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ESEMPI DI ARCHITETTURA

La collana editoriale Esempi di Architettura nasce per divulgare pubblicazioni scientifiche edita dal mondo universitario e dai centri di ricerca, che focalizzino l'attenzione sulla lettura critica dei progetti. Si vuole così creare un luogo per un dibattito culturale su argomenti interdisciplinari con la finalità di approfondire tematiche attinenti a differenti ambiti di studio che vadano dalla storia, al restauro, alla progettazione architettonica e strutturale, all'analisi tecnologica, al paesaggio e alla città.

Le finalità scientifiche e culturali del progetto EDA trovano le ragioni nel pensiero di Werner Heisenberg Premio Nobel per la Fisica nel 1932.

È probabilmente vero, in linea di massima, che nella storia del pensiero umano gli sviluppi più fruttuosi si verificano spesso nei punti d'interferenza tra diverse linee di pensiero. Queste linee possono avere le loro radici in parti assolutamente diverse della cultura umana, in diversi tempi ed in ambienti culturali diversi o di diverse tradizioni religiose; perciò, se esse veramente si incontrano, cioè, se vengono a trovarsi in rapporti sufficientemente stretti da dare origine ad un'effettiva interazione, si può allora sperare che possano seguire nuovi ed interessanti sviluppi.

Esempi di Valore

Ogni concetto di valore pone le basi per aprire un dialogo costruttivo e di confronto tra esperienze ed approcci metodologici diversificati in relazione ai principi culturali riguardanti la conservazione del patrimonio e quindi della sua trasmissione come dono per le generazioni future. Questo enunciato costituisce l'impegno scientifico e divulgativo della collana Esempi di Valore. La consapevolezza dei contenuti di questo enunciato consente di analizzare con maggiore oggettività le dinamiche che caratterizzano i differenti approcci teorici e metodologici che si possono riscontrare non solo tra diverse realtà geografiche, ma anche all'interno di uno stesso Paese tra contesti socio-culturali diversificati. La conoscenza della diversità diventa quindi la risorsa principale e fondamentale per il rispetto e la conservazione della stessa diversità.

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CULTURAL INFORMATICS

CHALLENGES AND PROSPECTS

Edited by

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OLIMPIA NIGLIO**

Foreword by

VIRGINIO CANTONI

Collaborative initiative of

**CENTRE FOR INFORMATICS RESEARCH AND DEVELOPMENT (CIRD)
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FOREWORD

CULTURAL HERITAGE IN THE AGE OF GENERATIVE ARTIFICIAL INTELLIGENCE

VIRGINIO CANTONI

Cultural heritage is the sum of tangible and intangible assets that a community considers to be of historical, artistic, scientific, or cultural value, and wishes to preserve and pass on to future generations. It is not limited to monuments and collections of objects but also encompasses all the living traditions passed down from ancestors: oral expressions, including language, performing arts, social practices, rituals, and festivals, as well as knowledge related to nature and the universe, and traditional crafts.

This heritage constitutes a fundamental resource, capable of strengthening collective identity and memory. Safeguarding and enhancing it means ensuring its continuity, protecting cultural diversity, stimulating creativity, and promoting sustainable development. In the context of increasing globalization, this plays a strategic role in the preservation of cultural specificities. Knowledge and understanding of these assets foster mutual respect and the coexistence of different lifestyles. Their value lies not only in the cultural manifestation itself, but above all in the heritage of knowledge and skills handed down over time.

Computer Science, and Artificial Intelligence (AI) in particular, is undergoing a period of extraordinary development, emerging as a catalyst for change in the way we live. AI-based technologies have been demonstrating widespread impact and enormous potential for transforming social and economic dynamics for years. Although rooted in the mid-twentieth century, the real leap forward came with the emergence of machine learning in the early 2000s and, more recently, with deep learning, which allows us to extract knowledge and value from the analysis of enormous amounts of data.

Thanks to historic international investments, this transformation has transcended academic boundaries, becoming a global social phenomenon. With the advent of research projects for the development of Large Language Models (LLMs) capable of recognizing and generating text, and Large Multimodal Models (LLMs) that process text, images, audio, and video, Foundation Models are increasingly being developed by private companies, backed by billion-dollar investments, such as Microsoft's initial \$10 billion investment in OpenAI or Amazon's \$4 billion acquisition of Anthropic. The launch of ChatGPT has significantly contributed to spreading unprecedented awareness of the potential of digital technology, accompanied, however, by intense debate on the limitations and risks of these technologies.

