

ANDREA ROBERTA COSTAGLIOLA

Ph.D. Student in Computer Science and Engineering

@ andrea.costagliola@unibo.it +39 3895136136 orcid.org/0009-0009-0119-2597
unibo.it/sitoweb/andrea.costagliola/en in andrea-roberta-costagliola



WORK

PhD Student

Alma Mater Studiorum - University of Bologna

Nov 2022 – Present Bologna, Italy

- Ph.D. Student at the Department of Computer Science and Engineering department (DISI) at the University of Bologna
- My research focuses on the design and development of methodologies and tools for creating collaborative Digital Twin platforms (CDT) tailored for smart city applications. I work on defining secure, interoperable, and scalable architectures, addressing key challenges related to Urban Digital Twins (UDTs), such as integrating heterogeneous data sources and ensuring interoperability. I explore the use of Blockchain, Decentralized Identifiers (DIDs) and Verifiable Credentials (VCs) to enhance authentication, data integrity, and privacy. My goal is to drive innovation in urban infrastructure management, enabling data-driven decision-making and fostering collaboration among stakeholders through intuitive and user-friendly tools.

Research Stay

Faculty of Computer and Information Science, University of Ljubljana

1/10/2024 – 31/03/2025 Ljubljana, Slovenia

- Research visit as part of the ongoing academic collaboration between Alma Mater Studiorum - University of Bologna and the Faculty of Computer and Information Science in Ljubljana.
- Development of a decentralized trust management system where each entity autonomously defines and manages its trust relationships based on reputation, availability, and data quality. The system leverages blockchain for transparency and security, while a smart oracle computes trust metrics, ensuring flexibility, interoperability, and scalability without relying on central authorities.

Teaching Tutor

Ragazze Digitali project

June 2022 – July 2022 Bologna, Italy

- Work alongside and support the teacher in introducing the python programming language and algorithmic thinking

Teaching Tutor

Coding Girls project

September 2021 – April 2022 Bologna, Italy

- Assisted high school students in designing and developing an app using the Thunkable platform, aligned with the themes of the Coding Girls 2021/2022 project: trust in science and eco-sustainability.

Research Fellow

Alma Mater Studiorum - University of Bologna

May 2022 – October 2022 Bologna, Italy

EDUCATION

M.Sc. (w/honors) in Computer Engineering

Alma Mater Studiorum - University of Bologna

2018 – 2021 Bologna, Italy

- Thesis Title "Design of a decision making architecture based on smart contracts and oracles applied to tourism industry"

B.Sc. (108/110) in Computer Engineering

Alma Mater Studiorum - University of Bologna

2015 – 2018 Bologna, Italy

- Thesis Title "Supporting infrastructure and Edge Computing applications based on ThingWorx Edge."

STRENGTHS

Motivation

Persuasiveness

Hard-working

Attention to detail

Effectiveness

Patience

LANGUAGES

Italian

English



- As part of the UNAEUROPA project, I worked on the issuance and verification of Unibo verifiable credentials, leveraging DIDs, VCs, and the EBSI blockchain to enhance security and efficiency in academic credential management

Research Fellow

Alma Mater Studiorum - University of Bologna

📅 May 2021 – May 2022

📍 Bologna, Italy

- Designed and validated a model for the digital representation of physical objects, products, and services on a blockchain, including processes that modify their attributes, as part of a blockchain platform implementation for secure data sharing between interconnected objects. Identified architectural and performance requirements for protocols, selected the most suitable ones from available options, and adapted them to meet project needs.
- Blockchain and Beauty: the impact of blockchain technology in the cosmetics industry. Analysis of the main blockchain solutions adopted in the cosmetics industry in order to ensure product authenticity, transparency and supply chain traceability.

PROJECTS

Interconnecting Urban Networks: a Novel Approach to Digital Twins through GlassBox Adaptation

📅 2025.

