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AUTOMATIC MIXED PIXEL CLASSIFICATION (AMPC): PROJECTION PURSUIT

In Chapter 15, LSRMA made use of skewness and kurtosis to detect and classify potential targets automatically without prior target knowledge. These two criteria were a simplification of the contrast function in (15.5) derived by Comon. In this chapter, we present a similar approach developed by Chiang, Chang and Ginsberg (2001), called projection pursuit (PP), also used skewness and kurtosis as a base to design various project indices for automatic target detection and classification. Both LSRMA and PP model small targets as anomalies with an understanding that their sizes are relatively small in the spatial image scene compared to the image background. With this assumption, such small anomalies can be detected by finding outliers of the background distribution. The criteria, skewness and kurtosis are well suited for this purpose. Unlike LSRMA that requires a linear mixture model, the proposed PP projects a high dimensional data set into a low dimensional data space while retaining desired target information. It utilizes skewness and kurtosis as projection indices to explore projections of interestingness which are those caused by small man-made targets in a large unknown background. To find optimal solutions for projection indices, an evolutionary algorithm is developed to prevent the solutions from being trapped in local optima. Finally, target detection and classification is achieved by projecting the image data into separate projection images. In order to segment potential targets from the image background in these projection images, a zero-detection process is developed to threshold the projection images into a sequence of binary images, each of which detects a particular type of targets. This approach is different from LSRMA where the number of independent components is determined by an estimate using VD in Chapter 17 or is selected *a priori*.