Eureka3D Final Conference

Authenticity and 3D Standardization

2024-12-13

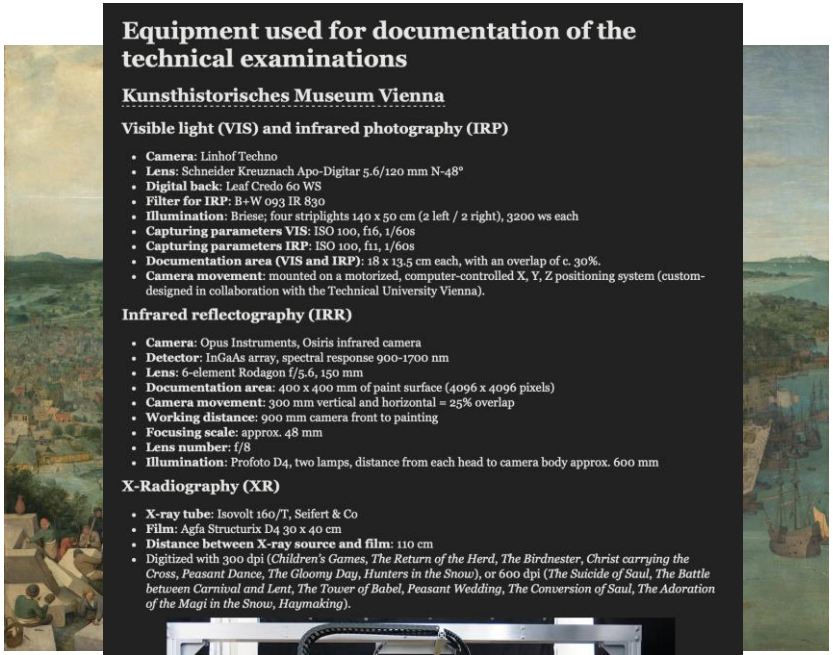
Frederik Temmermans
imec

Bruegel: Tower of Babel

InsideBruegel.net

Google Art Project

Bruegel: Tower of Babel



Equipment used for documentation of the technical examinations

Kunsthistorisches Museum Vienna

Visible light (VIS) and infrared photography (IRP)

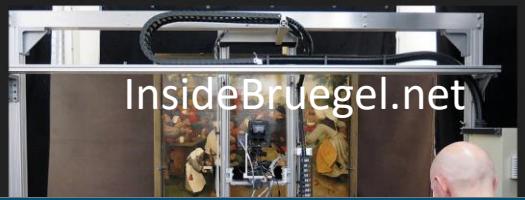
- **Camera**: Linhof Techno
- **Lens**: Schneider Kreuznach Apo-Digitar 5.6/120 mm N-48°
- **Digital back**: Leaf Credo 60 WS
- **Filter for IRP**: B+W 093 IR 830
- **Illumination**: Briese; four striplights 140 x 50 cm (2 left / 2 right), 3200 ws each
- **Capturing parameters VIS**: ISO 100, f16, 1/60s
- **Capturing parameters IRP**: ISO 100, f11, 1/60s
- **Documentation area (VIS and IRP)**: 18 x 13.5 cm each, with an overlap of c. 30%.
- **Camera movement**: mounted on a motorized, computer-controlled X, Y, Z positioning system (custom-designed in collaboration with the Technical University Vienna).

Infrared reflectography (IRR)

- **Camera**: Opus Instruments, Osiris infrared camera
- **Detector**: InGaAs array, spectral response 900-1700 nm
- **Lens**: 6-element Rodagon f/5.6, 150 mm
- **Documentation area**: 400 x 400 mm of paint surface (4096 x 4096 pixels)
- **Camera movement**: 300 mm vertical and horizontal = 25% overlap
- **Working distance**: 900 mm camera front to painting
- **Focusing scale**: approx. 48 mm
- **Lens number**: f/8
- **Illumination**: Profoto D4, two lamps, distance from each head to camera body approx. 600 mm

X-Radiography (XR)

- **X-ray tube**: Isovolt 160/T, Seifert & Co
- **Film**: Agfa Structurix D4 30 x 40 cm
- **Distance between X-ray source and film**: 110 cm
- Digitized with 300 dpi (*Children's Games, The Return of the Herd, The Birdnester, Christ carrying the Cross, Peasant Dance, The Gloomy Day, Hunters in the Snow*), or 600 dpi (*The Suicide of Saul, The Battle between Carnival and Lent, The Tower of Babel, Peasant Wedding, The Conversion of Saul, The Adoration of the Magi in the Snow, Haymaking*).



