ChemImage™

*Application Note*

# Latent Print Detection and Enhancement Through the Use of Hyperspectral Imaging

## Introduction

Conventional latent print detection and enhancement is commonly performed using excitation or illumination from a suitable forensic light source, with direct image capture on photographic film or via a high sensitivity charge coupled device. This configuration collects data at one specific color, with a single barrier filter. ChemImage hyperspectral imaging (HSI) technology uses liquid crystal tunable filters (LCTF) to eliminate the need for all barrier filters. HSI combines standard digital imaging techniques with common spectroscopic methods to provide increased sensitivity and enhanced fingerprint to substrate contrast.

## Experimental Information

Using ChemImage HSI technology, a hyperspectral image was generated by collecting digital images as a function of wavelength through the use of an LCTF. Images can be collected in reflection mode (broadband white light illumination) or in fluorescence mode (300-400 nm UV excitation) from 400-720 nm. Because the images are collected as a function of wavelength, each pixel within the image has a fully resolved reflectance or fluorescence spectrum associated with it. Data acquisition and processing was accomplished using ChemImage software. Following data acquisition, the software may be used to generate univariate (i.e., single wavelength) images characteristic of absorption, reflectance or fluorescence exhibited by the ridges of the fingerprint. Alternatively, through the use of multivariate (i.e., multiple wavelengths) statistical tools, the software probes the variability present at a range of wavelengths to enhance the contrast between the substrate and the fingerprint. Conventional fingerprint imaging systems that rely on single wavelength images are not capable of this superior level of image enhancement.

## Results & Discussion

HSI combines conventional spectroscopy and digital imaging for the imaging of materials. This nondestructive technique provides high spatial and spectral resolution data. The advantage of HSI lies in the information embedded within the image. This method of data collection allows for better visualization and discrimination of ridge detail, even on complex, patterned or otherwise interfering backgrounds. Contrast within the image is generated from the varying reflection or emission that the treated fingerprint and the substrate exhibit at particular wavelengths.


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***Figure 1.*** *Fingerprint revealed on a counterfeit $10 bill, dark background extracted.*

Conventional fingerprint imaging systems collect data at one specific color using a single barrier filter and, with limited knowledge of the fingerprint's absorption or luminescence properties, require the operator to change barrier filters to optimize contrast. With HSI, the data is separated into individual wavelengths within one dataset. This enables the examiner to discern usable information from background information on a pixel by pixel basis. In addition, the user can easily isolate the maximum absorption or emission of a treated fingerprint, thereby optimizing image contrast. Further, the variability

present at multiple wavelengths allow multivariate statistical processing algorithms in ChemImage software to further enhance visualization of the ridge detail to background contrast.

## Conclusion

HSI:

- Enables enhanced fingerprint to substrate contrast
- Provides accurate, reliable and validated courtroom friendly results
- Obtains data in a nondestructive manner

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