediction, supporting the assessment of environmental impact and sustainability in livestock production systems.

Pico2Raee: research project "PiCo2RAEE – Piattaforma collaborativa seconda vita RAEE", aimed at developing a digital platform for the promotion of the circular economy in the sector of electrical and electronic equipment, through eco-design solutions, life cycle management and reuse and regeneration scenarios.

Bi-Made: Participation in the Lazio Region project on BIM-based platform for real-time anomaly detection through AI on the consumption of energy-intensive systems within data centers. The BI-MADE project aims to develop an innovative ICT platform to identify anomalies in consumption and enable preventive/predictive maintenance processes in data centers. The combination of IoT monitoring, AI models and BIM information will provide a comprehensive solution enabling greater energy efficiency, increased security and greater environmental sustainability of IT assets.

PON: Scientific coordinator of the project within the National Operational Program Research and Innovation 2014-2020 - FSE REACT-EU, Axis IV "Education and research for recovery", Action IV.4 "Doctorates and research contracts on Innovation topics" and Action IV.6 "Research contracts on Green topics".

LazioChain: The LazioChain national project aims to introduce blockchain technology into the Lazio agrifood supply chain.

PREEMPTIVE: The European PREEMPTIVE project addressed the prevention of cyber attacks against hardware and software systems such as DCS, SCADA, PLC, networked electronic sensing, and monitoring and diagnostic systems used by the utilities networks.

GIT-Projects

Kdbtree https://github.com/kdbtree/kdbtree
The Kdbtree library is a realization of the DB-tree data structure. DB-trees enable to realize persistent authenticated data structures (ADSes).

Member of:

DLT Italian Distributed Ledger Technology Working Group
https://dltgroup.dmi.unipg.it/index.php

Organizing Commitee of DLT22 4th Distributed Ledger Technology Workshop
https://dlt2022.github.io/

Program Commitee of IEEE DAPPS 2024 The 6th IEEE International Conference on Decentralized Applications and Infrastructures
https://ieeedapps.com/

Board of Directors of Tech4All Innovative startup that creates digital tools based on artificial intelligence to support students with learning difficulties
https://tech4all.ai/

Founding member of HuMouving a university spin-off creating advanced AI, sensor-based and 3D technologies to analyze human movement and enhance accessibility, inclusion and digital wellbeing.

Other experiences

Cyberchallenge 2023: Local organizer and **instructor** for the University of Roma3.
https://cyberchallenge.it/

Teachings

2022/2023

• Course instructor of "Information Technology and Digital Communication Technologies" at the DISUCOM Department, University of Tuscia *(6 CFU – Bachelor's Degree in Digital Technologies and Cultures, L-20).*

2023/2024

• Course instructor of "Elements of Computer Science" – Bachelor's Degree in Industrial Engineering, Curriculum in Maintenance Engineering for Aeronautics (L-9) *(6 CFU).*

• Course instructor of "Foundations of Digital Engineering Applied to Agriculture – Module on Mechatronics and IoT" – Master's Degrees LM-69 and LM-73 in Digital Management of Agriculture and Mountain Territory *(6 CFU).*

• Course instructor of "Advanced Informatics" – Bachelor's Degree in Industrial Engineering, Curriculum in Maintenance Engineering for Aeronautics (L-9) *(3 CFU).*

• Course instructor of "Laboratory of Digital Skills for Web Data Collection" – Master's Degree in Administration, Finance and Control (LM-77) *(2 CFU).*

2024/2025

• Course instructor of "Elements of Computer Science" – Bachelor's Degree in Industrial Engineering, Curriculum in Maintenance Engineering for Aeronautics (L-9) *(6 CFU).*

• Course instructor of "Foundamentals of Digital Engineering Applied to Agriculture – Module on Mechatronics and IoT" – Master's Degrees LM-69 and LM-73 in Digital Management of Agriculture and Mountain Territory *(6 CFU).*

• Course instructor of "Advanced Informatics" – Bachelor's Degree in Industrial Engineering, Curriculum in Maintenance Engineering for Aeronautics (L-9) *(6 CFU).*

• Lecturer for the PhD course "Data Integrity in Industrial Systems: From Theory to Practice" – PhD in Engineering for Energy and Environment (DEIM) *(3 CFU).*

• Lecturer for the first-level Master's program "Specialist Operator in Information and Communication Technologies (ICT)" at the University of Roma Tre *(16 total hours).*

2025/2026

• Course instructor of "Elements of Computer Science" – Bachelor's Degree in Industrial Engineering (L-9), DEIM – Department of Economics, Engineering, Society and Business, University of Tuscia *(6 CFU, 48 hours, SSD ING-INF/05).*

