Public Abstract

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Graduation Term:FS 2013
Department:Electrical Engineering
Degree:MS

Title:ACCOUNTING FOR SPECTRAL VARIABILITY IN HYPERSPECTRAL UNMIXING USING BETA ENDMEMBER DISTRIBUTIONS

Hyperspectral imaging sensors collect radiance/reflectance values over an area (or a scene) across hundreds of spectral bands (Goetz, et al., 1985). Each element of the image data represents the radiance/reflectance values measured in one particular wavelength at one pixel location.
Endmembers are the pure individual spectral signatures of materials in the scene. It is assumed that each material has relatively constant, yet distinct spectral characteristics. The percentage of the materials presented in each pixel is called a proportion. Hyperspectral unmixing is to find the proportions of endmembers at every pixel in the scene.
Due to factors such as atmospheric effects, illumination, moisture conditions, and inherent spectral variability of the material itself, such as the variations in biophysical and biochemical composition in vegetation (Song, 2005), the spectral signature of endmembers may vary from time to time and from pixel to pixel in the scene. Such endmember variability is taken into consideration in this thesis by representing endmembers using Beta distributions. The image data is assumed to follow the Beta Compositional Model (BCM) (Zare, et al., 2013).
In this thesis, new BCM-Spatial unmixing algorithms that incorporate both spectral and spatial information are proposed and compared to existing methods in the literature for spectral unmixing. Results indicate that the new algorithms are effective at unmixing. Applications can include agriculture forecasting (Corp, et al., 2010), environmental regulation (Krezhova, et al., 2011; Wan, et al., 2011), urban planning (Heiden, et al., 2003; Guglietta, et al., 2007; Gamba, 2013) and geology and medical image analysis (Martin, et al., 2006; Akbari, et al., 2012).