

## 1. MOTIVATION

Denoising is an essential step on the hyperspectral analysis pipeline. It is unavoidable that noise will be introduced during the image acquisition process and it can interfere negatively on the accuracy of the information extracted. The methods used for the denoising of a single channel image can be directly applied to each channel of a hyperspectral image. However, there is valuable information that comes from the correlation across spectral bands that can significantly improve the reduction of noise. This proposal is to implement and evaluate the performance of a chosen denoising method that takes into account the relationship between bands.

## 2. PROJECT OVERVIEW

This proposal consists in the implementation and evaluation of a denoising method called Adaptive Spatial-Spectral Dictionary Learning, proposed by Fu *et al.* [1], that was shown to reduce noise effectively on a variety of test images. The method takes advantages of the high correlation across the spectra, as well as the sparsity in the spatial-spectral domain and the non-local spatial self-similarity. The performance of the method will be compared against two simpler and very well-known methods, bilinear filter and non-local means. The comparison will be quantitative (PSNR) as well as qualitative, by means of visual perception.

The algorithms will be implemented in MATLAB and test images will be obtained from the Columbia Multispectral Image Database [3].

## 3. MILESTONES AND TIMELINE

Task:	Conclude by:
Implement the adaptive spatial-spectral dictionary learning method	03/03
Implement bilinear filter and non-local means	03/06
Add different levels of artificial noise to test images to be reconstructed by the denoising methods	03/08
Evaluate performance and consider possible variations of the method	03/10

#### 4. REFERENCES

- [1] Y. Fu, A.Lam, I. Sato and Y. Sato, "Adaptive Spatial-Spectral Dictionary Learning for Hyperspectral Image Denoising", in Proc. of International Conference on Computer Vision (ICCV), Dec. 2015
- [2] A. Buades, B. Coll and J.M. Morel, "A non-local algorithm for image denoising", in Proc. of 2005 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'05)
- [3] F. Yasuma, T. Mitsunaga, D. Iso, and S.K. Nayar, "Generalized Assorted Pixel Camera: Post-Capture Control of Resolution, Dynamic Range and Spectrum", Technical Report, Department of Computer Science, Columbia University CUCS-061-08, Nov. 2008