• Course instructor of "Advanced Informatics" – Bachelor's Degree in Industrial Engineering (L-9), DEIM – Department of Economics, Engineering, Society and Business, University of Tuscia *(6 CFU, 48 hours, SSD ING-INF/05).*

• Lecturer for the PhD course "Data Integrity in Industrial Systems: From Theory to Practice" – PhD in Engineering for Energy and Environment, 41st cycle, DEIM – University of Tuscia *(3 CFU, SSD ING-IND/05).*

• Lecturer for the course "Basics of Data Analysis and Performance Analysis" – First-level Master's programme in Science and Innovation of Sport Performance, UNITUS Academy, University of Tuscia *(5 CFU, SSD MEDF-01/B).*

International Teaching Activities

University of Córdoba, Spain: Invited short-term teaching assignment at the *Departamento de Ciencias de la Computación e Inteligencia Artificial*, University of Córdoba, from 31 March 2025 to 4 April 2025. The activity consisted of a 10-hour course entitled "Basics of Blockchain and Application Scenarios", delivered through daily two-hour lectures. The course covered blockchain fundamentals, distributed architectures, consensus protocols, security and scalability issues, and application scenarios in financial, logistics, public-sector and industrial domains. The activity was formally certified by the academic supervisor at the University of Córdoba.

Roles and Responsibilities

Departmental IT Contact Person: Departmental IT contact person, acting as liaison between the Department and the University's central IT services. Direct management of selected departmental digital services, including internal web systems, survey platforms and other IT tools supporting academic and administrative activities.

Publications

Journal Publications:

[j10] Lorena Foschi, Diego Pennino, Giulia Gislon, Giampiero Grossi, Alberto Mantino, Marco Barbanera, Marco Marconi, Francesco Cesarini, Chiara Rossi, Andrea Vitali, Anna Sandrucci, Maddalena Zucali, Luciana Bava, Matteo Finocchi, Marcello Mele, Nicola Lacetera: **Development of a machine learning tool for the enhancement of carbon footprint prediction for cattle milk production.** *International Journal of Life Cycle Assessment*, 30(12):3161–3174 (2025). DOI: 10.1007/s11367-025-02521-z.

[j9] Alessandro Cardarelli, Michele Ciambella, Pietro Fornai, Marco Marconi, Diego Pennino, Luca Tortora, Marco Barbanera: **Kinetic analysis and prediction modeling by advanced machine learning of pyrolysis of dairy cattle manure from conventional and organic systems.** *Biomass and Bioenergy*, 202:108247 (2025). DOI: 10.1016/j.biombioe.2025.108247.

[j8] Diego Pennino, Maurizio Pizzonia: **Toward scalable docker-based emulations of blockchain networks for research and development.** *Blockchain: Research and Applications*, 5(3):100212 (2024). DOI: 10.1016/j.bcra.2024.100212.

[j7] Andrea Vitaletti, Maurizio Pizzonia, Marco Zecchini, Diego Pennino, Salvatore Esposito De Falco, Francesco Pacileo, Alessandro Bellini, Antonio Bonifacio, Domenico Sardanelli, Pietro Vito, Simone Naldini: **On-chain global maintenance services: technical, legal and managerial implications.** *International Journal of Parallel, Emergent and Distributed Systems*, 41(1):120–133 (2026; first online 2023). DOI: 10.1080/17445760.2023.2192933.

[j6] Lorenzo Ariemma, Niccolò De Carlo, Diego Pennino, Maurizio Pizzonia, Andrea Vitaletti, Marco Zecchini: **Blockchain for the supply chain of the Italian craft beer sector: tracking and discount coupons.** *International Journal of Parallel, Emergent and Distributed Systems*, 41(1):104–119 (2026; first online 2023). DOI: 10.1080/17445760.2023.2190974.

[j5] Diego Pennino, Maurizio Pizzonia, Andrea Vitaletti, Marco Zecchini: **Blockchain as IoT Economy Enabler: A Review of Architectural Aspects.** *Journal of Sensor and Actuator Networks*, 11(2):20 (2022). DOI: 10.3390/jsan11020020.

[j4] Albenzio Cirillo, Vito Dalena, Antonio Mauro, Francesco Mogavero, Diego Pennino, Maurizio Pizzonia, Andrea Vitaletti, Marco Zecchini: **Empowering Citizens by a Blockchain-Based Robinson List.** *International Journal of Computers and Applications*, 44(10):920–928 (2022). DOI: 10.1080/1206212X.2021.1986245.

[j3] Diego Pennino, Maurizio Pizzonia, Andrea Vitaletti, Marco Zecchini: **Efficient Certification of Endpoint Control on Blockchain.** *IEEE Access*, 9:133309–133334 (2021). DOI: 10.1109/ACCESS.2021.3115343.

