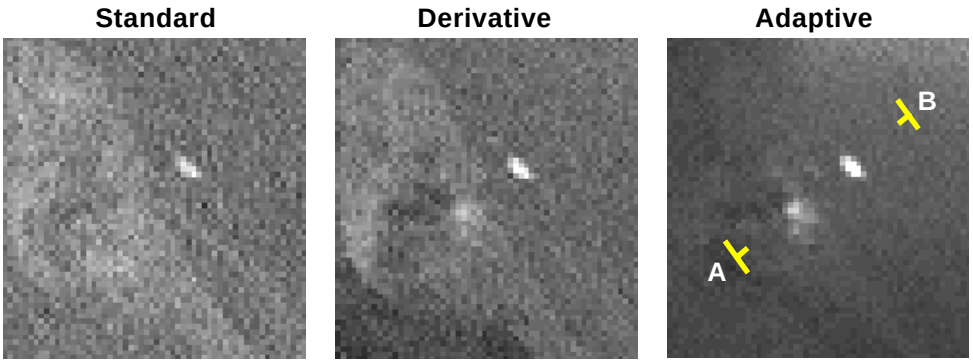
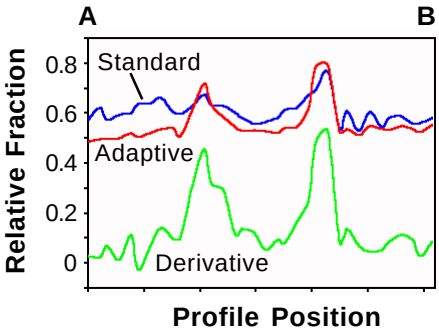
# New Matched Filtering Options

Two new variants have been added to the standard Matched Filtering procedure in the Hyperspectral Analysis process: Derivative and Locally Adaptive Matched Filtering. All of the matched filtering methods detect a target spectral signature against a background of unknown spectra, and produce a grayscale image showing the relative abundance of the target material for each image cell. The standard and derivative methods estimate the composite background spectrum using the pseudoinverse of the correlation matrix for the entire image. The new derivative method uses the first derivative of the spectra in place of the original spectral values when comparing spectra. This provides a better match between spectra with the same shape but differing overall brightness. The derivative method accentuates the contrast between the target signature and the background in the fraction image, and can improve the signal-to-noise ratio.

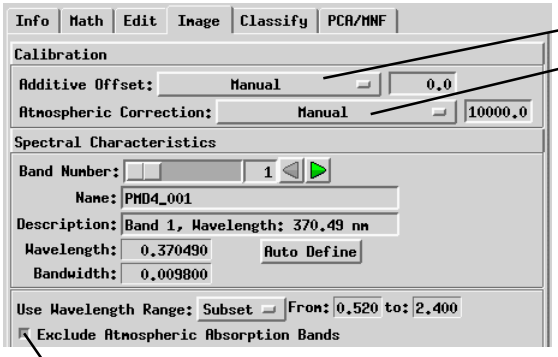
The locally adaptive matched filtering method is best suited for locating a target signature that is only very locally abundant. It estimates a composite background signature individually for each cell in the image. Inverse correlation matrices are computed for a number of overlapping square windows covering the scene, and are then used to interpolate an approximate matrix for each image cell. The adaptive method greatly reduces background noise in the fraction image for rare target signatures. Its performance can degrade in parts of a scene if the target material is abundant enough to contribute significantly to the local composite background signature.



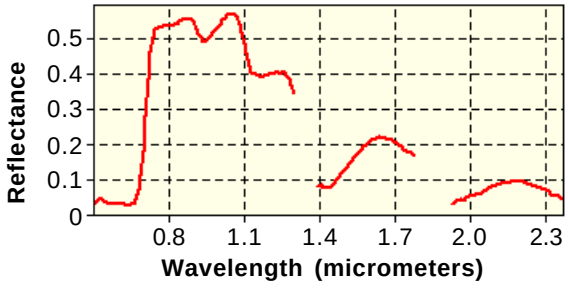

Comparison of matched filtering results for a small part of the Cuprite, Nevada AVIRIS scene using the wavelength range 1.98 to 2.5 µm. The target signature is an image spectrum for the mineral alunite. Only the brighter of two small concentrations of alunite is evident in the standard matched filter fraction image. The weaker concentration is barely identifiable in the derivative matched filter image against the still-noisy background. Both concentrations are very evident in the adaptive matched filter fraction image, and background noise is greatly reduced. Points A and B in the adaptive matched filter image identify the ends of a profile line across the alunite concentrations. The graph shows a plot of the fraction image raster values along the profile line for each of the matched filter methods. In this example both derivative and adaptive methods improved the signal-to-noise ratio.

## Other New Hyperspectral Analysis Features:




New Manual options are available for the on-the-fly Additive Offset and Atmospheric Correction (scaling) conversions. These options let you set global offset and scale values for a hyperspectral image that has already been converted to scaled reflectance. In this example, the reflectance range 0 to 1.00 is represented in the hyperspectral image by 16-bit signed integer values from 0 to 10,000. Setting the Additive Offset value to 0.00 and the Atmospheric Correction value to 10000 ensures that true reflectance values are shown in spectral plots and used in processing.

You can now automatically exclude from processing the two ranges of spectral bands near 1.4 and 1.9 µm that are severely degraded by water vapor absorption. These ranges are shown as gaps in spectral plots, as in the plot to the right.

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