Adopting a passive role as mere AI users could, in the long run, foster processes of cultural standardization and stereotyping. It is therefore crucial to promote the development of AI systems capable of representing and

enhancing the specificities of each country, investing in research, infrastructure, and projects focused on country-specific data and models. This avoids importing solutions born in different social and value contexts, while simultaneously protecting cultural and environmental heritage and integrating AI into educational processes.

The education sector, in particular, is witnessing a rapid expansion of AI applications, which, however, must be carefully managed to preserve quality, territorial identity, and cultural heritage. It is essential to develop strategies tailored to the national context, avoiding initiatives disconnected from real local needs and values.

This volume was compiled with aim of supporting the protection and preservation of those assets - tangible and intangible - considered precious by a community: buildings, monuments, works of art, archaeological sites, traditions, languages, knowledge, and practical skills. It invites young people to explore and appreciate not only their own cultural heritage, but also that of other communities, thus broadening their awareness, understanding, and sense of belonging, becoming responsible citizens and promoters of cultural diversity.

The volume explores examples ranging from natural to historical, religious, and artistic expressions: from early university experiences to the development of art forms such as music, painting, and graphics. Among the illustrated testimonies are: religious landscapes in sacred contexts of culture, the suburban landscapes, people, costumes, and emotions portrayed by Namboothiri, custodians of historical memory and traditions, with the artist himself donating his

works without ever selling them; the Gita-Govinda project for the integrated learning of Indian literature, music, dance, and art; the city of Kashi (Benares), one of the oldest world heritage sites; the Greek Museum of Indian Musical Instruments in Athens; the Durga Festivals along the Bhagirathi; and Kanthaloor Salai, with the use of information technology for the study and preservation of an ancient university in South India.

Each example demonstrates how precious the heritage of an ancient civilization is and how it must be preserved and shared. The descriptions in this volume are the result of careful and passionate work, capable of conveying immersion and depth that are difficult to replicate even by the most advanced forms of generative AI.

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PREFACE

FOR THE NOBLE CAUSE OF PRESERVATION OF CULTURE IN THE DIGITAL AGE

GIREESH KUMAR THEKKUM KARA, OLIMPIA NIGLIO

Significant digital advancements are revolutionizing our approach to understanding, preserving, documenting, and sharing cultural heritage - tangible, intangible, and landscape, thereby placing the field of cultural informatics at a crucial juncture. Cultural Informatics is an interdisciplinary area that combines the humanities, social sciences, computer science, data science, and engineering to support the entire lifecycle of cultural information through digital tools and methods. This edited volume, titled 'Cultural Informatics: Challenges and Prospects,' explores the opportunities for managing cultural heritage and emphasizes the role of digital technologies and tools, which are vital for developing sustainable information systems to organize, conserve, administer and disseminate cultural data. This volume compiles twelve scholarly articles discussing the interconnection between culture, technology, and society. It offers insights from academics and practitioners, including theoretical frameworks, practical case studies, innovative applications, and future development perspectives. It also demonstrates that the challenges of the 21st century demand a far broader and more collaborative approach.

Paper 1, 'Cultural Heritage Informatics (CHI) and Reconnecting With Your Culture (RWYC): Reciprocity and Prospects,' emphasizes

cultural heritage preservation through a multidisciplinary approach to CHI. It advocates that integrating education and ICTs can be supported by pedagogical programs like 'Reconnecting With Your Culture' to enhance CHI's advantages. Using informatics for both preservation and cultural reconnection remains a central theme.

Paper 2, 'Building Multidisciplinary System for Heritage Conservation with Environment as Focal Point,' argues that effective heritage conservation requires a system that integrates natural science, technology, and the humanities, with the environment as the focal point. Paper 3, 'Lines Conserving Cultural Heritage and Human Emotions,' makes a strong case for creating a digital archive of works of Artists like Namboothiri, emphasizing the importance of preserving intellectual and artistic legacies which embeds visual data of evolution of culture in different regions. The paper also highlights how some Indian art forms are underappreciated and suggests an informatics-based solution to prevent the loss of crucial cultural treasure works.

Paper 4, 'The Origins of Cultural Computing,' offers a historical perspective, reproducing a seminal 1990s article by Ranjit Makkuni. His vision for an N-Dimensional museum of the future, realized through multimedia Tibetan Thangka applications, shows that modern cultural computing was planted decades ago. His foresight, now realized, highlights the power of a visionary approach. Paper 5, 'Reimagining the Heritage of Banaras,' discusses heritage preservation challenges amid rapid urbanization in Kashi, the cultural capital of India, and notes that the city has lost its unique qualities due to 'unplanned and unscientific development.' The paper proposes 'nerdy digital solutions' using ICT, artificial intelligence, and machine learning to protect the city's spiritual and cultural essence, emphasizing technology's role in combating neglect and sprawl.

