ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Time Machine activities @UNIBO

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UniBo in numbers

Formal name: Alma Mater Studiorum - Università di Bologna

5 campus in 120 x 30 km **934.000 m²** overall surface area, **€ 655,6 M** turnover
32 Departments; **5** Schools

87.758 students
6.484 International students
2,771 teaching staff
2.962 technical administrative staff
2nd Italian University
in QS World University Rankings 2020 (ranked 69th in the world and 1st in Italy for the category Academic Reputation)

Horizon 2020

319 funded projects (86 coordinated)
> 138,1 M € funding
1st Italian University in the Pillar "Societal Challenges"

Interdisciplinary research centers

- Alma Mater Research Center for Human-Centered Artificial Intelligence (Alma AI)
- Research Center for Interaction with the Creative and Cultural Industries (C.R.I.C.C.)

Networks/Infrastructures

- EIT DIGITAL, Climate KIC, EIT Raw Materials , EIT Food and the major European Partnerships (ETPs, EIPs, JPIs, PPPs ..)
- E-RIHS - European Research Infrastructure for Heritage Science (project IPERION CH)
- National Cluster Technological Innovation in Cultural Heritage
- National Cluster «Made in Italy»
- Regional Clust-ER Cultural and Creative Industries
- Big Data Association
- Competence Center BIREX - Big data Innovation & Research Excellence

UniBo activities in the legal domain:
Legal and ethical viewpoints on Digital Cultural Heritage Datasets

Sustainable and Responsible use and re-use of the Digital Cultural Heritage Datasets

Topics and issues focused by our ongoing research projects:

- ***Open Data Directive***: standard licensing policy, charging policy, metadata ownership
- ***Digital Single Market Directive***: text and Data Mining, use of protected content by online content-sharing service providers
- ***Data Ethics and Privacy (GDPR)***: personal data concerns, custody of datasets, cognitive bias in the creation of the dataset, liability and accountability
- ***Competition Law***: Digital Service Act (forthcoming)
- ***Explicability*** in the case of AI
- ***Data Strategy of the EU Commission and GaiaX***

Towards an «**Universal Declaration of the Rights on Digital Cultural Heritage Datasets**»

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UniBo activities in data acquisition:
X-ray tomography to digitize ancient & fragile manuscripts

This innovative approach addresses the challenges for document digitization such as the fragility of many ancient manuscripts. The X-ray tomographic digitization avoids the need to open or specially prepare them, making the process completely non-invasive and safe.

Results obtained

- A broad chemical investigation of manuscript inks proved the large use in Europe (before XIX cent.) of ink visible in X-rays (Iron-gall ink);
- Successful X-ray tomography of small documents (last wills);
- Successful imaging of a 200-page handwritten book;

Future directions

- A new X-ray tomographic facility for manuscripts investigation needs to be engineered;
- New algorithms to extract pages and text from the 3D tomographic volumes - also based on AI and deep learning – need to be developed;
- Multi-energy tomography and different scan geometries to maximize the ink visibility and to reduce the cost and effort of digitization need to be evaluated;

UniBo activities in data representation: Modelling uncertainties, conjectures, debatable hypothesis

Most scholars, for sure in the humanities, are rarely ever completely certain of the truth of the statements they are making. Even in the simplest situations, they would probably use "certain" to mean "non disputed" or "the most likely interpretation" or "the hypothesis that best fits data".

Descriptive models for CH artefacts do NOT allow for uncertainties and hypothetical statements, and syntaxes such as RDF only allow facts and truth to be expressed. We want to change that.

Results obtained

- A broad survey of museum curators' attitude towards enriching their digital records with uncertain or conjectural information (they are not tempted, and their software does not help);
- *Contexts*: eight metamodels to enrich existing metadata and ontologies: provenance, geo-temporal characterization, confidence, relevance, etc.;
- *Conjectures*: a plain RDF approach to model statements that are not meant as facts.

Future directions

- An online editor for contextual conjectures usable with all metadata models;
- Integration of conjectures in back-office tools for GLAM curators;
- Correct representation, search of conjectures in GLAM web sites for visitors and scholars.

```
CONJECTURE :C1 {
    :Hamlet dc:creator :EdwardDeVere .
}
:C1 prov:wasAttributedTo :JThomasLooney .
:C1 cio:has_Confidence_Level :Low .

CONJECTURE :C2 {
    :Hamlet dc:creator :WilliamShakespeare.
}
:C2 prov:wasAttributedTo :SamuelJohnson.
:C2 cio:has_Confidence_Level :High .
```