15

AUTOMATIC MIXED PIXEL CLASSIFICATION (AMPC): LINEAR SPECTRAL RANDOM MIXTURE ANALYSIS (LSRMA)

Independent component analysis (ICA) has shown much success in blind source separation and channel equalization. Its applications to remotely sensed images are investigated in recent years. Linear spectral mixture analysis (LSMA) has been widely used for subpixel detection and mixed pixel classification in remote sensing image processing and already studied in Chapters 3, 8-10, 13. It models the spectral signature of an image pixel vector as a linear mixture of spectral signatures of targets present in the image data and the target abundance fractions are assumed to be *unknown*, but *nonrandom constants*. This chapter combines these two approaches to one, called ICA-based linear spectral random mixture analysis (LSRMA), which describes an image pixel vector as a random process resulting from a random composition of multiple spectral signatures of distinct targets in the image data. It differs from LSMA in that the abundance fractions of the target signatures in LSRMA are considered to be *unknown random independent signal sources*. Two major advantages can be benefited from LSRMA. First, LSRMA does not require any prior knowledge of the targets used in the linear mixture model. Second and most importantly, LSRMA models each of target signatures as an independent random signal source so that the spectral variability of target signatures can be captured more effectively in a stochastic manner. The only required knowledge for LSRMA is the number of signal sources, p assumed to be present in the image data. This number is estimated by Neyman-Pearson detection theory-based eigen-thresholding methods to be investigated in Chapter 17.