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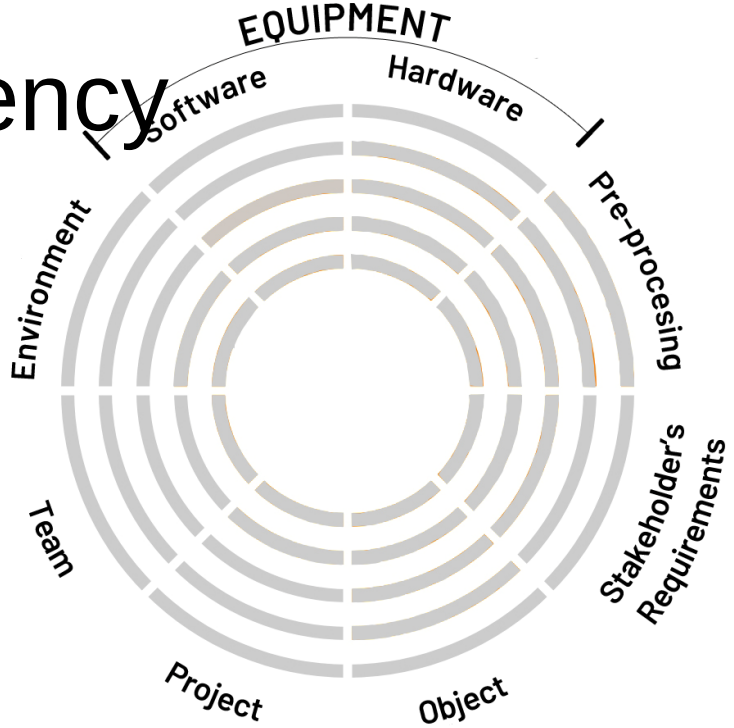
Why does it matter?

- A digitization is a **static capture** of a **dynamic object** at a certain moment in time.
- A still image of a painting is a **2D projection** of a **3D object**.
- Equipment, practices, actual setting, software processing all **impact the final result**.
- For scientific assessments, knowing the **exact digitization circumstances** is paramount.

