IP4AI: TRANSFORMING CONSERVATION

Ella Hendriks

Programme Restoration and Conservation of Cultural Heritage
University of Amsterdam

This presentation broadly considers the ways in which image processing is transforming conservation and restoration of cultural heritage in terms of both methods and approach. At the University of Amsterdam conservation and restoration training programme, past years have witnessed an increased demand for image processing expertise involved in research and practice across the nine different tracks of specialisation. This together with the speaker's own projects in the field of paintings conservation, provides a representative picture of the types of problem that can benefit from collaboration with image processing specialists (in the broadest sense of the word). While by no means an exhaustive survey, it provides an opportunity to stand still and evaluate this development from a user's perspective in the context of this sixth IP4AI conference.

A primary task of the modern-day conservator is to manage undesirable processes of change in cultural heritage objects. A limitation is that we can only analyse the present, while to do this we also need to understand the past and to predict the future. Increasingly, image processing plays an important role in all three related areas of activity, ranging from diagnostics to preventive conservation and treatment. These concepts will be used as a convenient way to structure this talk, in which case study examples of image processing application will be grouped according to these three, overlapping areas of conservation practice.

Diagnostics

Image processing-based methods have greatly expanded the range of diagnostic tools available to the conservator. One example is automated mapping of thread count and thread angle in woven fabrics, such as canvases used in paintings. This combined information is useful to answer art historical questions relating to dating, provenance or attribution, but has also proved informative to the conservator as it helps to distinguish features belonging to the original object from later damages and alterations, as examples will demonstrate.

Combined optical and chemical mapping of art works is especially helpful to support process-based analysis in conservation. On the one hand it can help to determine whether certain degradation processes have stabilized or are still ongoing, information that is crucial to the conservator's assessment of condition (an example of metal soap aggregation will be given). On the other hand it enables the process of conservation treatment to be monitored, in order to evaluate its effects as a basis for adaptive decision-making. For example, while still at the developmental stage, a combination of optical coherence tomography (OCT) and reflection mid-Fourier Transfer Infrared (mid-FTIR) proves highly promising to visualize the progressive effects of varnish removal on a painting, mapping both the area and thickness of the layer(s) removed.

Preventive conservation

A combination of non-invasive, micro-analytical scanning techniques can also provide a 'risk' mapping of e.g. light sensitive colour areas in paintings (see paper Koen Janssens et al. in this conference). Potentially this opens the way for selective lighting of different parts of a painting, or of paintings that belong to different risk category groups in a collection, according to their level of vulnerability. A recent development has been to model *future* states of discoloration in digital visualizations that make the problem tangible. In effect, this has taken research on pigment deterioration out of the laboratory and into the stakeholder's office, where the visualizations have been used as a basis for discussions on what constitutes acceptable damage and deciding an appropriate lighting policy (example Van Gogh Museum).

Restorations

In the past, a common goal of 'restoration' was to return objects to a past, or perceived original state. Nowadays we may question the validity of this approach, while the irreversible removal or addition of material required to achieve this goal may no longer be considered an ethically viable option. Image processing methods can provide an alternative by creating visualizations of former states of an object, without changing the object itself (therefore offering a solution for objects that are too fragile to withstand handling and manipulation). These visualizations can take on various forms- from computer screen images to physical or virtual 3D replicas of the object- and allow different options for restoration to be explored. Also, light can be projected onto the object itself to perform a 'virtual restoration', reversing effects of colour change on the original. Case examples considered in this talk will include 3-D reconstructions of (maritime-) archaeological objects, virtual varnish removal from paintings, reversal of colour change in painted surfaces using digital visualisations, and light retouching of furniture.

In those instances when it is decided to physically restore objects, incorporating image processing methods can help to improve the efficiency, cost and ethics of the restoration procedure, as well as benefiting the result. Examples for this talk will include the use of computer generated recipes for non-metameric inpainting of losses, and the use of 3-D scanning and casting/printing technologies for loss compensation. It should be noted that while new computer technologies may play an important role in treatment, the traditional skills and judgement of the trained conservator remain of paramount importance for the quality of the result. The new technologies may be seen to complement existing methods, extending the range of possibilities at the conservator's disposal.