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Spectral Anomaly Detection and Clustering in Radiological Search

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Abstract : Radiological search and mapping depends on the successful recognition of anomalies in large data sets which contain varied and dynamic backgrounds. We present a new algorithmic approach for real-time anomaly detection which is resistant to common detector imperfections, avoids the limitations of a source template library and provides immediate, and easily interpretable, user feedback. This algorithm is based on a continuous wavelet transform for variance reduction and evaluates the deviation between a foreground measurement and a local background expectation using methods from linear algebra. We also present a technique for recognizing and visualizing spectrally similar clusters of data. This technique uses Laplacian Eigenmap Manifold Learning to perform dimensional reduction which preserves the geometric "closeness" of the data while maintaining sensitivity to outlying data. We illustrate the utility of both techniques on real-world data sets.

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