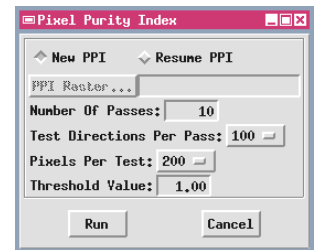


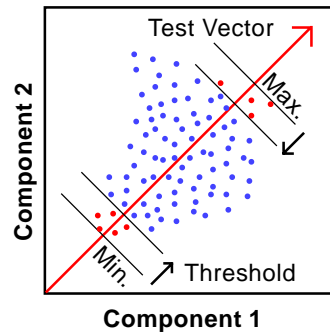
Pixel Purity Index and Masking Aid Endmember Selection

The Pixel Purity Index (PPI) is a new automated procedure in the Hyperspectral Analysis process for defining potential image endmember spectra for spectral unmixing. When image spectra are treated as points in n-dimensional spectral space, endmember spectra should lie along the margins of the data cloud. The PPI creates a large number of randomly-oriented test vectors anchored at the origin of the coordinate space. The spectral points are projected onto each test vector, and spectra within a threshold distance of the minimum and maximum projected values are flagged as extreme (as illustrated here in two dimensions). As directions are tested, the process tallies the number of times an image cell is found to be extreme. Cells with high values in the resulting PPI raster should correspond primarily to “edge” spectra. The PPI raster then can be used as a mask to control input to the n-Dimensional Visualizer.

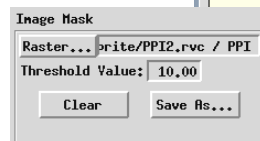
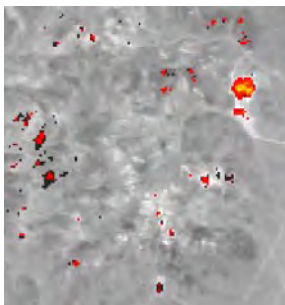


① Run PPI on MNF Components

To speed processing, first reduce the dimensionality of the hyperspectral data by running the Minimum Noise Fraction Transform (MNF). Select the set of noise-free MNF components and open it as a hyperspectral image. Then select Pixel Purity Index from the Image menu in the Hyperspectral Analysis window.

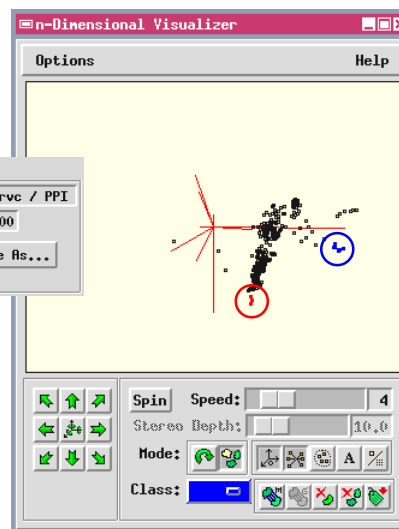


② Use PPI raster as mask for n-Dimensional Visualizer

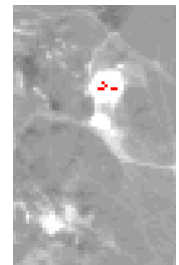
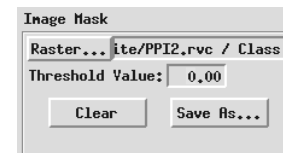


You can use the n-Dimensional Visualizer to explore the

extreme MNF spectra that were found by the PPI process. Use the controls on the Image Mask subpanel to select the PPI raster as a mask and set a threshold PPI value. The mask is automatically displayed over the current image. (You can create a color map for the PPI raster to show values above the threshold in color [in the example above, red to yellow with increasing PPI value]. Nonzero values below the threshold are shown in black.) When you launch the n-Dimensional Visualizer and select an area, only spectra from cells exceeding the PPI threshold are plotted. Use the Visualizer controls to rotate the plot and mark potential endmember spectra. When you are satisfied with the selected endmember classes, use the Classes from Source operation to save a new mask raster with the selected endmember cells shown in their class color.



③ Use class raster as mask with original hyperspectral image to extract endmember image spectra.



To extract the final image endmember spectra, open the original hyperspectral image and select the endmember class raster created in the previous step as an Image Mask. Use the Spectral Profile tool to view image spectra for the endmember class cells and save your selected spectra in a library. (The endmember class cells are easier to find if you display a single image band or MNF component as a grayscale reference image over the hyperspectral image, as in the illustration above.)

CIR Band Display



Vegetation Fraction



Soil Fraction



Water / Shade Fraction



RMS Error image



The Linear Unmixing procedure now produces not only fraction images for each endmember, but also an RMS error raster that helps identify parts of the scene that were not adequately modeled by the selected endmember spectra.