Paradata = transparency

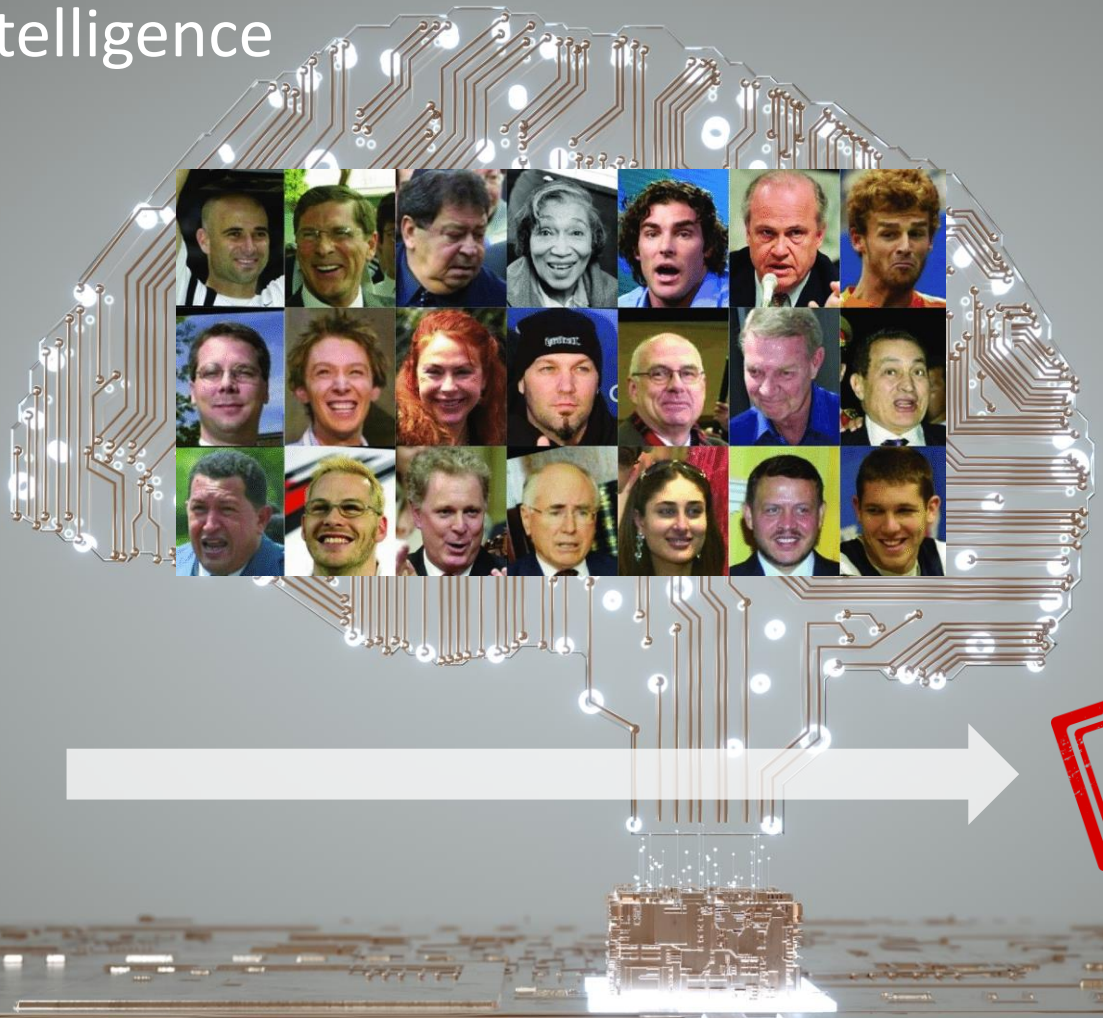
Radial Chart proposed in the VIGIE Study methodology for the assessment of the complexity for a digitisation project.



- Paradata, Metadata and Data for 3D acquisition in cultural heritage
  - (8 April and 17 May 2024)
  - https://eureka3d.eu/webinar-paradata/


Real?
Fake?

Artificial Intelligence



FAKE

Mr. deep fake

vs detection method

Verifiable provenance information
from creation to end-user perception

Traditional metadata

- Metadata is **embedded** in images at the **moment of capture**.
- Contains information such as **location**, **time**, **camera model** and **settings**, etc.
- Common formats include **EXIF**, **IPTC**, **XMP**, …

Louvre, Paris
8 June 2024
iPhone

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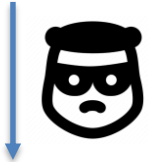
- Common formats include **EXIF**, **IPTC**, **XMP**, …
- However, this information is often **not retained after transcoding**.
- **Manipulation** of this metadata is **trivial** and often **unnoticeable**.
- The **associated content** might have **changed** as well. Leading to **inconsistencies**.

Louvre, Paris
8 June 2024
iPhone



Louvre, Paris
13 Dec 2024
iPhone

Traditional metadata

- If present, **traditional metadata** can provide valuable information about the **authenticity of the media file**.

But…

- Requires **careful consideration** because the metadata easily be **manipulated**, and the **associated content might have changed**.
  - Closed environment
  - Reliable source
  - …

How to improve?

