Researchers explore hyperspectral imaging to virtually restore murals

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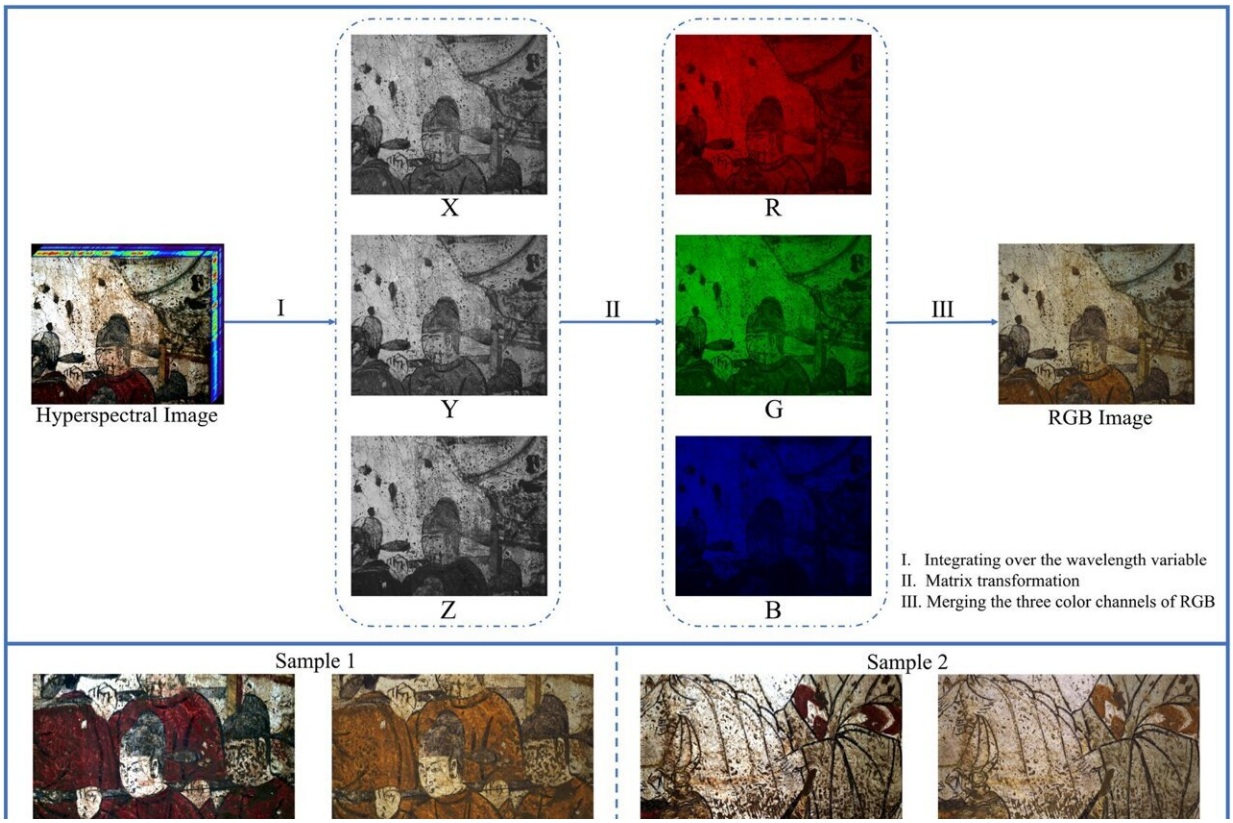

The process of color reconstruction by the CIE standard colorimetric system. Credit: *Heritage Science* (2024). DOI: 10.1186/s40494-024-01501-0

In a study published in *Heritage Science*, a team led by Prof. Zhang Pengchang from the Xi'an Institute of Optics and Precision Mechanics

of the Chinese Academy of Sciences developed an automated virtual restoration system for murals based on hyperspectral imaging technology. This system was applied to reconstruct murals and achieved outstanding restoration results.

Hyperspectral imaging technology, integrating feature detection and visual perception, is widely used for high-dimensional information recording and the analysis of material properties of color layers on mural surfaces. Additionally, hyperspectral pseudo-color display technology enables the virtual restoration of faded colors.

In this study, researchers virtually restored murals from the Tang Dynasty tomb discovered in Baiyangzhai Village, Xi'an, Shaanxi Province.

Researchers first identified and classified mural damaged regions utilizing superpixel division of hyperspectral images and spectral binary coding algorithm. Then, they converted hyperspectral images into red-green-blue (RGB) images utilizing a standard colorimetric system, which effectively addresses color fading and improves multi-scale image quality.

Finally, they proposed a layered restoration strategy which integrates partial convolutional neural network with the Criminisi algorithm, ensuring consistency and coherence in the restoration of large-scale missing points and defaced points.

"This work offers non-contact, non-destructive testing with superior color fidelity and restoration results compared to existing methods. It offers valuable insights for cultural heritage preservation," said Prof. Zhang.

More information: Zimu Zeng et al, Virtual restoration of ancient

tomb murals based on hyperspectral imaging, *Heritage Science* (2024). DOI: 10.1186/s40494-024-01501-0

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