

CIPA 2025 Seoul - Heritage Conservation from Bits. From Digital Documentation to Data-driven Heritage Conservation: Preface

Hyeseung Shim^{*1}, Seungae Choi², Wonjin Lee², Hae Un Rii^{3,4}, Sungyoung Kim⁵

¹ Hong Kong Shue Yan University, Hong Kong SAR - hsshim@hksyu.edu, hs.shim@kaist.ac.kr

² National Museum of Korea, Republic of Korea - (eroschoi, wonjin81)@korea.kr

³ Dongguk University, Republic of Korea - riihaeun@gmail.com

⁴ ICOMOS International Scientific Committee on Places of Religion and Ritual - riihaeun@gmail.com

⁵ Korea Advanced Institute of Science and Technology, Republic of Korea - sungyoung.kim@kaist.ac.kr

The content of this publication brings together papers presented at the 30th CIPA 2025 Symposium, entitled "*Heritage Conservation from Bits: From Digital Documentation to Data-driven Heritage Conservation*." The selection of the contributions was based on a peer review of the full papers by the CIPA 2025 Seoul Scientific Committee, and a total of 48 contributions are included in the ISPRS Annals publication. The objective of this publication is to explore the role of digital data in cultural heritage conservation, management, and dissemination through the integration of advanced digital technologies. It highlights how diverse forms of digital data can contribute to improving the state of conservation of cultural and natural heritage, enriching interpretation and presentation, and demonstrates their significance when coupled with human expertise and professional insight.

The 30th CIPA International Symposium, jointly hosted and organized by the National Museum of Korea (NMK) and the Korea Advanced Institute of Science and Technology (KAIST), took place at Education Center in NMK from 23rd to 29th August 2025 in Seoul, Republic of Korea, with the support of CIPA Heritage Documentation (CIPA-HD), International Council on Monuments and Sites (ICOMOS), International Society for Photogrammetry and Remote Sensing (ISPRS), and ICOMOS Korea.

In today's rapidly evolving digital landscape, heritage conservation, both cultural and natural heritage, stands at a transformative crossroads where data has emerged as the cornerstone of innovative conservation approaches and strategies. Digital data now serves as more than mere documentation or recording. It functions as a dynamic infrastructure for predictive conservation, real-time monitoring, and evidence-based decision making in every conservation practice, and it also expands opportunities for public appreciation and engagement with heritage in cultural institutions, such as museums. Data-driven conservation enabled by the convergence of artificial intelligence (AI), machine learning, and cutting-edge digital technologies has empowered not only heritage professionals but also a wide range of stakeholders. This enables to establish and implement proactive and scientifically informed conservation measures that can anticipate and mitigate potential threats and imminent risks caused by climate change or natural disasters before they manifest.

Such advances, however, demand more than the adoption of new tools and technology. They call for rethinking how we structure, prioritise, and apply our practices within an evolving, data-driven conservation ecosystem. The ideas underpinning this year's theme are central to the current discourse in our field, reflecting our mission to bridge technology and heritage conservation in ways that generate productive synergies. Achieving this requires both innovation and critical reflection, and it is through the insight of heritage professionals, engineers, academics, and communities that these capacities can be fully realised, ensuring that innovation strengthens our mission to safeguard heritage for present and future generations.

This symposium represents a critical moment in the evolution of heritage science, where the systematic application of data-driven methodologies promises to create more resilient, accessible, interpretive, and scientifically grounded approaches to safeguarding and enjoying our heritage for current and future generations. The papers presented here demonstrate how the intelligent use of digital data by connecting to various digital technologies not only supports current conservation practices but also transforms the very nature of how we understand, conserve, experience, and share our cultural inheritance. This transformation can only be achieved through the active integration and interpretation of heritage professionals' expertise with technological innovation, allowing people to appreciate, understand and engage with their heritage in more meaningful ways.

The contributions in this publication are aligned with the Symposium's themes with a focus on conservation, monitoring, and dissemination of heritage with the adoption and integration of innovative technologies for documenting both cultural and natural heritage sites, built heritage, underwater heritage, and intangible heritage. Topics of presented papers cover 3D laser scanning and the analysis of point cloud data; photogrammetry and reality-based modelling; AI-powered analysis, database design, and heritage data management; architectural heritage documentation and HBIM; digital applications in the museum context; educational applications for participatory learning of cultural heritage; digital conservation for underwater archaeology; heritage inventories, innovative digital heritage projects; heritage data platforms and collaborative knowledge sharing; safeguarding the heritage at risk using digital technology; smart management technology for cultural heritage; spatial documentation and analysis using GIS; strategy, standardisation and ethics; and virtual, augmented, and extended reality for heritage interpretation and presentation.

The Symposium was kicked off by a two-day pre-symposium programme (23rd and 24th August), which included seven workshops led by experts in their respective fields (four workshops on the 23rd and three on the 24th). The Opening Ceremony took place on the 25th of August at Grand Hall in the Education Center, NMK, followed by five days of 42 thematic technical sessions.

The Symposium presented four invited keynotes by distinguished speakers: Maurizio Forte (Adviser on Neuroaesthetics, U.S. Department of State, Bureau of Overseas Building Operations; Professor at Duke University, U.S.); Kostas Konstantinidis (Founder and CEO, PostScriptum LTD Greece; Europeana Delegate to China); Peng Tang (Professor at Southeast University, China; Deputy Director, National Key Laboratory of Urban and Architectural Heritage Conservation of Ministry of Education, China), and Mario Santana Quintero (Professor at Carleton University, Canada; Faculty member of Carleton Immersive Media Studio; Senior fellow at International Centre for Interpretation and Presentation of World Heritage Sites).

Moreover, the Symposium included three special sessions: Roundtable on People-Centred Digital Twins for World Heritage (UNESCO Chair on Digital Twins for World Heritage Conservation, an initiative led by Carleton University and the University of Azuay); Colloquium on Digital Heritage Reimagined at NMK: Innovative Practices for Engagement, Access, and Conservation by NMK; and Panel by Scientific Committee of Cultural Heritage Conservation by Digitalization (CHCD) under ICOMOS China.

Last but not least, this Symposium offered various cultural programmes such as guided museum tours, generously supported by NMK, to enable participants to experience and enjoy cultural heritage in the Republic of Korea. The in-person attendance of 580 participants from 47 countries is an encouraging testament to the strong global interest in the CIPA community.

We, as editors of these ISPRS Annals proceedings, would like to extend our heartfelt gratitude to all the authors, the International Scientific Committee, and the local Organizing Committee, without whom this publication would not have been possible.

Hyeseung Shim*
Symposium Director of CIPA 2025 Seoul
Seoul, 25 September 2025