[j2] Diego Pennino, Maurizio Pizzonia, Federico Griscioli: **Pipeline-Integrity: Scaling the Use of Authenticated Data Structures up to the Cloud.** *Future Generation Computer Systems*, 100:618–647 (2019). DOI: 10.1016/j.future.2019.05.018.

[j1] Diego Pennino, Maurizio Pizzonia, Alessio Papi: **Overlay Indexes: Efficiently Supporting Aggregate Range Queries and Authenticated Data Structures in Off-the-Shelf Databases.** *IEEE Access*, 7:175642–175670 (2019). DOI: 10.1109/ACCESS.2019.2957346.

Conference Publications:

[j12] Tommaso Caiazzi, Stefano Iannucci, Valerio Marini, Diego Pennino, Maurizio Pizzonia, Riccardo Torlone: **A Novel Architecture for Cyber-Resilient Self-Protecting Systems Based on Blockchain.** *Proceedings of the 2025 IEEE 49th Annual Computers, Software, and Applications Conference (COMPSAC 2025)*, 1–8 (2025).

[j11] Alessandro Paolucci, Mattia Gianvincenzi, Marco Marconi, Claudio Favi, Diego Pennino: **Development of a Decentralized Digital Product Passport for Enhanced Lifecycle Management of Electrical and Electronic Equipment.** *Procedia CIRP*, 135:356–361 (2025).

[j10] Mattia Gianvincenzi, Marco Marconi, Enrico Maria Mosconi, Diego Pennino, Francesco Tola: **Digital Product Passports: A Framework for Developing Adaptable and Compliant Data Models.** *Lecture Notes in Mechanical Engineering*, 182–189 (2025).

[j9] Diego Pennino, Maurizio Pizzonia: **Virtual Private Blockchains for GDPR: Cheap Private Blockchains out of Public Ones.** *CEUR Workshop Proceedings*, Vol. 3791 (2024).

[j8] Diego Pennino, Maurizio Pizzonia: **Toward Scalable Docker-Based Emulations of Blockchain Networks.** *5th Distributed Ledger Technology Workshop (DLT 2023)*, CEUR Workshop Proceedings, Vol. 3460 (2023).

[j7] Andrea Mariani, Gianluca Mariani, Diego Pennino, Maurizio Pizzonia: **Blockchain Scalability and Security: Communications Among Fast-Changing Committees Made Simple.** *IEEE 20th International Conference on Software Architecture Companion (ICSA-C 2023)*, 209–215 (2023).

[j6] Alessandro Bellini, Antonio Bonifacio, Salvatore Esposito De Falco, Simone Naldini, Francesco Pacileo, Diego Pennino, Maurizio Pizzonia, Domenico Sardanelli, Andrea Vitaletti, Pietro Vito, Marco Zecchini: **On-Chain Global Maintenance Services.** *CEUR Workshop Proceedings*, Vol. 3166: 119–129 (2022).

[j5] Lorenzo Ariemma, Niccolò De Carlo, Diego Pennino, Maurizio Pizzonia, Andrea Vitaletti, Marco Zecchini: **Blockchain-Based Tracking of the Supply Chain of the Italian Craft Beer Sector.** *CEUR Workshop Proceedings*, Vol. 3166: 130–145 (2022).

[j4] Albenzio Cirillo, Antonio Mauro, Diego Pennino, Maurizio Pizzonia, Andrea Vitaletti, Marco Zecchini: **Decentralized Robinson List.** *3rd Workshop on Cryptocurrencies and Blockchains for Distributed Systems (CryBlock'20)*, in conjunction with ACM MobiCom 2020.

[j3] Gianmaria Del Monte, Diego Pennino, Maurizio Pizzonia: **Scaling Blockchains Without Giving Up Decentralization and Security: A Solution to the Blockchain Scalability Trilemma.** *3rd Workshop on Cryptocurrencies and Blockchains for Distributed Systems (CryBlock'20)*, in conjunction with ACM MobiCom 2020.

[j2] Diego Pennino, Maurizio Pizzonia, Andrea Vitaletti, Marco Zecchini: **Binding of Endpoints to Identifiers by On-Chain Proofs.** *1st Workshop on Blockchain theoRy and ApplicatIoNs (BRAIN 2020)*, in conjunction with IEEE ISCC 2020.

[j1] Matteo Bernardini, Diego Pennino, Maurizio Pizzonia: **Blockchains Meet Distributed Hash Tables: Decoupling Validation from State Storage.** *DLT@ITASEC 2019*, 43–55 (2019).

Awards

2020	Algorand first prize	Asset Creation and Management Platform Challenge at Future of Blockchain competition
2018	First prize	Scientific School on Blockchain & distributed ledger technology Contest, in Pula(italy)