

## Editorial

### Special Issue on Information Processing in the Arts and Humanities

Recent years have witnessed the emergence of various sophisticated information processing tools – including some involving artificial intelligence – that are capable of interrogating increasingly complex datasets in order to tackle challenges arising in a wide range of application domains.

In parallel, increasing digitization efforts adopted by libraries, museums, and other cultural heritage institutions as well as technical examination of collections – using sophisticated imaging techniques such as X-ray fluorescence scanning, hyper-spectral imaging, computerized tomography, and many more – have led to rich and extensive data sets.

This combination provides a unique opportunity to explore the application of state-of-the-art information processing tools to investigate arts and humanities related data sets and provide the new insights for further scholarly work. Our tools can help address high-profile questions in the arts and humanities; they can also support art conservation and preservation; and they can also lead to new ways to communicate scholarship about art to the general public, and enrich the general experience of art.

My own lab's journey into this area dates back to 2015. We had then been concentrating on how to integrate side information in various data processing challenges; besides contributing new theoretical insights in the form of reconstruction bounds, we had also proposed new algorithms, and we were applying our proposed methods to image and video processing problems with side information.

When Ingrid Daubechies suggested that some of our approaches could potentially be used to address problems arising in art-historical investigation, conservation, and presentation, we were immediately intrigued. We were not only interested in this area, and fascinated by its challenges, but we were also excited about the prospect of working with her and her applied mathematics group.

In a collaboration involving my own lab, Nikos Deligiannis' lab – who had then just moved from University College London to the Vrije Universiteit in Brussels – and Daubechies' group, we set forth to apply our techniques to X-ray image separation challenges posed by Hurbert and Jan van Eyck's *Adoration of the Mystic Lamb* (also known as the Ghent Altarpiece). Our effort was meant to support some of the then-ongoing conservation work on this masterwork. Art conservators were interested in obtaining a clearer reading of the X-ray images associated with the double-sided panels from the Ghent Altarpiece, which required disentangling the contribution from each of the painted sides from their mixed X-ray images. We have developed various approaches to tackle this and related challenges since 2015, with our work generating considerable interest in cultural heritage institutions.

I have become increasingly fascinated by challenges arising in arts and humanities. I feel such challenges allow us to connect to our historical legacy, offer an opportunity to interact with and learn from open-minded scholars operating in other areas, and

also – in view of the specificity of the challenges – demand us to develop new foundational information-processing capability.

As our work in the area grew, our network of collaborators also grew – we currently have a long-standing collaboration with the National Gallery, London – and we are glad to witness an increasing appetite among information-processing researchers to engage with cultural heritage scholars, and vice-versa.

This special issue – which builds upon not only our own journey but also on similar experiences by other researchers worldwide – intends to showcase how information processing tools (broadly defined, hence encompassing artificial intelligence, signal and image processing powered by machine learning, and more) can be used to address challenges arising in the arts and humanities. It also intends to bridge the gap between the information processing and the arts and humanities communities, by offering representative contributions from interdisciplinary teams spanning both fields.

In line with the richness of the area, our collection of articles branches into many different directions: some articles focus on challenges arising in the arts (Sober et al.; Chopp et al.; Zhang et al.; Liere et al.; Yu et al.); others on humanities (Lu and Doms); others in paleography (Faigenbaum-Golovin et al.); yet others in anthropology (Olver et al.). These articles describe technology that has been developed to address specific challenges arising in these areas and also outline broader challenges in the art and humanities that may require novel information processing capability.

Our collection of articles – in line with the ethos of the special issue – also aims to reach out to both the information processing and cultural heritage communities: inevitably, some articles are more geared toward information processing researchers, whereas other articles are primarily directed to arts and humanities scholars. Notably, there are also articles that report on increasingly relevant issues that arise in the application of information processing technology – notably, machine learning techniques – to challenges in the arts and humanities (e.g. Olver et al., Zhang et al.).

The articles are further complemented by a series of columns offered by members of cultural heritage institutions that outline specific challenges that may benefit from information processing capability. The issue also includes a column written by a member of the UK's Arts and Humanities Research Council outlining their past, current, and future work within the area.

We do hope that you find the issue engaging, the area stimulating, and the prospect of collaborating with scholars from different areas illuminating. I would like to thank the editor-in-chief Robert Calderbank for challenging us to put together such a special issue, and I am deeply grateful to the team of guest editors who have played a key role in shaping, curating, and making this special issue possible.

Miguel Rodrigues

Lead Guest Editor  
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