VIRTUAL RESTORATION AND ANALYSIS OF DIGITIZED PAINTINGS

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Digitization of art works has become a common practice. Museums are digitizing their collections mainly for the purpose of archiving and dissemination. This way the cultural heritage is protected and made accessible to a larger audience. Digitization opens also possibilities for virtual restoration of art works and mathematical analysis. For example, we can remove the signs of aging (such as cracks) from a digitized painting, visualize the effect of using different varnishes, discover patterns that would otherwise remain unnoticed or facilitate detection of forgeries.

With the rapid development of imaging sensors and various imaging modalities, the interest in scientific analysis of paintings is growing. It is now possible to zoom in the tiny details of the painting or the brushstrokes revealing structures that could have never been noticed by a naked eye. Moreover, imaging in different parts of the electromagnetic spectrum (from infrared to X-ray) as well as simultaneous imaging in a multitude of narrow spectral bands (hyperspectral imaging) can reveal other amazing aspects, such as under drawings and differentiation between the paint layers that would otherwise remain undiscovered. Digitization of paintings enables also a marvelous interaction between art and vision science. Vision scientists can learn from the works of art about features that are important for our visual perception of a scene. Using this knowledge, we can improve our computational models of the visual system and our digital image processing algorithms, which can in return improve digital restoration and computational analysis of images in general.

Fig. 1. Original (left) and digitally restored (right) fragments of the painting.

This talk addresses virtual restoration and painter style characterization in digitized paintings, using as a case study the famous polyptich "Adoration of the Mystic Lamb" painted by the Flemish masters, brothers Van Eyck in the 15th century. In the actual, physical restoration the cracks are never removed. Hence, only virtual restoration could present us the painting as it used to appear centuries ago, before marks of aging arose. This can not only greatly enhance the visual experience (which is important from the aesthetical and psychological points of view) but in some cases it can also facilitate deciphering the content (like text fragments), which can be of great importance for art historical and iconographical analysis (see Fig. 1).

Equally challenging is development of new tools for painter style authentication. We present some of the metrics for objective characterization of the painter style, especially focusing on painted pearls, which are so beautiful and abundant in the works of Van Eyck. We are challenged to extract a kind of painter's signature or an individual characteristic of the painter style by means of mathematical analyisis. In this context, the method that will be described here aspires to create a tool for art historical attribution. The potentials of this method to distinguish between the painter styles are discussed as well as some side applications, like bringing the painted object closer to a style of another painter.

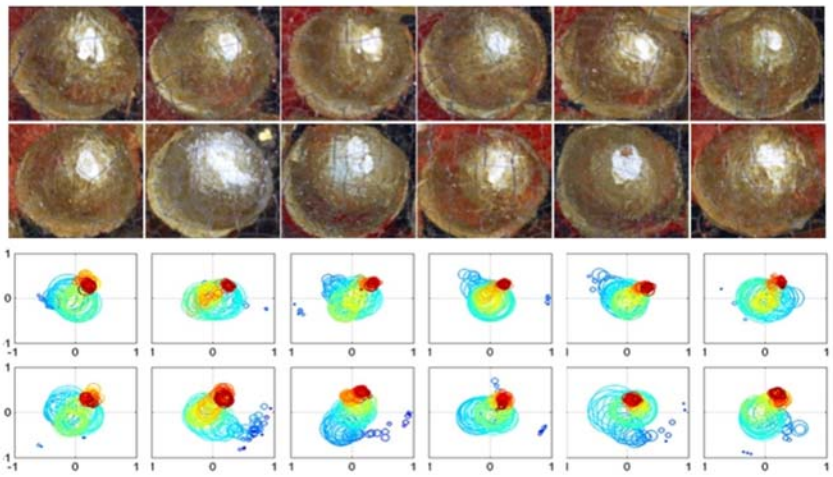

Fig. 2. A selection of painted pearls (top) and their digital signatures presented as spatiogram plots (bottom).

Aleksandra Pižurica is a professor in statistical image modelling at Ghent University. She received the Diploma Degree in Electrical Engineering from the University of Novi Sad, Serbia (1994), the M.Sc. degree in Telecommunications from the University of Belgrade, Serbia (1997) and the Ph.D. degree in Engineering from Ghent University, Belgium (2002). She was a postdoctoral fellow with the Fund for Scientific Research in Flanders – FWO (2005-2011). Since 2009, she is professor at Ghent University, where she has founded a Statistical Image and Vision Modelling team within the research group Image Processing and Interpretation. In 2009, she was also appointed as principal investigator within Belgian inter-University research department Future Media and Imaging (FMI) at the Institute of Broadband Technology (IBBT), where she is leading the research unit Video and Image Content Analysis (VICA).

Aleksandra Pižurica has authored and co-authored more than 200 publications in international journals, conferences and book chapters. She has published mostly on multiresolution statistical image modelling with applications to image and video restoration, especially in the area of wavelet domain noise reduction. Her current research interests include efficient representations of multidimensional signals and hierarchical statistical models of visual perception.