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5. Emerging tools for Conservation practice

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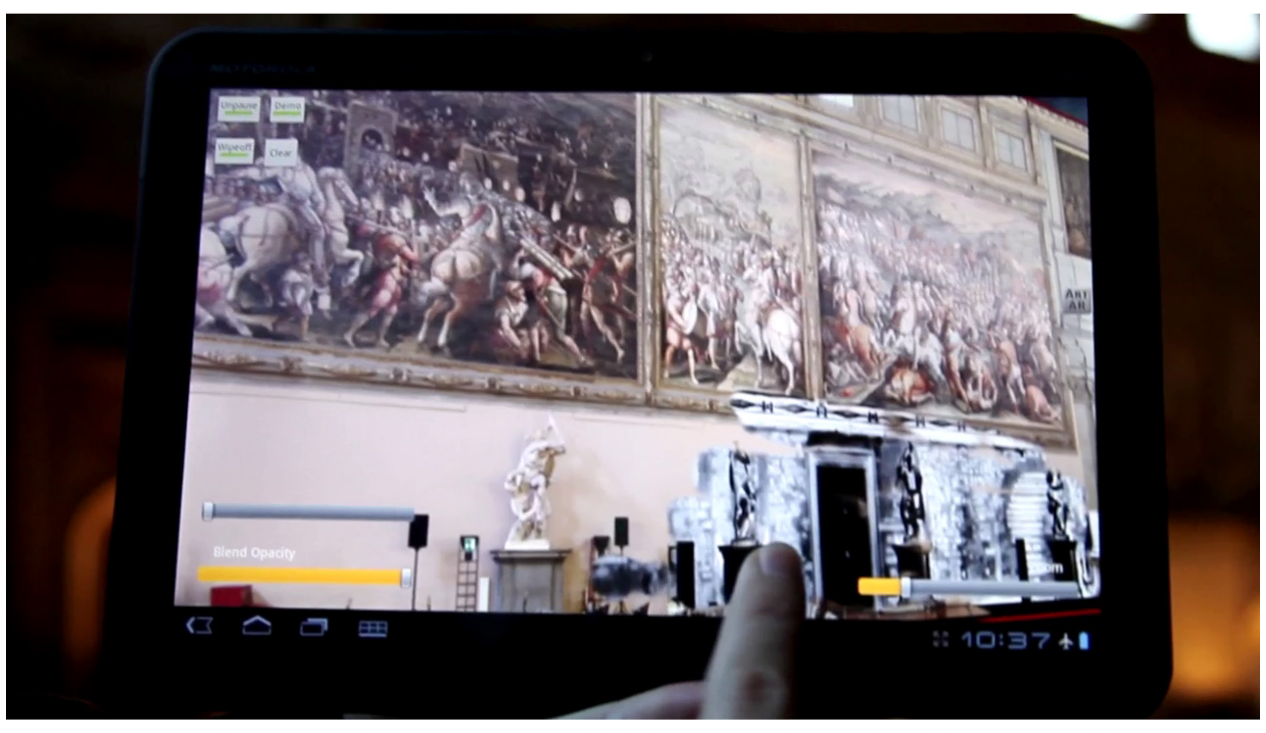

Figure 1. Region of interest analysis comparing a visible light image with an infrared thermogram of the east wall of the Salone dei Cinquecento inside Palazzo Vecchio, allowing the user to literally "wipe-off" one layer to reveal the next.

