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Computer Science Applications to Cultural Heritage

Introduction

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DAIS, Ca' Foscari University of Venice

Academic year 2017/2018



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About this course

Official UNIVE course page:

<http://www.unive.it/data/course/254854>

Unofficial course page:

<http://www.dais.unive.it/~bergamasco/csa2ch.html>

- 48 hours frontal lessons (lab included)
- Timetable:
 - Monday 8:45 - 10:15
 - Friday 12:15 - 13:45
- Code: CM0512

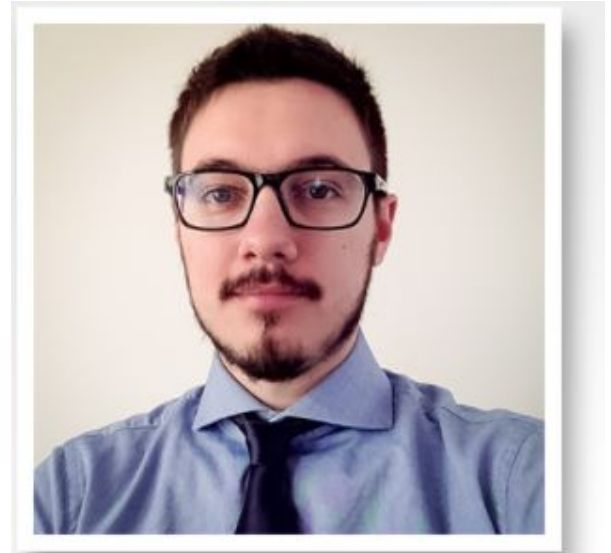


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About the teacher

Filippo Bergamasco

<http://www.dais.unive.it/~bergamasco>



- I'm currently a postdoctoral research fellow at DAIS (Dipartimento di Scienze Ambientali, Informatica e Statistica)
- Member of the KiiS research group. Research interests: 3D reconstruction, camera calibration, ego-motion estimation, photogrammetry etc.

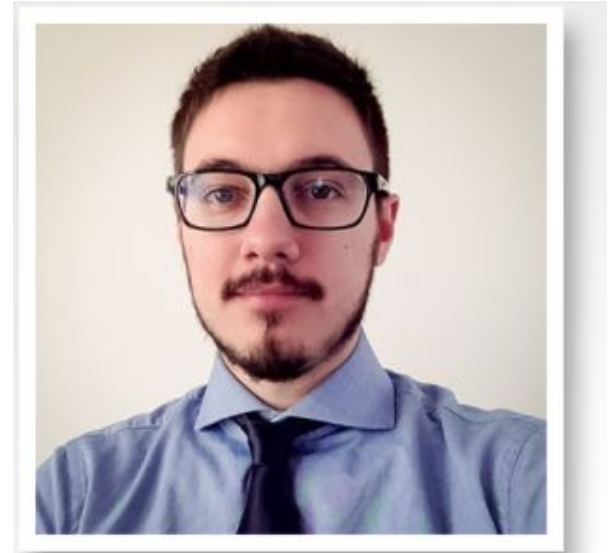


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About the teacher

Filippo Bergamasco

<http://www.dais.unive.it/~bergamasco>



Currently teaching:

- This course (of course :)
- Computer Vision 2017/2018

Previously:

- Computer Vision 2016/2017
- Discrete Mathematics
- Matematica di base

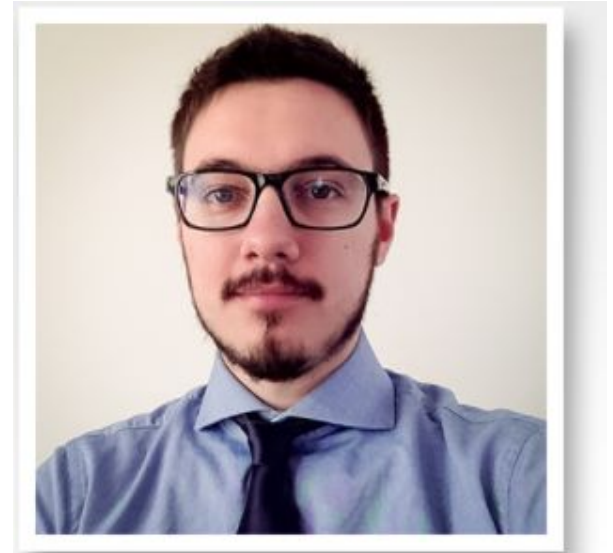


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About the teacher

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For any question regarding this course, please contact me
via mail: filippo.bergamasco@unive.it

