

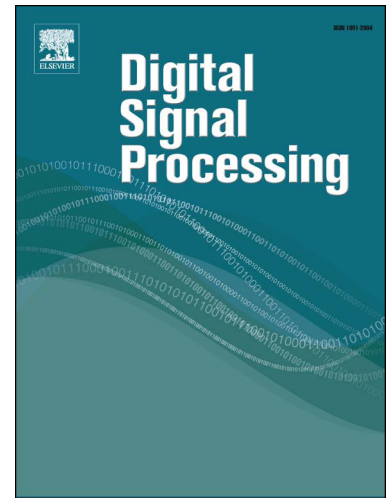
Accepted Manuscript

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PII: S1051-2004(16)30157-9
DOI: <http://dx.doi.org/10.1016/j.dsp.2016.09.007>
Reference: YDSPR 2016

To appear in: *Digital Signal Processing*



Please cite this article in press as: J. Blažek et al., Improvement of the visibility of concealed features in artwork NIR reflectograms by information separation, *Digit. Signal Process.* (2016), <http://dx.doi.org/10.1016/j.dsp.2016.09.007>

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Improvement of the visibility of concealed features in artwork NIR reflectograms by information separation

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Abstract

Near Infrared (NIR) reflectography, coupled to visible (VIS) one, is a spectrophotometric imaging technique employed to probe both the inner and the outer layers of artworks. NIR reflectograms may partially contain information pertinent to the visible spectrum (due to the poor pigment transparency in NIR) and this decreases their comprehensibility. This work presents an innovative digital processing methodology for accentuating information contained in the infrared reflectograms. The proposed method consists of inducing minor changes in pixel intensity by suppressing VIS information content from NIR information content. The method creates such enhanced NIR reflectogram by extrapolating VIS reflectogram to a reflectogram recorded in NIR range and by subtracting it from the measured values in the near infrared spectral sub-band. As an extrapolator we suggest a feed forward artificial neural network (ANN). Significant results of improved visualization are exemplified on reflectograms acquired with a VIS-NIR (400,2250)nm scanning device on real paintings such as Madonna dei Fusi attributed to Leonardo da Vinci. Parameters of the method, artificial neural network and separability of used pigments are discussed.

Keywords: signal separation, painted layer enhancement, separability limitations, artwork analysis, infrared reflectography

1. Introduction

Infrared reflectography (IRR) is a technique established in the 1960s [1] for investigation of historical paintings. It consists of detecting the radiation scattered back from a painted surface in a spectral range starting at around 800nm, immediately beyond the visible one. By means of such utterly non-invasive and non-contact examination technique, one can shed light onto the artist's original idea by visualization of either a preliminary sketch made by the painter on a preparation ground, prior to painting, or the so-called *pentimenti*, changes to the original project during painting construction made by the artist himself. The analyses of underdrawing and hidden layers (presence/absence and type) are essential for a historic/stylistic

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