

4th International Conference on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding (VIPERC 2025)

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Abstract

This document presents the 4th International Conference on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding (VIPERC 2025), a premier forum for presenting academic and industry papers on big data, data mining and knowledge discovery, machine learning and deep learning, 3D modeling and simulation (structural, thermal, functional and acoustic analysis), software engineering, and, more generally, aspects related to digital transition for visual pattern extraction, analysis, and recognition to preserve cultural heritage.

Keywords

Cultural heritage, Artificial intelligence, Digital transition, Modeling and simulation.

1. Introduction

Cultural heritage integrates all tangible and intangible elements carrying artistic, historical, architectural, or archaeological value. Permeating everyday life from historical sites to contemporary art and environments, it embodies the collective memory of societies, serving as a vital bridge between past origins and future direction. Tangible cultural heritage includes ancient buildings, archaeological ruins, monuments, sculptures, paintings, coinage, submerged cities and shipwrecks, manuscripts, photographs, and historical films. Intangible heritage embraces the acoustic heritage of historical spaces, traditional crafts, local festivals, oral expressions, dialects, music, culinary heritage, and regional ways of life. Knowledge extraction in this field centers on identifying, recognizing, and modeling visual patterns, understood as any humanly perceivable characteristic, which enables the analysis of latent features, correlations, hypotheses, and emerging trends within heritage datasets. Supported by ongoing digital transformation, modern visual pattern recognition deploys smart systems, soft computing, big data analytics, and automated modeling to analyze cultural heritage in complex real-world contexts.

From all aforementioned, the 4th International Conference on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding (VIPERC 2025¹) aimed to be an international

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CEUR Workshop Proceedings (CEUR-WS.org)

¹<https://sites.google.com/view/viperc-2025/>

event, presenting academic and industry papers on big data, data mining and knowledge discovery, machine learning and deep learning, 3D modeling and simulation (structural, thermal, functional and acoustic analysis), software engineering, and, more generally, aspects related to digital transition for visual pattern extraction, analysis, and recognition to preserve cultural heritage. The VIPERC 2025 conference welcomed contributions from various research areas related to the digitization of cultural heritage, building recovery, conservation, and maintenance, leveraging current technologies and the support of robotics and automation. It also favored the participation of young research scholars who wanted to present their early-stage in-progress academic work.

VIPERC 2025 was officially co-sponsored by the MUD-MADE project (Multi-objective optimization of digitally manufactured earth building components supported by neural networks), PRIN PNRR, CUP: D53D23020070001, N. prog.: P20229EY3E. More information about the project can be found at the official webpage: <https://www.ingeo.unich.it/pagina-mudmade-multiobjective-optimization-of-digitally-manufactured-earth-building-components-supported-by-neural-networks-1952>. Additionally, VIPERC 2025 was officially endorsed by the LIP3D project (Living forever the Past through a 3Digital world), DIGITAL-2023-CLOUD-DATA-AI-05-CULTURAL HERITAGE. More information about the project can be found at the official webpage: <https://www.lip3dproject.eu/>.

Finally, VIPERC 2025 was technically co-sponsored² by the International Neural Network Society (INNS).

2. Topics

Topics of interest included, but were not limited to:

- Disruptive technologies
 - Machine learning and data science for cultural heritage multimedia data
 - Artificial intelligence in the recovery, analysis, and enhancement of cultural heritage
 - Augmented and virtual reality systems
 - 3D printing
 - Internet of things in cultural heritage
- Diagnostics
 - Intelligent sensor systems for building monitoring, recovery, conservation, maintenance and art restoration
 - Discrete geometry techniques for pattern recognition and pattern matching in cultural heritage images
 - Image processing, texture, shape analysis and natural language processing in historical data
- Acoustics and digital technology
 - Acoustics in cultural heritage

²https://www.inns.org/index.php?option=com_content&view=article&id=215:inns-at-viperc-2025&catid=20:site-content