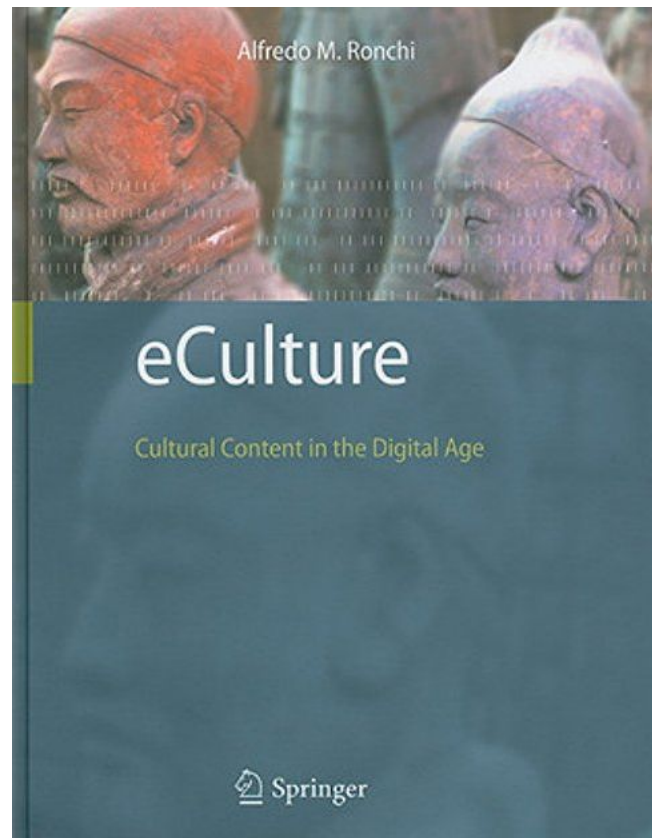
Or come visit me at my office (Building Z, Room 7)



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Referral Texts

- Alfredo M. Ronchi, "ECulture: Cultural Content in the Digital Age", Springer-Verlag Berlin Heidelberg, 2009
(DOI: 10.1007/978-3-540-75276-9)

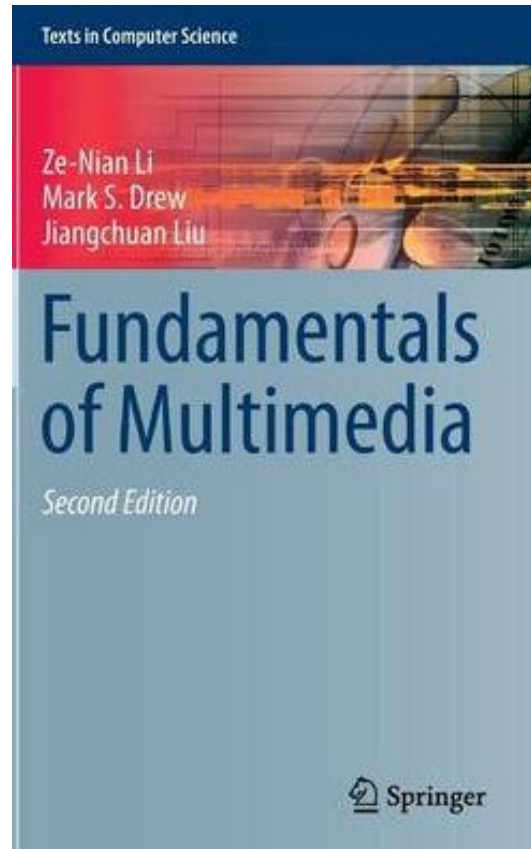




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Referral Texts

- Z. Li, M. Drew and J. Liu. "Fundamentals of Multimedia", Springer International Publishing, 2014
(DOI: 10.1007/978-3-319-05290-8)