ARtifact Conservation: Representation and Analysis of Spectroscopic and Multispectral Imaging Data Using Augmented Reality

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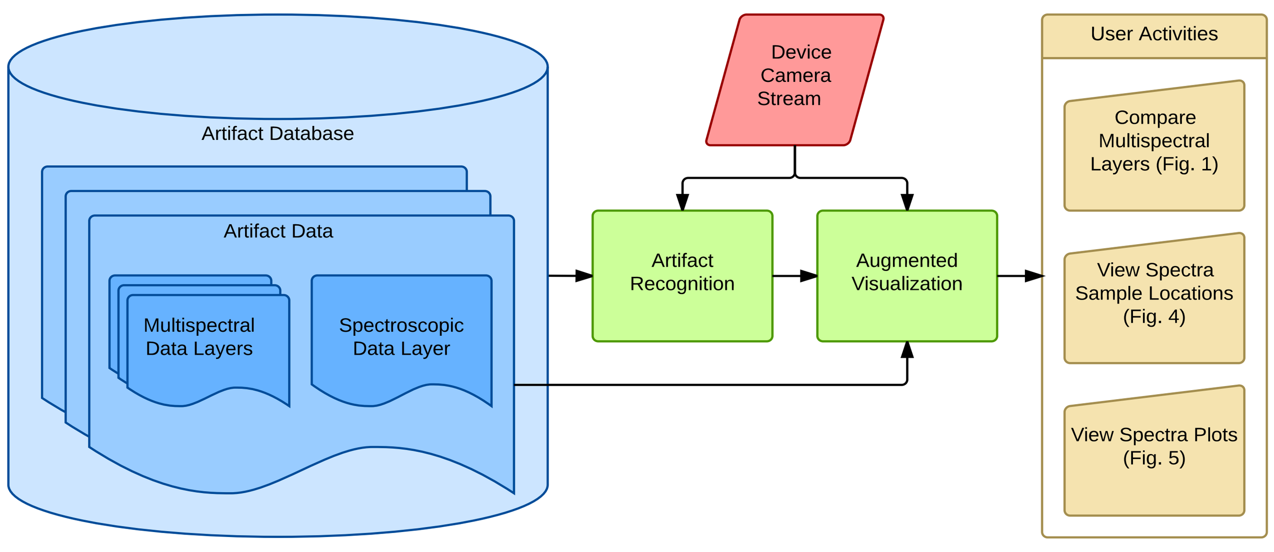
Abstract

This paper presents an augmented reality technique for the visualization of diagnostic imaging and analytical diagnostics data, creating a contextualized data analysis workflow. A mobile device with see-through video serves as the interface that intuitively combines the physical artifact with multispectral imaging and spectroscopy data, strengthening the analytical process carried out during conservation efforts. An improved workflow for the acquisition of point-based X-ray Fluorescence (XRF) spectra is proposed and demonstrated, using the sensing capabilities of the mobile device. The presented, contextualized data analytics approach enhances the retention of important metadata, while streamlining the collection and comparison of key datasets routinely used for material identification.

ARtifact Contextualized Visualization Approach

ARtifact utilizes a technique known as "video see-through" augmented reality (AR) in which virtual objects are superimposed in real time onto a live video stream captured with the rear-facing camera available on most of today's mobile devices. The video is captured and each video frame analyzed for the presence of a known artifact for which additional data is available. If a known artifact is found, it is flagged, subsequently continuously tracked, and available data augmented on top of the video, based on user definable filters. This means that contextualized data visualization becomes as easy as pointing the mobile device at the physical artifact.

Data Flow Diagram



Conclusions

Augmented reality holds great promise for the creation of a new data-driven acquisition and diagnostics workflow, where different imaging and sensing techniques inform each other. An improved workflow for the acquisition and visualization of point-based X-ray Fluorescence (XRF) spectra is presented, using the sensing capabilities of a tablet device to create a contextualized data analysis workflow and augment digital data directly onto physical artifacts. The presented, contextualized data analytics approach enhances the retention of important metadata, while streamlining the collection and comparison of key datasets routinely used for material identification. The presented technique for spectra acquisition and visualization can be broadly applied to other spectroscopy techniques typically applied in non-invasive investigation of cultural artifacts, such as fiber optics reflectance spectroscopy (FORS) used in the field to study art.

