Topic

This Thesis concerns the search for solutions, from the digital technology perspective, to various and different problems related to art investigation, that is the scientific inspection of a piece of art (mainly paintings), with the aim at gaining new insights about its nature and its “story”. The main theme of the research activity conducted during the PhD period can be summarized (though in a reductive manner) as the comparative visualization and processing of diverse, non-invasive measurements of artworks (multimodal/multispectral acquisitions) for the improvement of the visibility of masked features (underdrawings, pentimenti, etc.). This theme has been explored from both the theoretical point of view and the “fieldwork” one, with case studies as input to new problems or as validation of developed techniques.

It is needless to remark the importance of using information technology for the preservation, study, dissemination, and fruition of our Cultural Heritage, especially the so rich European one. In particular, the processing/analysis of the digital images, coupled with information fusion, plays a special role, for its capability to simulate several possible actions without harming the original piece of arts, or even to suggest new approaches and techniques to restorers, scholars, historians and art critics.

Organization

According to the Charles University rules, the Thesis is organized as a large Introduction, which describes the research field, the related problems along with their possible solutions, and the state of the art, followed by the collection of the scientific publications produced by the candidate during his PhD work. This peculiar type of organization is motivated and justified by the wide variety of problems dealt with by the candidate in his studies, and the number of scientific papers, among which 5 are proceedings of reputed international conferences and 3 are published in valued international journals.

Contribution

The contribution should be distinguished into two parts: the proper contribution of the Thesis, and the contribution of the PhD work, documented in the published papers.

As per the Thesis, its more relevant content is the Introduction, which provides a critical panorama of the issues and interesting questions arising in art investigation, and the tools available to solve them, by using multimodal digital image acquisition and digital signal/image processing techniques. These arguments are not limited to the aspects considered during the PhD work, but go also beyond, thus demonstrating the profound personal interest, and the knowledge and competences gained by the candidate during his studies. This Introduction can be considered an excellent, comprehensive and up-to-date, survey of the research field in artwork investigation, with more than 200 recent bibliographic references.
As per the research activity carried out by the candidate during his PhD studies, it is noticeable his constant, fruitful contiguity and collaboration with art restorers and specialized Institutes and Museums. These contacts and experiences have influenced very much his research path. Indeed, a significant activity has regarded the set-up of a low-cost, calibrated acquisition system, in the VIS-NIR range, for paint material spectral analysis, which, in turn, made possible the building of a database of reflectance and transmittance responses of pigments. In parallel, signal processing techniques have been attempted and developed according to the needs raised by the fieldwork experience. However, the candidate has been able to make the algorithms general enough to become useful tools in different contexts.

**Evaluation**

The Thesis is very well written, and in a professional way. It treats in a comprehensive way a nowadays strategic field of research, i.e. technology applied to Cultural Heritage. However, the high-level discussion of the considered topics, as provided in the Introduction, makes the Thesis useful for specialists only. Indeed, it is neither an educational account of the state-of-the-art in the topic, nor a detailed description of a solution proposed for a specific problem. In this sense, it lacks one of the normally very useful sub-products of PhD theses, that is to serve as introductory material for students and/or researchers that are interested in starting to work in the same area. In addition, the description of the single published papers is very short, and scarcely informative. Rather than presenting the papers in chronological order, the candidate could have introduced the subjects of the papers according to his personal research path, that is according to the flow of experiences, motivations and even difficulties that made him moving from a subject to the other. Nonetheless, as I have already stressed several times, this Thesis demonstrates the high scientific value and the theoretical and practical impact of the large amount of research activity carried out by the candidate during his studies.

**Conclusions**

There are no doubts that the candidate is a mature researcher, which has proved his qualification for creatively perform scientific research. I thus recommend his Thesis for defence, with the aim at allowing the candidate to receive the PhD degree.

Pisa, December 4, 2017

Anna Tonazzini  
Senior Researcher  
Institute of Information Science and Technologies  
National Council of Researches, Pisa, Italy