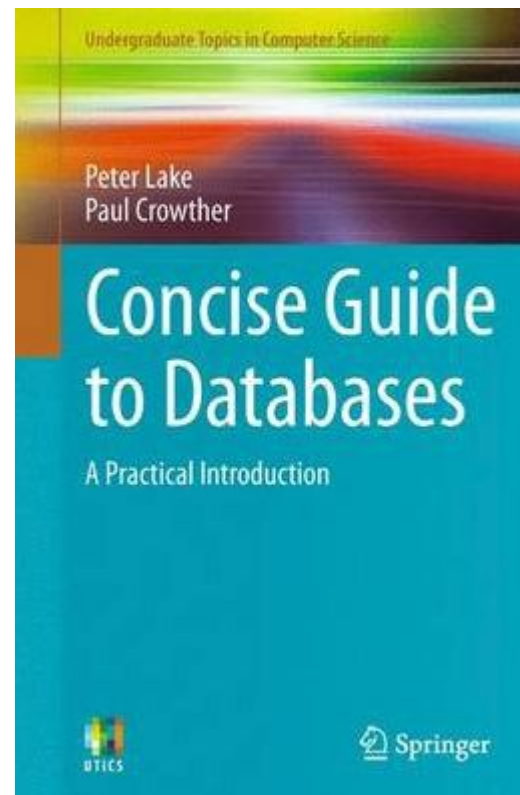




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Referral Texts

- P. Lake, P. Crowther, "Concise Guide to Databases", Springer London, 2003
(DOI: 10.1007/978-1-4471-5601-7)





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About the exam...

Final assessment will be in the form of a written exam with 3-4 open questions

- Questions can comprise all the topics discussed during the course
- Some questions may require solving short exercises (especially regarding databases or metadata)
- Evaluation is valid indefinitely (1 year guarantee, following years may depend to possible different Professors)



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About the lab/seminars

We will spend some hours in the computer lab so you can put your hands on some of the techniques discussed during the course

Depending on how the course evolves, we can organize short seminars on selected topics (which may influence the final evaluation)



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Why this course?

*“**ICTs** are the most powerful means to **produce**, **preserve** and **communicate** the fruits of human creativity, including information, know-how, knowledge, and works of art.”*

*Passage from the “Vienna Conclusions” of the conference
“ICT and Creativity: Towards a Global Cooperation for Quality
Content in the Information Society”,
held in Vienna, Austria, 23 June 2005*



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Why this course?

We won't restrict on the mere information and communication **technologies**, but on a broader range of computer science applications, to:

- Acquire
- Analyze (to extract knowledge!)
- Visualize and disseminate

...**fruits of human creativity**, which will be generally referred in this course as **content**



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Content and cultural heritage

Before looking in depth at the relationship between cultural heritage and computer science/technology, we should try to define which class of objects (content) we associate with the words cultural heritage.

Works of art typically associated with “cultural heritage”:

- Paintings
- Frescoes
- Sculptures
- Monuments



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Content and cultural heritage

However, most cultural heritage consists of “minor” cultural and artistic objects, such as medals, coins, plasters, silver, furniture, musical instruments, knick-knacks, ethno-graphic collections, etc.

To which we can also add (if we consider ethnographic collections):

- Movies and TV recordings
- Pictures
- Speech/Recordings
- Etc.

Content and cultural heritage

Cultural heritage should be considered to be **the sum of the experiences that shaped a society...**

... and so it should include a broad range of content from different domains.





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Tangible/Intangible heritage

At a higher level, we can divide the cultural heritage to **tangible** (like tangible objects and works of art we listed before) and **intangible** which is **transmitted from generation to generation**, is **constantly recreated** by communities and groups in response to their environment and **provides** them with a **sense of identity** and continuity, thus promoting respect for cultural diversity and human creativity



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Intangible heritage: a definition

The **practices, representations, expressions**, as well as the knowledge and skills, that communities, groups and, in some cases, individuals recognise as being part of their cultural heritage

Synonym: *living cultural heritage*

Comprise the following domains:

- Oral traditions and expressions, including language as a vehicle of intangible cultural heritage
- Performing arts
- Social practices, rituals and festive events
- Traditional craftsmanship
- etc.