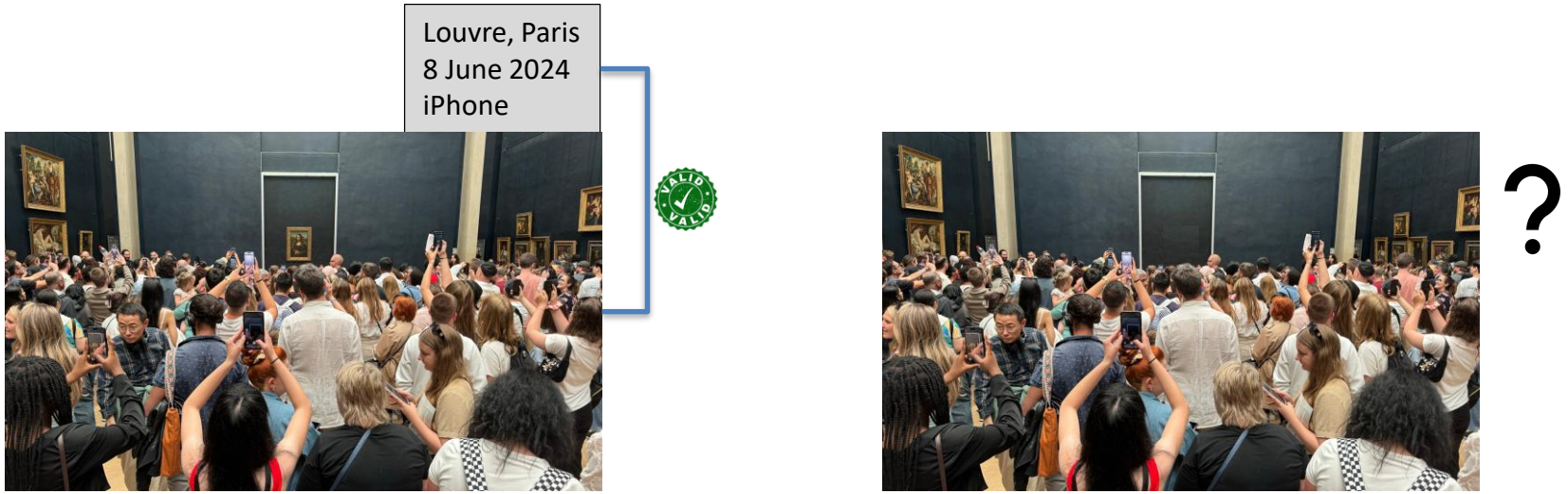
- Two improvements to traditional metadata are needed:
  - **Securing metadata**, allowing identification of modifications.
  - Documenting not only creation but the entire **provenance**, a **persistent chain of information** documenting the **creation** details, as well as **all changes** made to a digital file since it's creation.

Securing metadata & provenance

- By using **cryptographic hashes**, the relation between the metadata and the associated content can be **verified.**

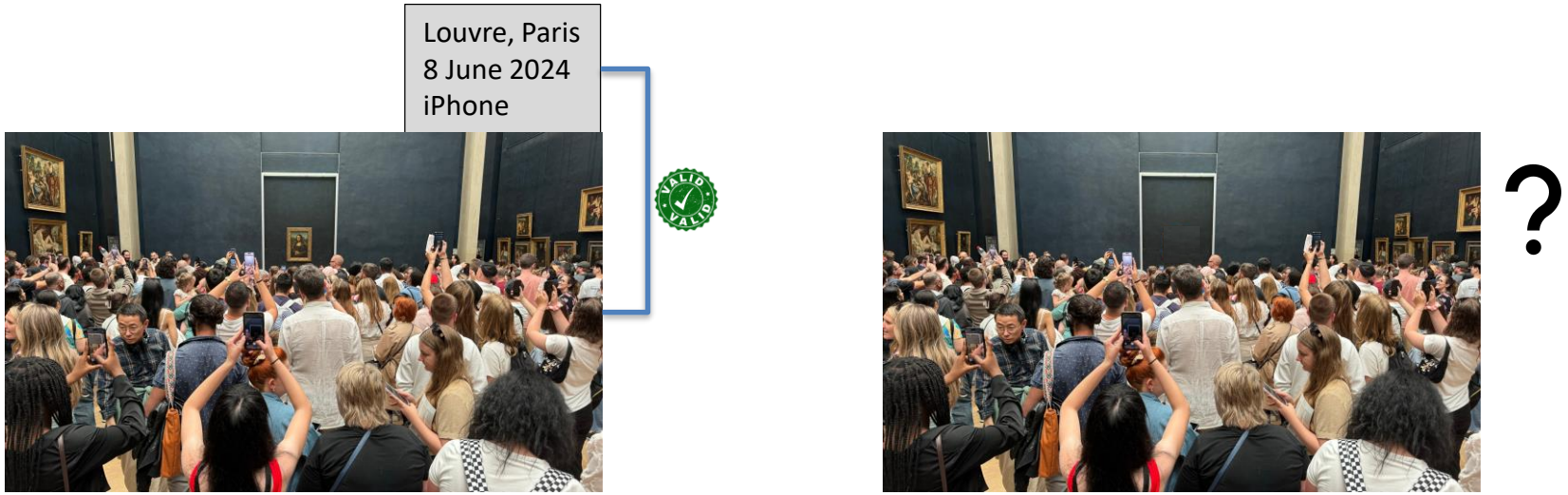
Securing metadata & provenance

- **Tampering** can be identified, since it will break the integrity of the file, however metadata **can still be removed**.