- Soundscape planning and preservation
- Analysis
 - 3D reconstruction and model processing
 - 3D modeling and simulation (e.g. structural, thermal, functional and acoustic analysis) for cultural heritage
 - Remote sensing for cultural heritage preservation
 - Surrogate models (computational models that approximate the behavior of complex systems or processes)
- Manufacturing and intervention
 - Robotics and digital manufacturing for built heritage
 - Digitization of industrial products, projects, prototypes, and artefacts for cultural heritage preservation
 - Cutting-edge and sustainable digital-supported materials for built heritage
 - Metamaterials fabricated with specific patterns
 - Climate changes and intelligent mitigation strategies to preserve cultural heritage sites

3. Past VIPERC events

To date, the VIPERC series includes five events, two international workshops and three international conferences:

- The 1st International Workshop on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding, that was held on 30 January 2019 in the CNR Area of Pisa, Pisa, Italy (VIPERC 2019³).
- The 2nd International Workshop on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding, that was held on 29 January 2020 at the University of Bari Aldo Moro, Bari, Italy (VIPERC 2020⁴).
- The 1st International Virtual Conference on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding, that was held on 12 September 2022 (VIPERC 2022⁵).
- The 2nd International Conference on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding, that was held on 25-26 September 2023 in Zadar, Croatia (VIPERC 2023⁶).
- The 3rd International Conference on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding, that was held on 1 September 2024 in Bari, Italy (VIPERC 2024⁷).

³<https://ircdl2019.isti.cnr.it/index.html%3Fp=537.html>

⁴<https://dblp.org/db/conf/ircdl/viperc2020.html>

⁵<https://sites.google.com/view/viperc-2022/>

⁶<https://sites.google.com/view/viperc2023/>

⁷<https://2024.ieeeecase.org/viperc2024/>

Both VIPERC 2019 and VIPERC 2020 were held in person and co-located with the Italian Research Conference on Digital Libraries (IRCDL 2019 and 2020). Their proceedings were published in CEUR-WS (Volumes 2320 and 2602, respectively).

Thanks to growing attendance, subsequent VIPERC events transitioned from workshops to full-fledged conferences. VIPERC 2022 took place virtually, co-located with the 19th International Conference on Artificial Intelligence: Methodology, Systems, Applications (AIMSA 2022). VIPERC 2023 was held as an in-person satellite conference alongside the 27th International Conference on Theory and Practice of Digital Libraries (TPDL 2023). The proceedings for both editions were published in CEUR-WS (Volumes 3266 and 3600). More recently, VIPERC 2024 was hosted in Bari, Italy, on September 1, 2024, as an in-person satellite conference of the 20th IEEE International Conference on Automation Science and Engineering (IEEE CASE 2024), one of the three flagship conferences of the IEEE Robotics & Automation Society. Its proceedings are available in CEUR-WS (Volume 3838).

Finally, VIPERC 2025 was held in person⁸ on December 3–4, 2025 at the Polo Pindaro campus of the "G. d'Annunzio" University of Chieti-Pescara in Pescara, Italy, as a technically co-sponsored INNS event.

4. Scientific Committee

High scientific standards were guaranteed by an international Organizing Committee of 18 members from Italy and Ireland, as well as an international Program Committee of 36 researchers representing 12 countries global-wide (Italy, Greece, Romania, France, Bosnia and Herzegovina, North Macedonia, Brazil, Bulgaria, Finland, Serbia, Sweden, and South Africa).

Furthermore, the Honorary Chair of the conference was the President of the INNS, Prof. Francesco Carlo Morabito, Full Professor at the "Mediterranea" University of Reggio Calabria, Italy, an internationally recognized authority in neural networks, artificial intelligence, and advanced signal processing, whose distinguished career and pioneering contributions have significantly shaped the field.

The Scientific Committee consisted of distinguished experts with proven expertise across cultural heritage, knowledge representation, information retrieval, algorithmic design, pattern recognition, artificial intelligence, and modeling and simulation techniques.