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Intangible heritage

Safeguarding intangible cultural heritage is a critical aspect which can take great advantage of computer science applications, including methods and technologies to:

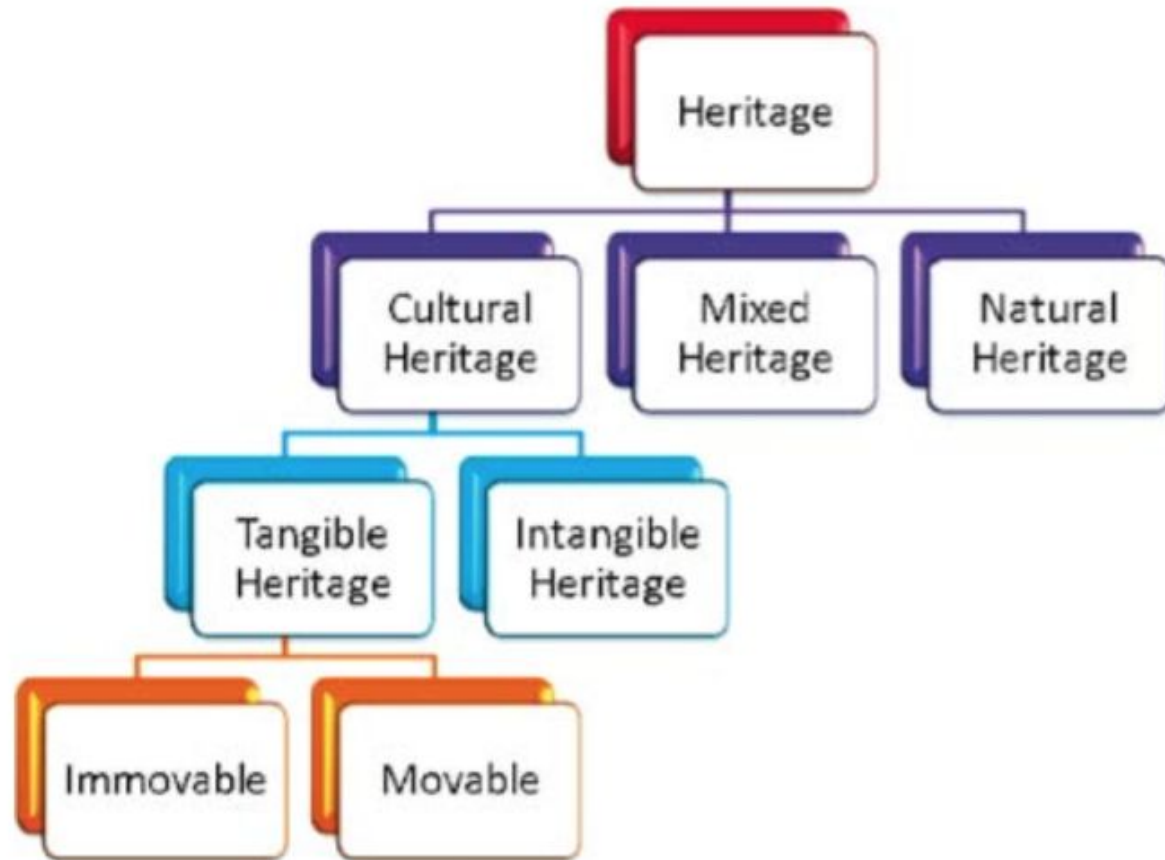
- Identify
- Document
- Research
- Preserve
- Promote
- Transmit

Such kind of content



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Heritage taxonomy





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Content and the digital age

Over the centuries, mankind has produced an ever-increasing amount of content in multiple formats, using multiple techniques and technologies.

- Some content becomes obsolescent and disappears
- Some content will survive to become our legacy to future generations

How is it has been typically preserved?

- Oral traditions
- Performing arts and rituals
- Signs, symbols, ideograms and alphabets (written)



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Content and the digital age

The printing press was one of the last true revolutions in content management as it enabled the unlimited **reproduction** of texts at limited cost.

Today we are facing a potential new revolution (even bigger than the printing) thanks to the **Digital Age**.

Digital Age enables not only the reproduction, but also the **transfer, dissemination, analysis**, and **preservation** of the content.



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Computer Science applications

Computer Science is the driving force of this digital revolution and can be effectively used to assist and enhance the three main activities usually associated with cultural heritage:

Conservation

Research

Exploitation



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Course syllabus

The path from the “originals” to the dissemination and exploitation of cultural content through ICT usually starts with the creation of so-called digital originals via **digitisation**

The first part of this course will be devoted to the acquisition (digitization) of the content to different media:

- Text
- Images
- Audio
- Video
- 3D shapes



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Course syllabus

One of the main applications of computer science to cultural heritage concerns the selection of appropriate filing systems and data structures.

