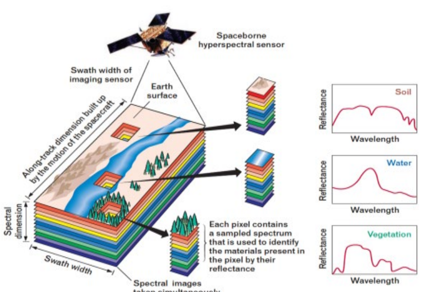
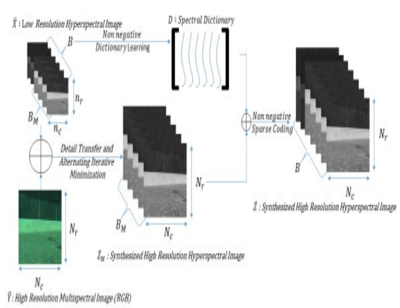
Title:	Extended Super Resolution of Hyperspectral Images via Non Negative Sparse Coding
Author(s):	Pawar, Maneesh
Supervisor(s):	Venkatesh, K S
Keyword(s):	Hyperspectral imaging ADMM Super resolution Multispectral
Subject(s):	Hyperspectral imaging Super resolution

Abstract:

Often high resolution (HR) RGB images generated by sparse sampling of the visible spectrum fail to produce differentiable modality for computer vision tasks, Hence computer vision tasks have to rely on gross structures in an image like corners, edges etc. instead of just the recorded reflectance of objects or materials at each pixel in a scene. In contrast to RGB, hyperspectral imaging allows pixels to record reflectance of the scene over multiple contiguous bands, which results in rich differentiable modalities. However, hyperspectral imaging, despite having a growing number of applications from agriculture, surveillance, mineralogy, food processing to eye care, is hitherto restricted to low spatial resolution imaging due to sensor hardware limitations. In this paper, we propose a hyperspectral super resolution technique to produce a high resolution (HR) hyperspectral image with a spectral support of 400nm-1020nm from a low resolution (LR) hyperspectral image of the same spectral support and a high resolution multispectral (RGB) image with reduced spectral support of 400nm-700nm. In the first step, we generate a HR prior by estimating HR hyperspectral band images in the spectral support of 400nm-700nm by detail transfer and alternating iterative minimization. In the next step, we use the generated prior to further estimate the HR hyperspectral images for 710nm-1020nm bands by learning a non-negative dictionary of reflectance spectra signatures of all the materials present in the scene from the LR hyperspectral image with spectral support in 400nm-1020nm. With the estimated prior and learned dictionary, we predict the non-negative sparse codes for HR hyperspectral band images in the band of 710nm-1020nm.





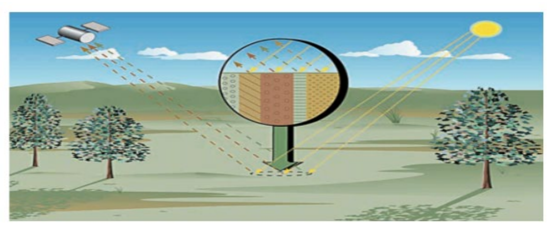


Figure 2.1: Linear spectral unmixing model [1].

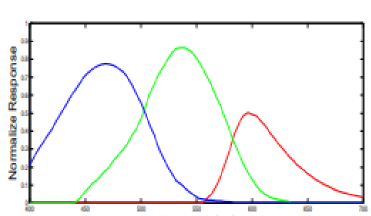


Figure 3.1: Spectral Response of Nikon D700.

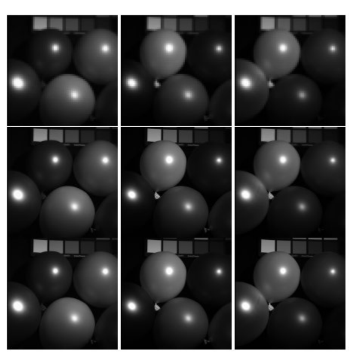


Figure 5.1: Reconstructed HR hyperspectral images for *balloons* from CAVE database. Top row represents the 64×64 LR hyperspectral image, middle row represents the 512×512 ground truth and last row represents the reconstructed 512×512 HR hyperspectral images for $430nm$, $540nm$ and $640nm$ (Left to right) bands respectively.

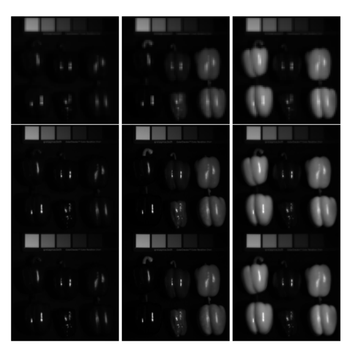


Figure 5.2: Reconstructed HR hyperspectral images for *peppers* from CAVE database. Top row represents the 64×64 LR hyperspectral image, middle row represents the 512×512 ground truth and last row represents the reconstructed 512×512 HR hyperspectral images for $430nm$, $540nm$ and $640nm$ (Left to right) bands respectively.