Honorary Chair:

- Francesco Carlo Morabito, "Mediterranea" University of Reggio Calabria, Italy

General Chairs:

- Alessia Amelio, Associate Professor, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy
- Sergio Montelpare, Full Professor, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy

⁸<https://sites.google.com/view/viperc-2025/pictures>

- Valentino Sangiorgio, Assistant Professor, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy
- Domenico Ursino, Full Professor, DII Marche Polytechnic University, Italy

Program Chairs:

- Samantha Di Loreto, Research Fellow, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy
- Michele Marchetti, Research Fellow, DII Marche Polytechnic University, Italy
- Alessandro Ricciutelli, Research Fellow, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy
- David Ramírez-Solana, Research Assistant, University College Dublin, Ireland
- Luca Virgili, Assistant Professor, DII Marche Polytechnic University, Italy

Publicity Chairs:

- Gianluca Bonifazi, Assistant Professor, DII Marche Polytechnic University, Italy
- Christopher Buratti, Junior Researcher, DII Marche Polytechnic University, Italy
- Naomi Di Marco, Junior Researcher, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy
- Eliezer Zahid Gill, Junior Researcher, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy
- Federica Parlapiano, Junior Researcher, DII Marche Polytechnic University, Italy
- Davide Traini, Junior Researcher, DII Marche Polytechnic University, Italy

Local Chairs:

- Cristina Cantagallo, Assistant Professor, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy
- Mariano Pierantozzi, Associate Professor, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy
- Massimiliano Pepe, Associate Professor, InGeo "G. d'Annunzio" University of Chieti-Pescara, Italy

Program Committee:

- Jacopo Bassetta, Telematic University "Leonardo da Vinci", Italy
- Cristina Cantagallo, "G. d'Annunzio" University of Chieti-Pescara, Italy
- Luciano Caroprese, "G. d'Annunzio" University of Chieti-Pescara, Italy
- Francesco Cauteruccio, University of Salerno, Italy
- Michelangelo Ceci, University of Bari Aldo Moro, Italy
- Adrian-Gabriel Chifu, Aix-Marseille University, France
- Marijana Ćosović, University of East Sarajevo, Bosnia and Herzegovina

- Domenico D'Orazio, Hugo Gernsback Research Lab Unidav, Italy
- Carlos Alexandre Barros de Mello, Federal University of Pernambuco, Brazil
- Dustin van der Haar, University of Johannesburg, South Africa
- Claudia Diamantini, Marche Polytechnic University, Italy
- Samantha Di Loreto, "G. d'Annunzio" University of Chieti-Pescara, Italy
- Serena Doria, "G. d'Annunzio" University of Chieti-Pescara, Italy
- Ivo Rumenov Draganov, Technical University of Sofia, Bulgaria
- Ionut Cosmin Duta, Huawei, Finland
- Stefano Ferilli, University of Bari Aldo Moro, Italy
- Iuliana Georgescu, University of Bucharest, Romania
- Andreas Giannakouloupoulos, Ionian University, Greece
- Anders Hast, Uppsala University, Sweden
- Radu Tudor Ionescu, University of Bucharest, Romania
- Zoran Ivanovski, "Ss. Cyril and Methodius" University in Skopje, North Macedonia
- Radmila Janković Babić, Mathematical Institute of the Serbian Academy of Sciences and Arts, Serbia
- Katerina Kabassi, Ionian University, Greece
- Tomislav Kartalov, "Ss. Cyril and Methodius" University in Skopje, North Macedonia
- Maura Mengoni, Marche Polytechnic University, Italy
- Christian Morbidoni, "G. d'Annunzio" University of Chieti-Pescara & Hugo Gernsback Research Lab Unidav, Italy
- Michail Panagopoulos, Ionian University, Greece
- Maria Antonietta Pascali, ISTI-CNR, Italy
- Antonio Pasculli, "G. d'Annunzio" University of Chieti-Pescara & Hugo Gernsback Research Lab Unidav, Italy
- Massimiliano Pepe, "G. d'Annunzio" University of Chieti-Pescara, Italy
- Mariano Pierantozzi, "G. d'Annunzio" University of Chieti-Pescara, Italy
- Marius Popescu, University of Bucharest, Romania
- Belma Ramić-Brkić, Sarajevo School of Science and Technology, Bosnia and Herzegovina
- Marco Ricci, University of Calabria, Italy
- Manuela Valeri, "G. d'Annunzio" University of Chieti-Pescara, Italy
- Gian Piero Zarri, Sorbonne University, France

5. Invited Speakers

The VIPERC 2025 Organizing Committee had the privilege of inviting Professor Francesco Carlo Morabito from the "Mediterranea" University of Reggio Calabria, as well as Professor Massimiliano Pepe, Professor Valentino Sangiorgio, and Eng. Naomi Di Marco from the "G. d'Annunzio" University of Chieti-Pescara, to present three brief lectures covering key conference themes.