The second part of this course will be devoted to the storage and organization of the digitized content:

- Databases
 - Relational
 - Object oriented
 - GIS
- Metadata
 - XML
 - Dublin Core



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Course syllabus

Probably the most important aspect of computer science is in the (possibly automatic) extraction of knowledge from data collections

The third part of the course will give a practical overview of data science applications:

- Data Mining
 - KDD
 - Supervised/Unsupervised learning
- Analysis
 - Visualization
 - Inference



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Course syllabus

Finally, recent advances in multimedia technologies can improve the way in which content is exploited and disseminated for future generations.

The fourth part of the course will explore fruition and advanced visualization of cultural heritage content and knowledge, including:

- Web technologies and mobile apps
- Computer graphics
- Virtual and Augmented Reality
- Serious games



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Case studies

Omeka is an open-source CMS for online digital collections (like wordpress for museums)

<http://omeka.org/>

The screenshot shows the Omeka.org website. The header has the Omeka logo and a search bar. Below the header, there are four colored boxes: 'Serious Web Publishing', 'Cost-Effective Design', 'Flexible and Extensible', and 'Free and Open Source'. The 'Serious Web Publishing' section contains text about creating complex narratives and sharing rich collections, with a 'Learn More' link. Below this is a 'Download Omeka' button with a download icon and text 'Linux, Apache, MySQL5, PHP5'. To the right of the download button is a 'System Requirements' link and a 'No server? Try Omeka.net!' button. The 'Omeka in Action' section features a 'Tour Omeka' video player. The 'News' section has a headline 'Omeka.net Refreshed and Renewed' dated 'August 28, 2017', followed by a paragraph about the launch of a new look for Omeka.net and many new benefits for users. At the bottom of the news section is a 'Continue reading...' link. The 'Previous Posts' section lists 'Annotating Washington with Exhibit Image Annotation'.



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Case studies

Project Gutenberg is a volunteer effort to digitize, archive and distribute cultural works, to encourage the creation and distribution of eBooks.

<https://www.gutenberg.org/>

The screenshot shows the Project Gutenberg website. At the top is the Project Gutenberg logo. Below it is a search bar with the text 'search for books'. To the right of the search bar is a list of links: 'Browse Catalog', 'Bookshelves', 'Main Page', 'Categories', 'News', and 'Contact Info'. Below this list is a section titled 'Project Gutenberg appreciates your donation!' with a 'Donate' button and a link 'Why donate?'. At the bottom, there is a section 'in other languages' with links for 'Português', 'Deutsch', and 'Français'. At the very bottom, there is a logo for 'hosted by ibiblio'.

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Case studies

Founded in 1971 by Michael S. Hart, it is the oldest digital library!

Contains over 38,000 full-text e-books.

The screenshot shows the Project Gutenberg homepage. At the top is the Project Gutenberg logo. Below it is a search bar with the text 'search for books'. To the left of the search bar is a vertical menu with links: 'Browse Catalog', 'Bookshelves', 'Main Page', 'Categories', 'News', and 'Contact Info'. Below the search bar is a section titled 'Project Gutenberg appreciates your donation!' with a 'Donate' button and a link 'Why donate?'. At the bottom is a section 'in other languages' with links for 'Português', 'Deutsch', and 'Français'. A small logo for 'hosted by ibiblio' is at the very bottom.

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Google Cultural Institute is "an effort to make important cultural material available and accessible to everyone and to digitally preserve it to educate and inspire future generations."

<https://www.google.com/culturalinstitute/about/partners/>

Google
CULTURAL
INSTITUTE

DIGITIZE

ORGANIZE

PUBLISH

ART TALKS

OUR HISTORY

JOIN US



GOOGLE CULTURAL INSTITUTE

FOUNDED IN 2011, THE GOOGLE CULTURAL INSTITUTE IS A NOT-FOR-PROFIT INITIATIVE THAT PARTNERS WITH CULTURAL ORGANIZATIONS TO BRING THE WORLD'S CULTURAL HERITAGE ONLINE. WE BUILD FREE TOOLS AND TECHNOLOGIES FOR THE CULTURAL SECTOR TO SHOWCASE AND SHARE THEIR GEMS, MAKING THEM MORE WIDELY ACCESSIBLE TO A GLOBAL AUDIENCE.



