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AMMIRA: AN EASY AND EFFECTIVE SYSTEM TO MANAGE DIGITAL IMAGES OF ARTWORKS*

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AMMIRA is a hardware-software system to manage digital images of cultural heritage objects. Currently under development, its final version will integrate the functionalities of three subsystems, a computer-controlled scientific camera for multispectral image capture, an easy-to-use package for image manipulation and annotation, and a metadata editor that enables nonspecialist users to include semantics into the processed data, so that they can be stored and searched by content in large databases. Such a tool is very important to extract and manage all the information related to valuable objects that must be studied, maintained, and also accessed by many types of users. The data acquisition is based on a *DTA Chroma* refrigerated camera, equipped with its standard control software, a custom-made motorized autofocus system, and a real-time viewfinder for rapid framing and focusing in all the channels available. A filter wheel allows three visible and two infrared channels to be captured. The illumination is provided by white-light lamps for RGB and IR reflection images, and Wood lamps for ultraviolet fluorescence images. Moreover, a structured-light projector can be used to reconstruct the 3D shape of the object under acquisition. Having 3D information available can be useful to many purposes. This is obvious for 3D objects, but is also true for paintings or documents, whose virtual restoration can include a flattening of the surface to reduce the effect of material deformation. The multichannel image data available help both virtual restoration and feature extraction. Most methods to perform these tasks need the channel maps to be precisely coregistered. Our raw data, however, do not meet this requirement. Indeed, each channel image is acquired separately, and the different filters used can produce displacements and differences in focusing from channel to channel. Additional distortions can arise from accidental causes during the capture procedure. This is why the first image manipulation module is devoted to coregister multiple images, corrected, where needed, for 2D or 3D geometric distortions. The other image manipulation modules are used for virtual restoration or extraction of spectrally-distinguishable features from the object's appearance. In particular, a group of algorithms are based on linear image models, and are able to both reduce degradations in documents (such as stains, blurred areas, etc.) and extract even barely visible features, such as erased text, watermarks, and stamps, which can then be classified and annotated. Other algorithms are based on nonlinear models, and are able to remove the characteristic back-to-front interference that often affects document images. A specially designed metadata editor allows the user to record the procedures applied to any piece of data and its relationships to other stored material, including all the administrative and descriptive information needed. The metadata files produced enable content-based searches in large databases. The effectiveness of all the procedures implemented has been evaluated quantitatively on simulated data, and tested successfully on real images of heavily degraded documents. The three *AMMIRA* subsystems are now operational, and a first software release is being tested by the project partners and by some selected user institution.

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