5.1. Prof. Francesco Carlo Morabito

Francesco Carlo Morabito is a Full Professor of Electrical Engineering at the "Mediterranea" University of Reggio Calabria, Italy, where he has also served in key institutional leadership roles, including Deputy Rector. His research activity focuses extensively on artificial intelligence, artificial neural networks, advanced signal and image processing, and soft computing techniques applied to engineering and industrial diagnostics. A internationally recognized authority in computational intelligence, Professor Morabito serves as the President of the INNS, one of the premier global scientific organizations in machine learning and neural computing. Author of hundreds of peer-reviewed papers, books, and international conference proceedings, he has led numerous national and European research projects and actively contributes to international scientific societies, including the IEEE.

Prof. Francesco Carlo Morabito's title of the talk was: "Outcomes of the FAIR NAEL project: energy-efficient and sustainable technology AI solution for pattern recognition". The present speech showed the methodological approaches proposed within the PNRR FAIR NAEL project and the results achieved, specifically in healthcare and BCI. It included a detailed description of the pre-processing of the data used to reduce the computational cost (and, thus, the energy consumption) in AI applications (i.e., classification, segmentation, and multimodal fusion). In addition, some meta-learning approaches were discussed that improve generalization performance also in different tasks, like in domain adaptation. Although the project is mainly focused in clinical applications, the talk included some examples of the use of the same methodological approaches for cultural heritage data.

5.2. Prof. Massimiliano Pepe

Massimiliano Pepe is an Associate Professor at the "G. d'Annunzio" University of Chieti-Pescara, Italy. His scientific research focuses primarily on photogrammetry, remote sensing, geomatics, 3D digital modeling, and the integration of artificial intelligence and computer vision techniques for cultural heritage documentation and structural monitoring. He has authored numerous peer-reviewed scientific publications in prestigious international journals and conference proceedings. Throughout his academic career, he has actively participated in and co-directed several national and international research initiatives dedicated to digital surveying, geospatial data processing, and heritage conservation technology.

Prof. Massimiliano Pepe's title of the talk was: "LIP3D project: Digital Tools and Immersive Technologies for the Virtual Reconstruction of Archaeological Heritage". The LIP3D project promotes the use of advanced digital tools for the documentation, analysis, and dissemination of archaeological heritage through 3D digitization and virtual reconstruction. The presentation illustrated the workflow developed within the project for acquiring and processing 3D data using UAV photogrammetry, TLS, and SLAM technologies. Special attention was given to the creation of open datasets and their reuse for educational, research, and AI-driven reconstruction purposes. Moreover, the talk explored how immersive technologies, such as virtual reality (VR) and head-mounted displays, can enhance public engagement and accessibility to archaeological sites, offering new ways to experience and interpret cultural heritage in virtual environments. A live VR demonstration was organized, allowing participants to explore 3D reconstructions of

archaeological sites involved in the LIP3D project using head-mounted displays (VR headsets). The demo enabled attendees to virtually walk through ancient sites, examine reconstructed architectural details, and experience interactive storytelling elements designed to communicate archaeological knowledge in an engaging and immersive way.

5.3. Prof. Valentino Sangiorgio and Eng. Naomi Di Marco

Valentino Sangiorgio is an Assistant Professor specializing in structural engineering, building pathology, and AI-driven decision-support systems for structural safety and risk assessment. He is the scientific director of the Digital Fabrication Lab at the “G. d’Annunzio” University of Chieti-Pescara, Italy. Naomi Di Marco is a Junior Researcher focusing on geomatics, 3D digital reconstruction, and computer vision applied to cultural heritage documentation and monitoring. Together, their joint research combines structural diagnosis with advanced geospatial and machine learning techniques to develop innovative, multidisciplinary solutions for heritage preservation and infrastructure monitoring.