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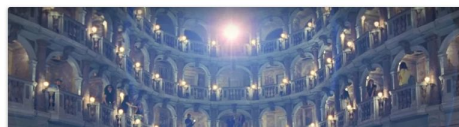
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One interesting part of Google Cultural Institute is the **Google Arts and Culture** (formerly Google Arts Project) which is an online platform to access high-resolution artworks hosted by a network of partner museums

<https://www.google.com/culturalinstitute/beta/?hl=it>



Accadde oggi ven 15 set





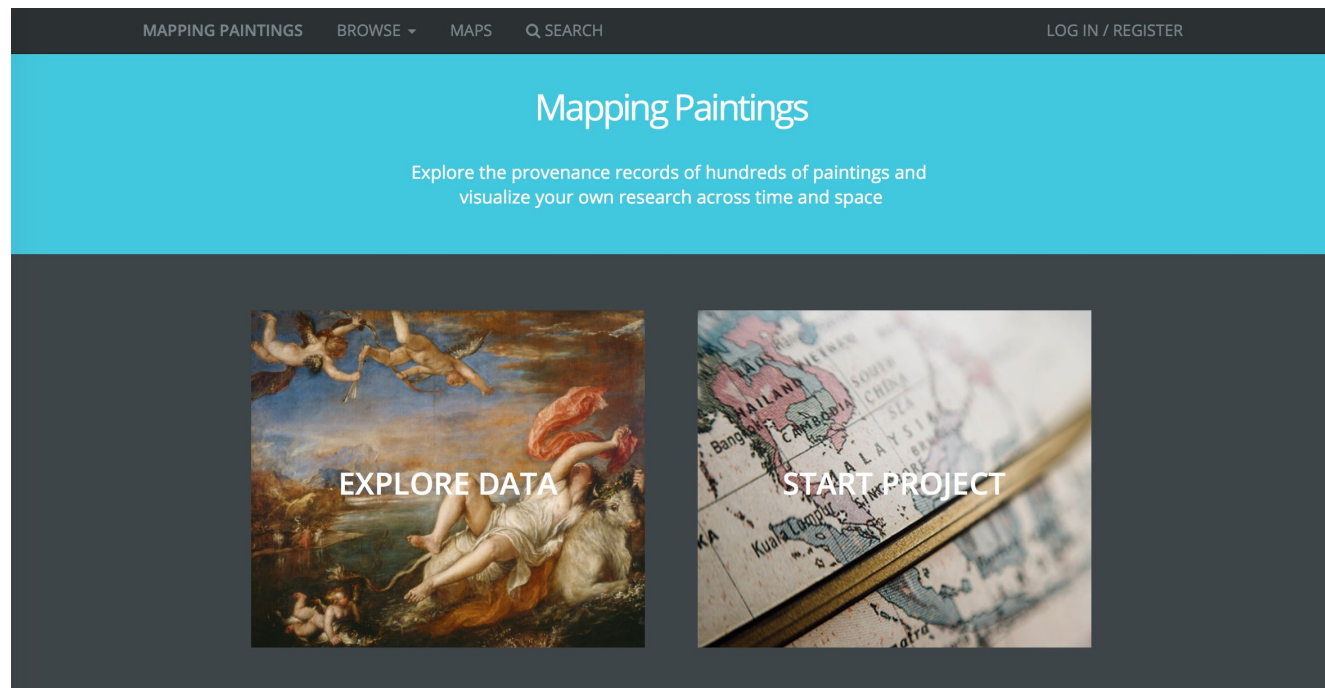
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Case studies

Mapping Paintings is a geographical database to explore the provenance records of paintings.

The trajectory of each painting across time and space can be viewed in dedicated pages or on a map

