Near infrared reflectography and image processing methods for the study of paintings

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Near InfraRed reflectography (NIRR) is a non invasive diagnostic method applied to artworks for monitoring the state of conservation, the analysis of materials and the study of techniques used by the artist.

In recent years, the availability of CCD sensors for digital image acquisition have strongly increased the potentiality of NIRR for mapping hidden features and alterations of artworks.

In particular, NIRR has be proven to be operative on paintings to identify under-drawings, changes made by the author himself, alterations due to restorations, hidden details behind the pictorial layers as well as to distinguish some pigments whose response in the visible spectrum is very similar.

Physically, it is due to the lower attenuation of the near infrared radiation (800– 3000 nm) in crossing the pictorial layer than the visible one. In particular, the capability of NIRR to penetrate the various paint layers according to their transparency characteristics and thickness depends on the spectral response which denotes the sensitivity across the wavelengths of the reflectographic system.

A contribution to the improvement of the results could be obtained by post processing techniques in order to extract features which cannot be seen in the visible spectrum.

This paper deals with the use of post processing methods applied to images taken from a CCD sensor which acquires data in the Visible (panchromatic and RGB (400-700 nm)) and in two bands of near infrared, IR1 (700-950 nm) e IR2 (950-1150 nm).

In particular, Principal Component Analysis and a Normalized Difference Index of IR1 and IR2 have been experienced for the study of a painting, thus revealing hidden details behind the pictorial layers not visible from the dataset acquired by the CCD sensor.