3

TARGET ABUNDANCE-CONSTRAINED SUBPIXEL DETECTION: PARTIALLY CONSTRAINED LEAST-SQUARES METHODS

Subpixel target detection has received considerable interest in remote sensing image processing in recent years (Sabol et al., 1992). Due to significantly improved spectral resolution by recent advances of remote sensing instruments, imaging spectrometers such as AVIRIS and HYDICE sensors can now uncover and extract targets smaller than the pixel spatial resolution, in which case targets are generally embedded in a single pixel and cannot be detected spatially. As a result, traditional spatial-based image processing techniques are not directly applicable. In order to resolve this problem, we must rely on their spectral properties to detect these targets at subpixel level. In this chapter, linear spectral mixture analysis (LSMA) is investigated for subpixel target detection. In particular, we consider the target abundance-constrained subpixel detection that imposes different partial constraints on the abundance fractions of the target signatures used in the LSMA. Two partially abundance-constrained methods, referred to as sum-to-one constrained least-squares (SCLS) and nonnegatively constrained least-squares (NCLS), will be presented in this chapter. SCLS constrains on the abundance fractions of the target signatures summed to one with no constraint on nonnegativity of the abundance fractions. On the other hand, NCLS requires the abundance fractions of the target signatures to be nonnegative, but discards the abundance sum-to-one constraint.