Prof. Valentino Sangiorgio and Eng. Naomi Di Marco’s title of the talk was: “MUD-MADE project: MUlti-objective optimization of Digitally MANufactureD Earth building components supported by neural networks”. The MUD-MADE project explores the integration of artificial intelligence and digital fabrication technologies in the design and production of sustainable raw earth building components. The initiative develops an innovative workflow that combines parametric design, multi-objective optimization, and neural network-based support systems to create high-performance architectural elements that balance structural, thermal, and acoustic properties. The presentation illustrated the AI-assisted workflow for generating and optimizing 3D-printed clay components, from parametric modeling and multi-performance assessment to prototyping and laboratory validation. Using Triply Periodic Minimal Surface (TPMS) geometries such as Gyroid, Diamond, and Schwarz, the project demonstrated how advanced raw earth-based additive manufacturing can enhance both material efficiency and constructive feasibility. A live demonstration showcased the 3D printing process of optimized earthen components using WASP technology, allowing participants to observe in real time how computational design and digital fabrication converge. The session featured interactive exploration of digital models and performance simulations, offering insights into how AI-driven methods can support architects and researchers in shaping the future of ecological construction through digitally manufactured raw earth architecture.

6. Best Paper and Best Presentation Awards

The VIPERC 2025 conference featured a ceremony dedicated to announcing the Best Paper and Best Presentation awards.

The Best Paper Award was decided by an Award Committee appointed by the General Chairs, comprising Program Committee members with no affiliations to the shortlisted authors. The committee evaluated the candidates based on scientific quality, originality, and the initial peer-review scores, ultimately selecting the highest-ranked contribution. Meanwhile, the Best Presentation Award was awarded directly by the General Chairs, who assessed speakers on their

clarity of delivery, visual presentation quality, and effective communication of their research's innovative core.

The best paper award of VIPERC 2025 was assigned to Aaron Giner and Reinhold Preiner, for their paper by title: "AnRoll: Analytic Unrolling of Painted Pottery Surfaces". The motivation for this choice by the Award Committee was the following: "The Best Paper Award is presented to this work for its outstanding contribution to digital heritage and computational archaeology. By developing a novel, four-parameter analytic model based on Elastic Flattening, the authors successfully solve long-standing challenges in pottery motif analysis, eliminating asymmetry and computational artifacts while achieving real-time performance. The combination of rigorous mathematical modeling, GPU-accelerated implementation, and the release of an intuitive, open-source tool provides the scientific and archaeological communities with an accessible, high-impact solution for non-destructive heritage documentation".

The best presentation award of VIPERC 2025 was assigned to Ahmed Dewedar, for presenting his paper by title: "Collection of 3D Data Useful for Surveying and Digitizing Cultural Heritage Using UAV Photogrammetry and Lidar Sensors: Iuvanum 3D Dataset".

7. Special Session ETech-CH

The conference included a Special Session organized by the "Hugo Gernsback" Research Laboratory of the Telematic University "Leonardo da Vinci" (Unidav) in Torrevecchia Teatina (CH), Italy, titled *ETech-CH: Emerging Technologies for History and Memory. Cultural and Industrial Heritage Between Complexity and Digital Transformation*. The Special Session was chaired by prof. Christian Morbidoni from the "G. d'Annunzio" University of Chieti-Pescara & Hugo Gernsback Research Laboratory, and dr. Jacopo Bassetta from the Telematic University "Leonardo da Vinci".

7.1. Abstract

In the context of digital innovation, historical, cultural, and industrial heritage represents a privileged field for questioning the role of technologies in the construction of contemporary, open, and accessible collective memory. Increasingly, the management and enhancement of cultural heritage involve a network of heterogeneous actors: researchers, historians, engineers, IT system developers, and public entities such as museum and archival institutions. This special session aimed to explore, from a transdisciplinary perspective, the practices of digital transition and the use of emerging technologies, such as artificial intelligence, generative AI, digitization processes, information systems, and digital infrastructures, that are transforming the ways in which material, documentary, historical, and industrial heritage is preserved, accessed, and enhanced. The session also intended to analyze the variety of innovative approaches to integrating new technologies into historical research processes and heritage digitization. The goal was to foster disciplinary exchange that connects the functionalities of emerging technologies with the purposes of conservation, historical research, and documentation, promoting forms of conscious integration among historical, engineering, computer science, and ethical perspectives. Special attention was given to both the potential and the vulnerabilities of such integrations, in

the awareness that every technology entails a specific interpretative posture and profoundly influences the construction of historical meaning.