Paper 6, 'The Soft Power of Indian Music,' shows how heritage boosts cultural diplomacy. The Indian Musical Instruments Museum in Greece demonstrates how museums and music promote international understanding and peace. This shifts cultural informatics from preservation to fostering global harmony. Similarly, Paper 7, 'Virtual Museum Builder (VMB) and Augmented Reality (AR) Programmes for Developing Cultural Heritage Information System (CHIS),' highlights the challenges in cultural heritage data collection, standardization, and interoperability. As cultural institutions digitize collections, inconsistent standards risk creating siloed data that hampers sharing and integration, threatening a connected global cultural heritage network.

Paper 8, 'Great and Little Traditions of Durga Festivals in the Banks of River Bhagirathi in West Bengal,' offers a captivating case study of the challenges involved in using informatics to preserve and transmit intangible cultural heritage. It emphasizes how informatics can document the vibrant colors and cultural details of the Durga festival, a UNESCO-listed Intangible Cultural Heritage, for sustainable tourism and preservation. While technology can make heritage more accessible, it also risks increasing the digital divide. Paper 9, 'Kanthaloor Salai,' directly addresses this by suggesting the use of non-invasive technologies like Ground-Penetrating Radar to survey ancient university sites, avoiding physical excavation that would be 'strongly opposed by the local population.' This exemplifies a thoughtful, ethical, and collaborative approach to cultural informatics.

Moving to the present, Paper 10, 'Immersive ESL Learning Through Heritage,' offers a compelling example of using technology to enhance both cultural and educational experiences. It describes a 360° interactive experience of the Qanat of Palermo, integrated into

an English as a Second Language (ESL) lesson plan. This approach clearly shows how cultural heritage can serve as a meaningful context for learning, connecting historical sites with modern educational goals. Paper 11, 'Enriching Digital Experiences: Valuing Visual Arts, Performances and Cultural Heritage Through Digital Exhibitions and Interactions,' introduces the WallMuse application. By exploring its features, the paper demonstrates how open-source digital tools can cross geographical boundaries to promote global dialogue and understanding. Paper 12, 'Application of Informatics for Mediation of Intangible Heritage,' describes an Erasmus+ project that uses digital tools to help conserve and promote intangible cultural heritage within a vocational education framework.

This collection makes a significant contribution to the expanding field of cultural informatics. It demonstrates that the challenges of heritage preservation are as complex as the cultures they seek to protect. Nonetheless, each paper conveys a clear message: the possibilities, fostered through collaboration, innovation, and a profound respect for heritage, are limitless.

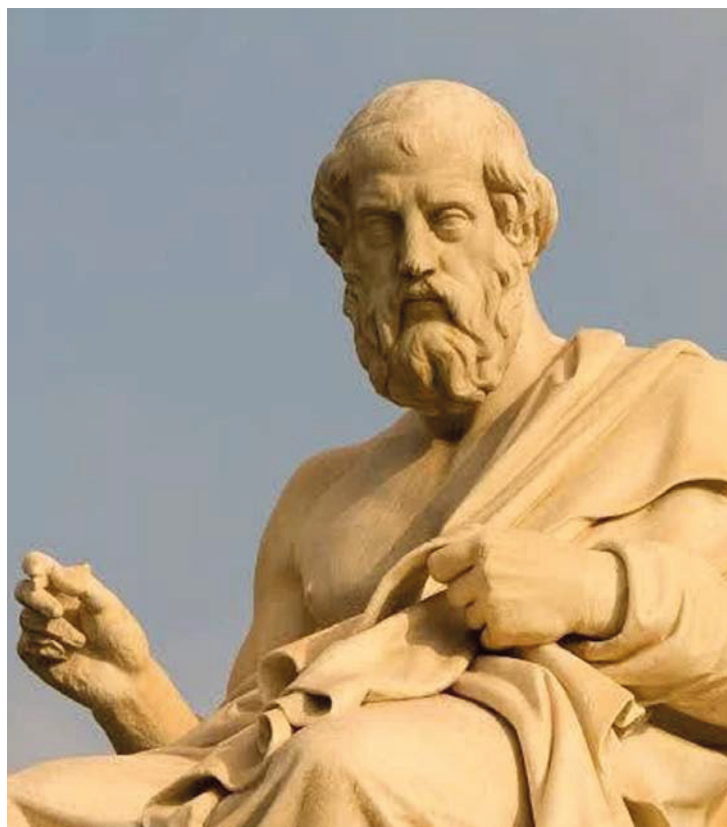
As we, the editors, reflect on the work of these 15 authors, we are left with a renewed sense of purpose. This book is more than just a compilation of research; it is a call to action. It invites scholars, practitioners, policymakers, and enthusiasts to join the conversation, to bridge the gaps between disciplines, and to harness the power of technology to ensure that our shared human story endures for generations to come. We hope this volume serves as an essential guide and a source of inspiration for everyone dedicated to the noble cause of preservation of culture in the digital age.