<http://www.mappingpaintings.org>





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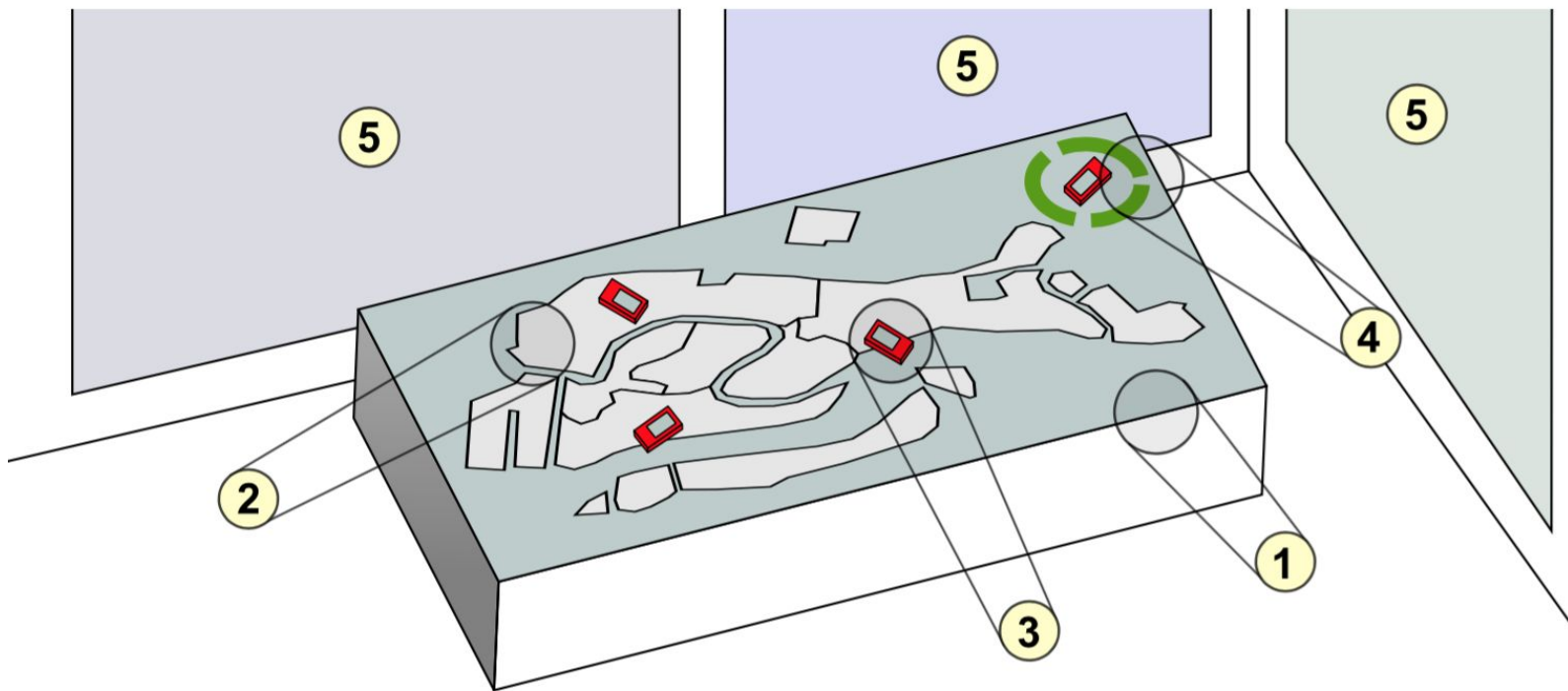
Case studies

Interactive tables developed by the computer vision group for the Ca' Foscari exhibition “William Congdon in Venice (1948-1960): An American Look”



Case studies

Interactive tables developed by the computer vision group for the Ca' Foscari exhibition “William Congdon in Venice (1948-1960): An American Look”





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Case studies

Interactive tables developed by the computer vision group for the Ca' Foscari exhibition “William Congdon in Venice (1948-1960): An American Look”





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Case studies

The same interactive tables were used to exploit new forms of 3D visualization by using active shutter glasses tracked by an external camera rig