7.2. Topics

The topics of the Special Session included, but were not limited to:

- Digital technologies for the modeling and analysis of cultural and industrial landscapes (digital mapping and surveying, 3D modeling, augmented reality, virtual reconstructions).
- Innovative approaches to digitization and heritage research (use of technologies for source analysis, metadata, interoperability, advanced digitization, archiving and access tools).
- Tools and methodologies for the documentation, protection, and enhancement of industrial heritage (surveying technologies, diagnostics, historical recording, technical preservation, cultural and narrative valorization of productive spaces and objects).
- Generative AI and collective memory: potential, limitations, and ethical implications (use of artificial intelligence for automated content generation and historiographical analysis, digital simulations, computational narratives; analysis of cognitive and symbolic distortions such as interpretative bias, informational hallucinations; critical reflection on algorithmic transparency, ethical implications, and AI usage benchmarks).

8. Outcomes

The VIPERC 2025 conference guaranteed high-quality content by: (i) gathering top-tier contributions across key fields in cultural heritage digitization, such as image processing, data mining, artificial intelligence, software engineering, and 3D modeling and simulation; (ii) assembling a diverse, gender-balanced Organizing and Program Committee of esteemed international experts in cultural heritage, AI, and pattern recognition; (iii) featuring keynote presentations from internationally renowned leaders in these domains; and (iv) implementing a rigorous peer-review process focused on clarity, relevance, and methodological soundness.

VIPERC 2025 took place on 3 December 2025, from 9:00 AM to 5:55 PM (registration, welcome speech, first invited talk, Session 1, second invited talk, Session 2, third invited talk, Sessions 3 and 4) and on 4 December 2025, from 9:00 AM to 12:45 PM (registration, Special Session ETech-CH, Award ceremony, and closing) - Italian time - at the Polo Pindaro of the “G. d’Annunzio” University of Chieti-Pescara, Viale Pindaro 42, 65127 Pescara, Italy, in the Room 31. For each participant, the registration fee was 200 euros. INNS members paid a reduced fee of 100 euros.

The event was attended by the Honorary Chair, prof. Francesco Carlo Morabito, three General Chairs, prof. Alessia Amelio, Sergio Montelpare and Valentino Sangiorgio, three Program Chairs, dr. Samantha Di Loreto, Alessandro Ricciutelli and David Ramírez-Solana, one Publicity Chair, Eng. Naomi Di Marco, two Local Chairs, dr. Cristina Cantagallo and prof. Massimiliano Pepe, and ten Program Committee members, dr. Jacopo Bassetta, dr. Cristina Cantagallo, prof. Luciano Caroprese, Eng. Domenico D’Orazio, dr. Samantha Di Loreto, prof. Serena Doria, prof. Christian Morbidoni, prof. Antonio Pasculli, prof. Massimiliano Pepe, and Eng. Manuela Valeri.

On December 3, 2025, at 09:30 AM (Italian time), prof. Antonio Teti (Chief Digital Transition Officer of the University), Alessia Amelio, Sergio Montelpare and Valentino Sangiorgio presented

the institutional greetings and welcome, followed by the invited talk of prof. Francesco Carlo Morabito from the “Mediterranea” University of Reggio Calabria. Prof. Luciano Caroprese chaired Session 1 on “AI and data science for cultural heritage”. After the invited talk of prof. Valentino Sangiorgio and Eng. Naomi Di Marco, dr. David Ramírez-Solana and dr. Samantha Di Loreto chaired Session 2 on “Acoustics and soundscape preservation”. After the invited talk of prof. Massimiliano Pepe, prof. Christian Morbidoni and dr. Alessandro Ricciutelli chaired Session 3 on “Smart diagnostics and pattern recognition”. Finally, dr. Cristina Cantagallo and dr. Davide Rapone chaired Session 4 on “3D reconstruction and simulation”. On December 4, 2025, at 10:00 AM (Italian time), prof. Christian Morbidoni and dr. Jacopo Bassetta chaired the Special Session ETech-CH.

The conference received 20 submissions, anonymously reviewed by 15 international research scholars from Italy, Ireland, and Brazil. Each submission was reviewed by at least two scholars from different institutions than the authors. Reviewers were not involved in co-authorship with the paper’s authors.