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Key Advantages

- Ability to interact with an artifact via augmented reality through the use of the built-in camera in live mode
- Common networking platform to view multiple datasets
  - Imaging and spectroscopy
- All data is contextualized
- Important metadata is easy to preserve (e.g. point location, rationale)
- Ability to zoom gigapixel images to view minute details
- Facilitates precise repetition of diagnostic exams

Methodology

- Previous representation of multiple datasets was completed in a piecework fashion (Fig. 2), resulting in incomplete representation of information and difficulty in retaining important metadata with precision.
- By using the ARtifact Conservation contextualized visualization approach as a single platform for multiple datasets, an improved analytical methodology can be implemented.

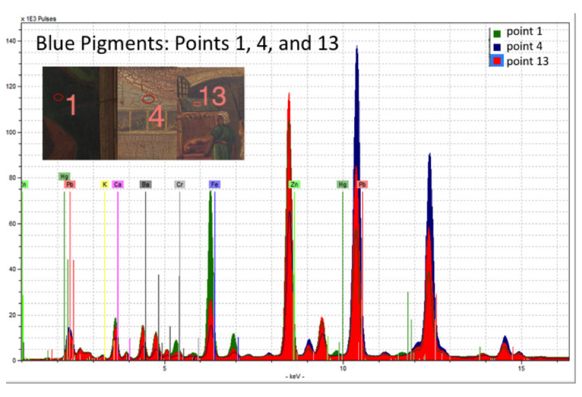


Figure 2. Example of data overlay using multiple platforms, constructed manually using the methodology employed previously.

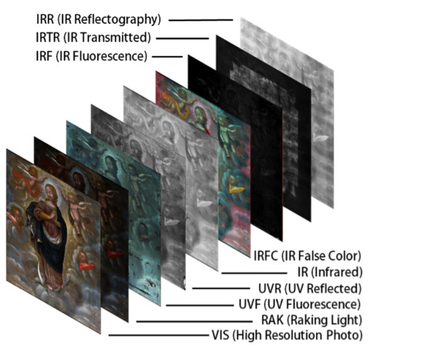
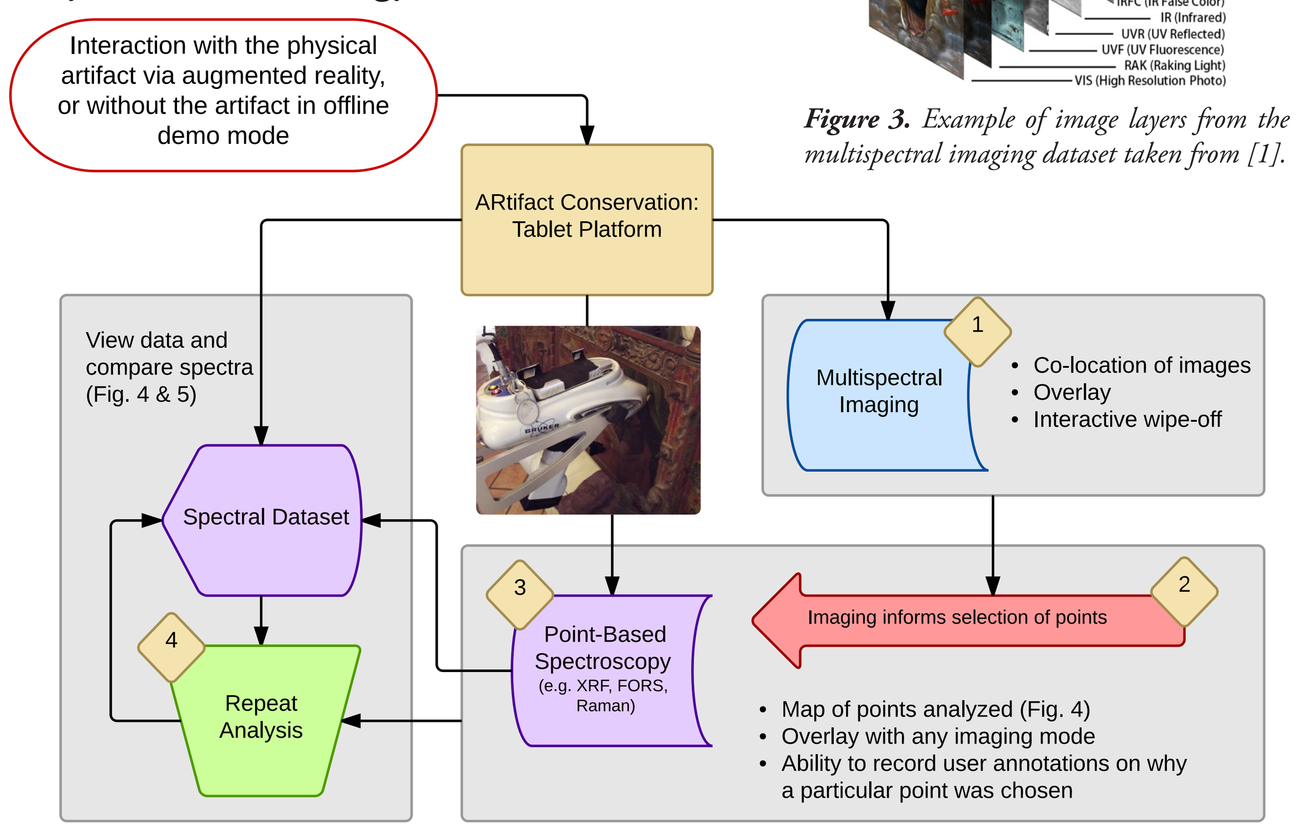