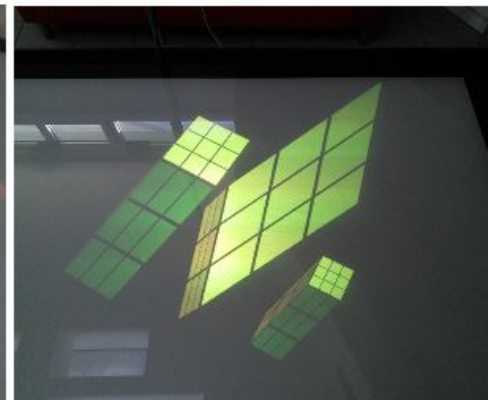
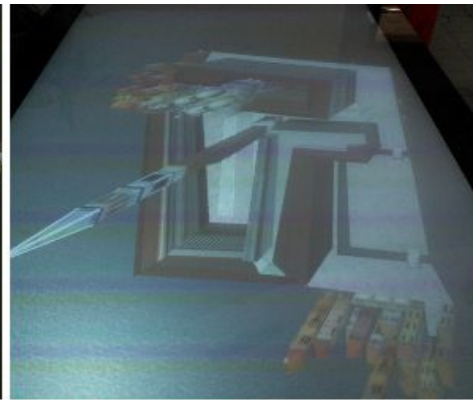
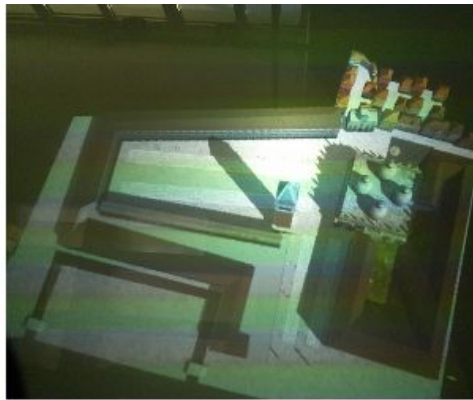
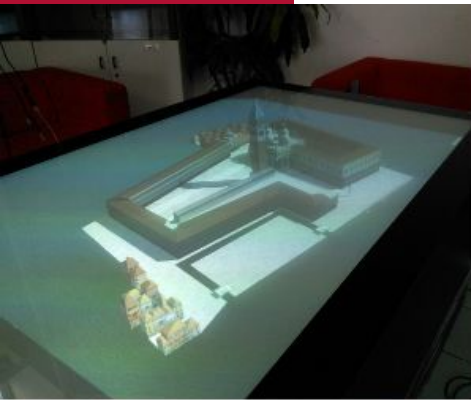




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Case studies

The same interactive tables were used to exploit new forms of 3D visualization by using active shutter glasses tracked by an external camera rig





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History

In February 1995, the European Commission organised the first meeting on the **Information Society**, in Brussels.

11 pilot projects was approved:

1. Global Inventory (of projects)
2. Global Interoperability
3. Cross-Cultural Education and Training
4. Bibliotheca Universalis
- 5. Multimedia Access to World Cultural Heritage**
6. Environment
7. Global Emergency
8. Government Online
9. Global Healthcare
10. Global Marketplace for SMEs
11. Maritime Information Systems.

The aim of these projects was to trace the guidelines of the Information Society



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History

Later on, in June 1995, a worldwide G7 summit approved and adopted such projects

In May 1996, during the *Information Society and Developing Countries* conference, held in South Africa, 4 demo projects were selected representing the four principal sections identified by the project *Multimedia Access to World Cultural Heritage*:

- 3D Acquisition, a laser camera presented by the National Research Council, Ottawa;
- Filing, of the Museo di Storia della Scienza in Florence;
- Visualisation of the Nefertari Tomb, developed by Infobyte, Rome;
- “SUMS” Navigation, developed by SUMS Corporation, Toronto.



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History

In 1997, a new “agency” called *the MEDICI Framework* was launched with the goal of promoting the use of advanced technologies to access, understand, preserve and to promote the economics of cultural heritage.
(Partnership with the European Council)

The MEDICI Framework closely cooperated with the World Wide Web Conference initiative exploring how multimedia technology could be employed to improve the way that visitors presently perceive a visit to a museum or art gallery.



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History

In 1999, the event “*Culture Counts Financing, Resources and the Economics of Culture in Sustainable Development*” took place in Florence.

The main focus of the conference was economics, but related concepts such as sustainability, access and **the digital divide** were also considered and discussed in depth too.

Specific emphasis was placed on **archives**, because both current records and historical archives document the actions of individuals and states



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History

In 2000, delegates of the European Council launched a guideline document entitled e-Europe containing guidelines with the following objectives:

- To bring every citizen and every business and administration into the digital age, and enabling them to get online
- To create a digitally literate Europe supported by an entrepreneurial culture that is ready to finance and develop new ideas;
- To ensure that the whole process is socially inclusive, building consumer trust and strengthening social cohesion.



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History

More recently, a number of different global initiatives aimed at predicting and possibly solving different problems related to the provision of universal access to information have been further activated, including:

- UNESCO's Intangible Heritage Task Force
- UNESCO OCCAM's Infopoverty Programme
- World Summit on the Information Society (WSIS)
- The creation of the Global Alliance for ICT and Development (GAID)
- Many more...