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IMPROVED SIGNATURE DEFINITION THROUGH BOUNDARY-EDITED CLUSTERING*

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ABSTRACT

It is desirable to enhance the performance of clustering techniques, so that cluster statistics more usefully represent the true spectral classes in the scene. If this is done, then improvements in classification can be realized, leading for example to more accurate large area crop surveys.

To improve the statistics available from a clustering algorithm, an edge-detection algorithm is used. The edge detector provides the cluster routine with inputs to filter out pixels which are likely to represent spectral response to a mixture of more than one ground cover type. The result is that the proportion of pixels representing pure classes in the scene is enriched.

While nearly all boundary detection algorithms are candidates for such use, this paper deals primarily with one which uses a gradient technique. Briefly, the gradient technique measures the spatial rate of change of signal value, averaged over all spectral bands. This is done by performing subtractions between neighboring pixels, and combining the along-scan and across-scan differences. Once the "gradient" at each point is calculated, a threshold is established so as to reject a specified percentage of the pixels to be used by the cluster routine. The paper will discuss the choice of the threshold, so as to filter most "mixture" pixels and yet avoid discarding too much, and perhaps losing high-texture ground cover types.

The effect of using the gradient filter on clustering seems to lie primarily in causing a greater proportion of pixels to fall in clusters which are near modes representing pure cover types, but also in bunching of the cluster centers somewhat closer to the modes. This aspect is discussed in conjunction with how the gradient filter affects the overall distribution function. In the quest toward improving techniques of clustering, a useful goal should be to improve the positioning of cluster centers relative to meaningful modes in the distribution. The enhancement of modes by the gradient filtering is an important step.

Two significant advantages are believed to result from the technique. First, it provides a suitable means of data reduction when clustering large scenes, so as to save processing costs. And second, the clusters which result more accurately represent the true ground classes, leading to better classification performance and more effective use of cluster-based signature extension techniques.

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