

ImageJ Toolbox for Working with Cultural Heritage Materials

Abstract

Cultural heritage materials, including ancient manuscripts, maps, and artworks, are the subject of many image analysis investigations. Example applications include: work with manuscripts to discover or improve the legibility of faint or nonvisible text and graphics; research that aims to discover text or drawings that have been erased, overwritten, or overpainted; work with graphical substrates (paper, parchment, rock, stucco, wood) to characterize ongoing or past damage processes and contaminants; efforts to identify and discriminate pigments and colorants that are visually similar; work to quantitatively measure color properties with high accuracy; and tracking of subtle changes of reflectance or fluorescence emission properties of materials over time.

The research questions and approaches in these efforts have clear parallels with those in the biological, medical, and physical sciences. Because of these parallels, the author has found ImageJ to be a vital tool for investigations that draw upon the range of operations that ImageJ implements. Many central questions of these investigations have been well addressed by capabilities in ImageJ that were developed for application in other fields of research.

The majority of these cultural heritage projects employ spectral imaging techniques spanning UV, VIS, and IR wavelengths. The general approach has been to capture numerous images of the scene using different illumination and detection wavebands of light, while also collecting control and calibration images that utilize spatial and spectral standards. The spatially processed and spectrally combined images that are at the core of processing of these images are naturally handled in ImageJ using native, macro- and plugin-based capabilities.

This talk describes the initial development and use of an ImageJ toolbox that facilitates use of operations that have been recurrently effective for the author and collaborators while working with cultural heritage materials. This toolbox ("Paleo") utilizes many existing ImageJ plugins, including: GUI features of Jerome Mutterer's "ActionBar" plugin; Michael Abramoff's principal components analysis implemented in the "BIJ.jar" plugins; and the "DStretch" plugin authored by Jon Harmann. Additional tools are implemented in custom macros and plugins, motivated by the work of project collaborators and presently implemented by the author. These include tools that facilitate work with spectral image stacks, tools for markup of images, tools for rigorous calibration and standardization, and others.

A goal of this presentation is to spawn interest and effort toward the further development and distribution of these open source tools for image processing of cultural heritage materials. It is hoped that this early work can attract the involvement and contributions of skilled scientists and code writers who are presently evolving the ImageJ constellation of tools.

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