

Iterative Target Detection for Detection and Classification with an Example Application in Hyperspectral Imaging

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Research Objective

Use targeted anomaly detection iteratively to detect and classify regions in an image and discriminate signals with very minor differences.

Related Work

Gallagher, NB, "Classical Least Squares for Detection and Classification," in *Hyperspectral Imaging*, 32, 1st Ed, JM Amigo ed, Elsevier (2019)
Gallagher, NB, Shaver, JM, Bishop, R, Roginski, RT, Wise, BM, "Decompositions with Maximum Signal Factors," *J. Chemometr.*, 28(8), 663-671 (2014)

1) Detect and Classify Major Classes

Use targeted anomaly detection (whitened PCA, WPCA) iteratively to characterize and detect major sources of signal in the image. Water was first. Circled areas were detections of minor water signal in the image. Blue pixels corresponded to suppressed clutter signal.

2) Remove Major Class Signals One-at-a-Time and Identify Additional Classes

Class target signals are similar but are easy to split apart. WPCA is related to generalized least squares (GLS).

3) Split Classes into Sub-Classes

Blue Class Green pixels in (2) in yellow box are the representative target used to split the class into sub-classes using ELS/GLS to discriminate signals with very minor differences (extended least squares).