Gireesh Kumar Thekkum Kara
Olimpia Niglio

CULTURAL HERITAGE INFORMATICS (CHI) & RECONNECTING WITH YOUR CULTURE (RWYC): RECIPROCITY AND PROSPECTS

RANA P.B. SINGH, OLIMPIA NIGLIO

Assessing the status and role of CHI in various contexts, learning, and understanding, here an attempt is made to present a review and appraisal of the contemporary scenario. Together with the ICTs various niches and attributes of CHI have the potential for promoting understanding and preservation of cultural heritage. Deeply-rooted education also plays an important role in this direction, so the RWYC. CHI will also help in clarifying and justifying the unity and integrity between Culture and Nature. The current debate in CHI pens space of the new corners on the line of multidisciplinary approaches. These issues are illustrated in this paper.



CHI: Following the Path

The idea of cultural preservation exists on the ground of a deeper human quest to learn from the continuity of the past, linking it to present existence, while passing on this Spatio-temporal path of visioning and creating the future. Of course, this term refers to a variety of functions that preserve and protect heritage attributes. Moreover, to different people and traditions, culture means different things in a different sense (see Doctors 2021). Similarly, every human society has its cultural heritage, distinguished and characterised by its codes and symbolism. Culture and its history inherently include morals, ethics, belief systems, and lifeways. They form a people's national image and identity. Culture encompasses a society's ideals and ethics, traditions, and rituals, arts, structures, archetypal and built representations, cosmogony, and cosmological imposition, landscape meanings and metaphysics, and values, among other things. From an overall perspective, culture defines people's behavioural patterns and its manifested representation between Humans and Nature. Heritage Landscape is conceived as a code and mode of Culture-Nature reciprocity and interconnectedness.

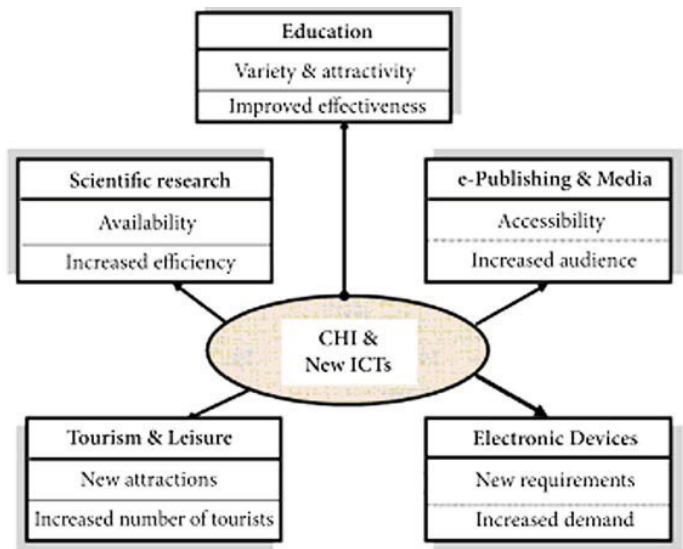


Figure 1. Influences of Modern CHI: Sectors, Characteristic Features, and Expected Impact (Source: Adapted from Filip *et al.* 2001).

To walk on the above path, “while linking understanding, documenting, awakening, initiating rational planning, attracting global society for concern, and also deepening the sense of belongingness, multidisciplinary research and practice have emerged recently, i.e., Cultural Heritage Informatics (CHI). The CHI is primarily concerned with the role of information and computing technologies (ICTs) to support the creation, capture, organization, and pluralization of culture and its attributes in the form of varieties and distinctiveness, linking locality to universality—convergence into the cosmic frame of heritage” (Singh 2022, p. 5). The CHI is a multidisciplinary subject involving and integrating the two: cultural heritage studies, and an application of information technology for the prime