The peer review process was conducted using the EasyChair system, evaluating each paper on clarity, topic relevance, and methodology. Only papers with at least two acceptance scores and no reject scores were accepted.

The accepted papers were authored by 54 research scholars from Italy, Spain, France, Austria, Pakistan, Algeria, Liechtenstein, Czech Republic, and Tunisia, resulting in 14 full papers included in the Proceedings.

Session 1 featured three presentations on the application of Generative AI, Large Language Models (LLMs), and big data analytics for archival research and multimedia retrieval in cultural heritage. Session 2 presented three papers on acoustic heritage mapping, soundscape preservation, and acoustic diffusion solutions for historical sites. Session 3 included three presentations on smart diagnostics, symbol recognition in ancient inscriptions, stratigraphy analysis, and cognitive frameworks for heritage understanding. Session 4 presented two papers on advanced 3D reconstruction, photogrammetry datasets, texture classification, and surface unrolling techniques. Finally, the Special Session ETech-CH featured three presentations on emerging digital twin frameworks for multi-risk analysis, generative AI in design transformation, and digital strategies for industrial and complex heritage.

In total, VIPERC 2025 successfully hosted 45 participants.

9. Program

3 December 2025 (9 AM - 5.55 PM Italian time)

- (9 AM - 9.30 AM): Registration Desk
- (9.30 AM - 10 AM): Institutional greetings and welcome
 - Prof. Antonio Teti, Chief Digital Transition Officer of the University
 - Prof. Alessia Amelio, General Chair of VIPERC 2025
 - Prof. Sergio Montelpare, General Chair of VIPERC 2025
 - Prof. Valentino Sangiorgio, General Chair of VIPERC 2025
- (10 AM - 10.30 AM): Invited Speaker

- Prof. Francesco Carlo Morabito, “Mediterranea” University of Reggio Calabria, Italy. Talk: *Outcomes of the FAIR NAEL project: energy-efficient and sustainable technology AI solution for pattern recognition.*
- **Session 1. AI and data science for cultural heritage.** Chair: prof. Luciano Caroprese
 - (10.30 AM - 10.50 AM) Cristina Cantagallo, Giorgia Cianchino, Guido Camata, Luigi Berardi, Samuel Bignardi, Paolo Boncio, Giuseppe Brando, Maria Giovanna Masciotta, Bruno Pace, Valerio Piattelli, Simone Ripani, Enrico Spacone, Giovanna Vessia, Luciano Caroprese. *MULTI-TWIN: AI-based Digital Twins for Multi-Risk Analysis of Historic Centers.*
 - (10.50 AM - 11.10 AM) Johannes Schneider, Sinem Kilic, Daniel Stockhammer. *Empowering Clients: Transformation of Design Processes Due to Generative AI.*
 - (11.10 AM - 11.30 AM) Zulfiqar Ali, Israr Ur Rehman, Rehan Ali Qazi, Muhammad Ismail, Umair Shabbir, Muhammad Bilal Khan. *Scalable Multimedia Retrieval in Cultural Heritage Archives Using Big-Data Analytics.*
- (11.30 AM - 11.50 PM) Coffee break
- (11.50 AM - 12.20 PM): Invited Speaker
 - Prof. Valentino Sangiorgio and Eng. Naomi Di Marco, “G. d’Annunzio” University of Chieti-Pescara, Italy. Talk: *MUD-MADE project: Multi-objective optimization of Digitally MANufactureD Earth building components supported by neural networks.*
- **Session 2. Acoustics and soundscape preservation.** Chairs: dr. David Ramírez-Solana, dr. Samantha Di Loreto.
 - (12.20 PM - 12.40 PM) Samantha Di Loreto, Alessandro Ricciutelli, Valentino Sangiorgio, Sergio Montelpare. *Acoustic Heritage Mapping of Florence Historic Center: A Digital Soundscape Preservation Approach along the Vasari Corridor.*
 - (12.40 PM - 1 PM) David Ramírez-Solana, Valentino Sangiorgio, Javier Redondo, Muhammad Gulzari. *TPMS Wall Patterns to Improve Acoustic Diffusion in Cultural Heritage.*
 - (1 PM - 1.20 PM) Gino Iannace. *Acoustics of Vanvitelli’s place.*
- (1.20 PM - 1.30 PM) Discussion panel.
- (1.30 PM - 3.15 PM) Welcome lunch buffet
- (3.15 PM - 3.45 PM): Invited Speaker
 - Prof. Massimiliano Pepe, “G. d’Annunzio” University of Chieti-Pescara, Italy. Talk: *LIP3D project: Digital Tools and Immersive Technologies for the Virtual Reconstruction of Archaeological Heritage.*
- **Session 3. Smart diagnostics and pattern recognition.** Chairs: prof. Christian Morbidoni, dr. Alessandro Ricciutelli
 - (3.45 PM - 4.05 PM) Alessandro Locaputo, Martina Siderini, Davide Redaelli, Andrea Brunello, Nicola Saccomanno, Stefano Magnani, Giuseppe Serra. *EpiSignum: Taxonomy and Annotated Dataset for Symbol Recognition in Late Antique Latin Inscriptions.*