Figure 3. Example of image layers from the multispectral imaging dataset taken from [1].

Organizational Flow Chart for the Analytical Methodology



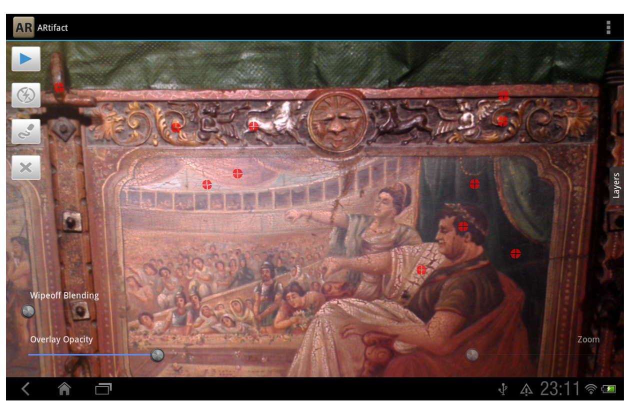


Figure 4. Augmented reality overlay, showing a video see-through representation of a wood panel, augmented with cross-hair markers that are identifying where spectral data was collected.

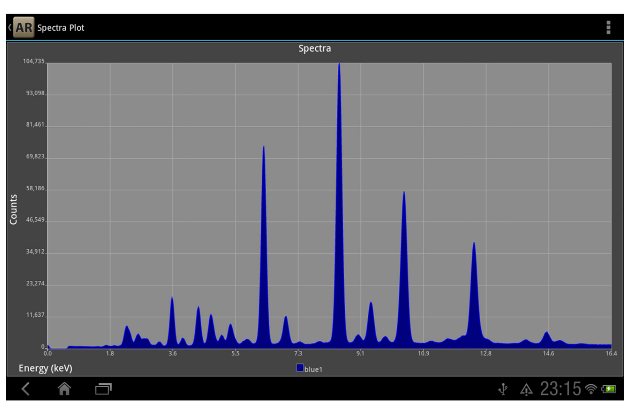


Figure 5. Example of spectra information for a blue pigment sample that can be accessed interactively, while the physical wood panel is being investigated.

Acknowledgements

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