Cross Correlation versus Normalized Mutual Information on Image Registration

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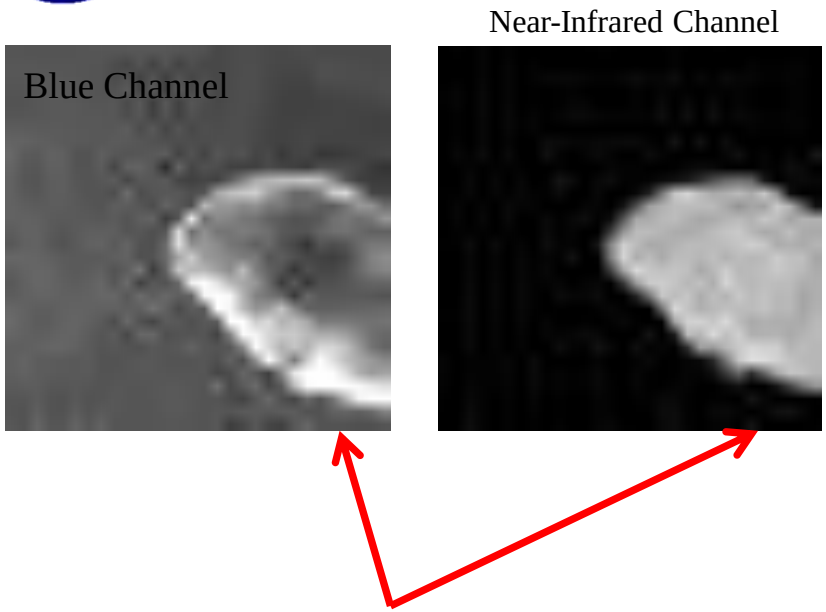

Shoreline in Different Location in Blue and Near-IR band

Figure 1

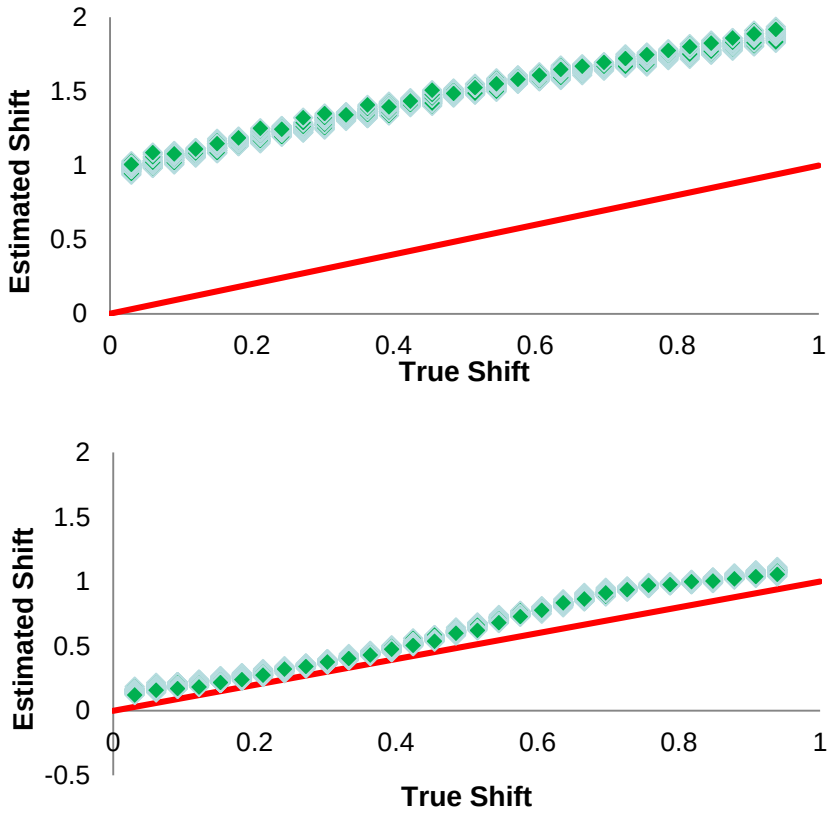

Figure 2

Normalized mutual information gives more accurate registration result than cross correlation when the edges of features are not aligned due to the spectral response differences between bands.

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Data Sources: Landsat image from over Hadi collected on Dec 09, 2005 (L71009047_0472005120).

Technical Description of Figures:

Figure 1: Blue and Near-infrared band images. Shoreline extends further to the ocean in blue channel due to the spectral response difference at shallow water region. This difference is a “false signal” in image registration.

Figure 2: Plots of registered near-infrared band to blue band images. The sub-pixel shifts are introduced due to spectral response differences in shallow water. Both the cross correlation method and the normalized mutual information method are used to assess the shift between blue and near-infrared images. Upper/lower plots shows the estimated shift against the true introduced shift for the cross-correlation/normalized mutual information methods.

Scientific significance, societal relevance, and relationships to future missions: This is the first study to quantitatively assess and compare cross correlation and normalized mutual information methods used to register images in subpixel scale. The study shows that the normalized mutual information method is less sensitive to unaligned edges due to the spectral response differences than is cross correlation. This characteristic makes the normalized image resolution a better candidate for band to band registration. Improved band-to-band registration in the data from satellite-borne instruments will result in improved retrievals of key science measurements such as cloud properties, vegetation, snow and fire.