- (4.05 PM - 4.25 PM) Regina Finocchiaro, Samuele Biondi, Sergio Montelpare. *The Gestalt Principles for Cultural Heritage Understanding. The Ermete Novelli Theater Case Study: an a-Posteriori Methodological Application.*
- (4.25 PM - 4.45 PM) Ahmed Hazem Youssef, Halim Benhabiles, Adnane Cabani, Ruiwen He, Karim Hammoudi. *OMVMMLP: 3D Texture Classification by Orthographic Multi-View Data Characterization and MLP.*
- (4.45 PM - 5.05 PM) Coffee break
- **Session 4. 3D reconstruction and simulation.** Chairs: dr. Cristina Cantagallo, dr. Davide Rapone
 - (5.05 PM - 5.25 PM) Massimiliano Pepe, Donato Palumbo, Ahmed Dewedar. *Collection of 3D Data Useful for Surveying and Digitizing Cultural Heritage Using UAV Photogrammetry and Lidar Sensors: Iuvanum 3D Dataset.*
 - (5.25 PM - 5.45 PM) Vincenzo Saverio Alfio, Alessia Amelio, Massimiliano Pepe, Domenica Costantino. *Is OpenAI the Future for Historical 3D Reconstruction? Analysis of a Suitable Pipeline Applied to the Iuvanum Case Study.*
- (5.45 PM - 5.55 PM) Discussion panel
- (7.30 PM) Social dinner

4 December 2025 (9 AM - 12.45 PM Italian time)

- (9 AM - 10 AM): Registration Desk
- **Special Session ETech-CH: Emerging Technologies for History and Memory. Cultural and Industrial Heritage Between Complexity and Digital Transformation.** Chairs: prof. Christian Morbidoni, dr. Jacopo Bassetta.
 - (10 AM - 10.30 AM): Welcome speech
 - * Eng. Domenico D’Orazio, Unidav Rector’s Delegate for ICT
 - * Prof. Christian Morbidoni, Chair of ETech-CH
 - * Dr. Jacopo Bassetta, Chair of ETech-CH
 - (10.30 AM - 10.50 AM) Aaron Giner, Reinhold Preiner. *AnRoll: Analytic Unrolling of Painted Pottery Surfaces.*
- (10.50 AM - 11.10 AM) Coffee break
 - (11.10 AM - 11.30 AM) Elisa Angeles Fernández. *Industrial Landscapes, Photographic Description and Generative AI: Testing GPT-5.0 'Thinking' and 'Instant'.*
 - (11.30 AM - 11.50 AM) Amani Mansouri. *Decoding Diplomacy: GPT in Historical Archives, AI neutrality, Linguistic Biases and Multilingual Challenges (Tunisia Czechoslovakia, 1956–1992).*
- (11.50 AM - 12 PM) Discussion panel
- (12 PM - 12.30 PM) Award ceremony
- (12.30 PM - 12.45 PM) Closing speech
- (12.45 PM - 2.30 PM) Closing lunch buffet

Declaration on Generative AI

During the preparation of this work, the author(s) used Google Gemini in order to: Grammar and spelling check, Paraphrase and reword. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the publication's content.

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