Securing metadata & provenance

- We aim for a future where **secure provenance information** is the **default**, and media **lacking** it is considered **untrustworthy**.



Tackling disinformation

- **Reactive approach**
  - Modification / deep fake detection
- **Proactive approach**
  - Secure provenance signaling
- **Collaborative approach**
  - Community feedback


To succeed,
interoperability will
be pivotal.


International Organization for Standardization
ISO
JPEG
Trust
T
S
U
R
T

JPEG Trust

*"The scope of JPEG Trust is to provide a **framework for establishing trust in media**. This framework includes aspects of **authenticity, provenance and integrity through secure and reliable annotation of the media assets throughout their life cycle**."*

Subjective nature of Trust(worthiness)

Trustworthiness is context dependent!

*"**JPEG Trust** does **NOT explicitly define trustworthiness** but rather provides a framework and tools for **individuals**, **organizations**, and **governing institutions** to establish trust in accordance with the conditions **they specify**."*

Establishing Trust

Trust Indicators

- ✓ From family member
- ✓ Authentic
- ✓ Date
- ✓ Location

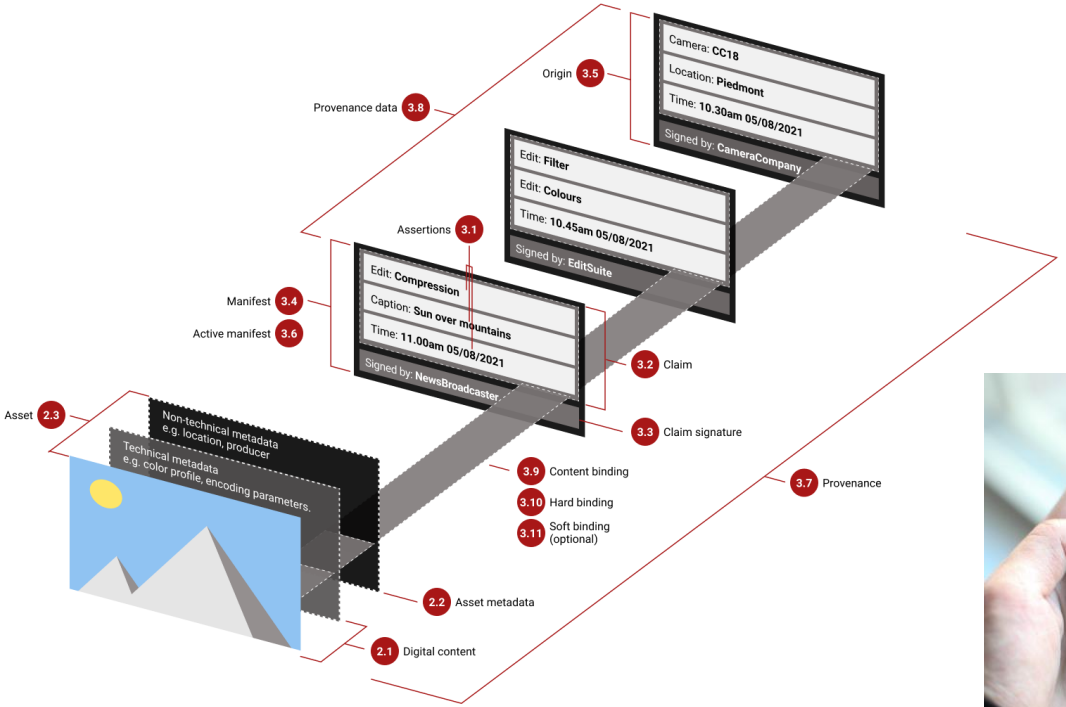
JPEG Trust Part 1: Core Foundation

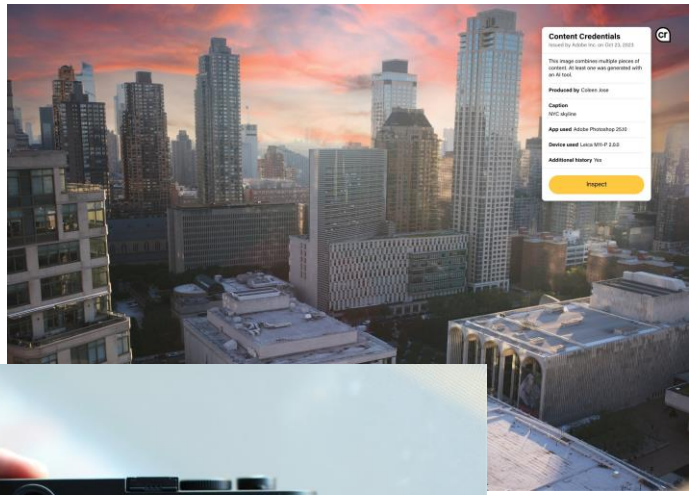
Annotating provenance

Extracting and evaluating Trust Indicators

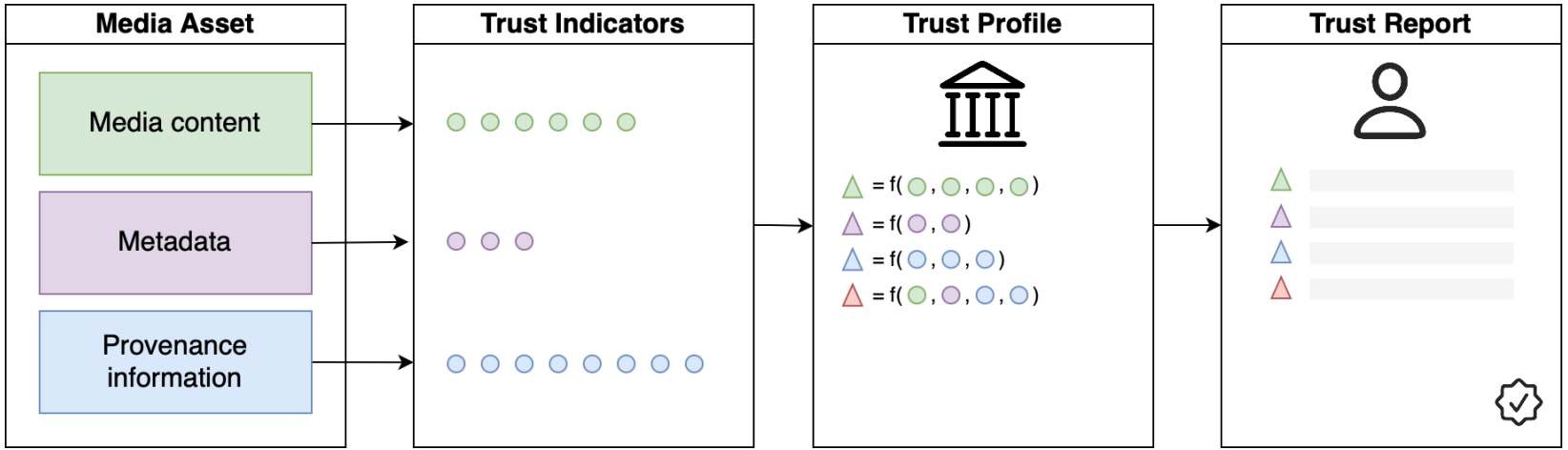
Handling privacy and security concerns

Annotating provenance





Extracting and evaluating trust indicators



Future of archiving

Holography

JPEG Pleno

AI based compression

JPEG AI

DNA storage

JPEG DNA

Transforming heritage:
formats, authenticity and preservation
Webinar Series 2024

26 September
24 October
15 November
2024

Webinar 1: 26 September, 4-5pm CET
Digital Media Authenticity

Webinar 2: 24 October, 5.30-6.30pm CET
A new dimension for the Audiovisual Heritage: a EUreka3D initiative

Webinar 3: 15 November, 3-4pm CET
An overview of recent and emerging JPEG formats for digital archival and long-term preservation

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ICA INTERNATIONAL COUNCIL ON ARCHIVES
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EUREKA3D

https://eureka3d.eu/transforming-heritage2024/