- Analysis of UDTs from an interoperability and multilayer integration perspective, addressing the horizontal challenge of seamless data exchange across diverse subsystems with different protocols and the vertical challenge of synchronizing interactions between urban layers to optimize resource management and reflect system interdependencies.
- Extension of the GlassBox simulation framework for urban environments, adapting it to model cities as multilayered networks with varying levels of abstraction, in order to overcome the limitations of traditional simulation models and better represent the complexity of real-world urban systems.
- Proposal of a multilayered architecture that leverages adaptable data description systems and structured data publishing endpoints. This architecture is designed to handle the complexity of urban data flows, facilitating the integration of both simulation-related and real-time monitoring data within the context of UDTs.

TrustFlow: a Traceable Federated Learning Framework to Enable Trustworthy Digital Twins

📅 The article will be published during 2025.

- Design of a blockchain-based revocation system for federated learning, leveraging DIDs to uniquely identify entities and artifacts, and VCs to certify revocation-related information, ensuring transparency and traceability;
- Integration of an influence estimation algorithm to assess the impact of data on global models, enabling automated and policy-driven revocation of harmful data and models via smart contracts on the Distributed ledger technologies (DLT);
- Implementation and evaluation of the proposed approach, demonstrating minimal overhead and efficient execution of the revocation mechanism through extensive experiments.

VESPACE: A Verifiable Blockchain-based Data Space Solution to Empower the Data Economy

📅 2025.

- Analysis of existing standards and reference projects for data spaces to identify guidelines for designing a decentralized data-sharing ecosystem that ensures verifiable data, audits operations, and enables fine-grained access control;
- Proposal of VESPACE, a verifiable, blockchain-based data space that adheres to the identified design guidelines while aligning with FAIR and SSI principles;
- Implementation and evaluation of a prototype of the proposed framework, demonstrating its feasibility using actual datasets and synthetic triggered actions to assess the scalability of the security primitives.

A Multi-faceted Interoperability Model for Reliable and Trustworthy Urban Digital Twins

📅 2024

- Address the challenges of data ingestion, processing, sharing, and interoperability in UDTs.

- Utilization of Minimal Interoperability mechanisms (MIMs) to address various dimensions of interoperability.
- Utilization of FaaS to provides a serverless computing model to ensure MIM compliance and interoperability
- Decentralized identifiers (DIDs) to provide unique and verifiable identities for IoT devices.

AREAS OF EXPERTISE

</> Programming Languages

- Proficient in: Python, Java, C, C++, and JavaScript.
- Familiar with: Go, Bash, SQL and C#.

🧩 Soft Skills

- Strong communication and presentation skills.
- Leadership and coaching abilities.
- Strong problem-solving skills.
- Teamwork and collaboration skills.

PUBLICATIONS

- [Conference Paper], Andrea Roberta Costagliola, Marco Montanari, Paolo Bellavista. **Interconnecting Urban Networks: a Novel Approach to Digital Twins through GlassBox Adaptatio** *SMARTGREENS2025 Conference*. 2025.
- [Article], Nicolò Romandini Andrea Roberta Costagliola, Armir Bujari, Rebecca Montanari. **TrustFlow: a Traceable Federated Learning Framework to Enable Trustworthy Digital Twins** *Submitted to Future Generation Computer Systems*. 2025.
- [Article], Andrea Roberta Costagliola, Carlo Mazzocca, Armir Bujari, Rebecca Montanari, Paolo Bellavista. **VESPACE: A Verifiable Blockchain-based Data Space Solution to Empower the Data Economy** *Elsevier Computer Communication Journal*. 2025.
- [Conference Paper] Andrea Roberta Costagliola, Andrea Sabbioni, Armir Bujari, Rebecca Montanari, Paolo Bellavista. **A Multi-faceted Interoperability Model for Reliable and Trustworthy Urban Digital Twins** *ACM GoodIT* . 2024.

June 26, 2025

PERSONAL DATA AUTH

In compliance with the GDPR and the Italian Legislative Decree no. 196 dated 30/06/2003, I hereby authorize you to use and process my personal details contained in this document.

Andrea Roberta Costagliola

Andrea Roberta Costagliola