Embedded Transform Coding based Lossless Compression in Compressive Spectral Imaging with Coded Aperture

Pinghao Li*, Hongkai Xiong*, Henry Arguello†, and Gonzalo R. Arce‡

*Dept. of Electronic Engineering, Shanghai Jiao Tong University, Shanghai, 200240, China, lipinghao@sjtu.edu.cn, xionghongkai@sjtu.edu.cn

†Dept. of Computer Science, Universidad Industrial de Santander, Bucaramanga, 680002, Colombia, henarfu@uis.edu.co

‡Dept. of Electrical and Computer Engineering, University of Delaware, Newark, Delaware 19716, USA, arce@udel.edu

The multi-shot Coded Aperture Snapshot Spectral Imaging system (CASSI) described in [1] is an imaging architecture that senses the spectral imaging information of a 3D cube using a 2D focal plane array snapshot. Modeled as the summation of coded and shifted versions of different spectral voxels, the compressive CASSI measurements are difficult to be further compressed. This paper proposes an embedded transform coding that contains three stages: transform, split and bit plane coding, shown in Figure 1. A mean filter-based transform is firstly adopted to the compressive measurements by taking advantage of the structure of CASSI. Then, the transformed measurements can be split into an image matrix that is efficiently encoded by traditional image compression methods, and a remainder matrix which is further compressed by a bit plane coding based on the coded aperture such that some bit planes and positions can be confirmed to be zero. The proposed method provides better compression efficiency than the traditional lossless compression techniques.

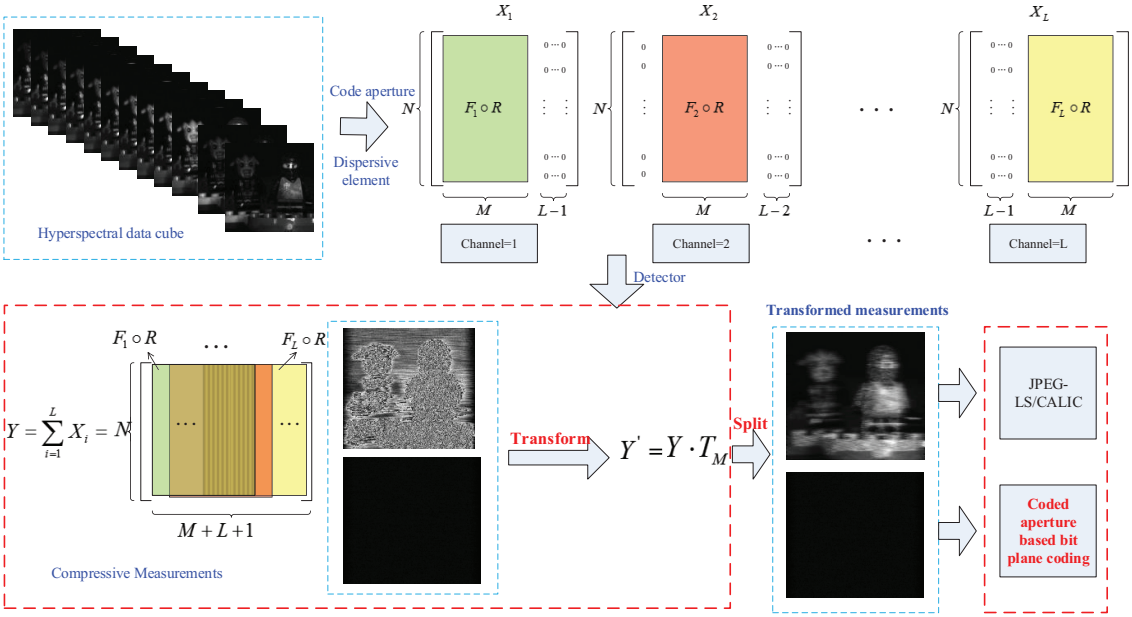

Figure 1: Illustration of the proposed embedded transform compression framework.

[1] H. Arguello and G. Arce, "Rank minimization code aperture design for spectrally selective compressive imaging," *IEEE Trans. on Image Processing*, vol. 22, pp. 941–954, 2013.

1068-0314/14 $31.00 © 2014 IEEE
DOI 10.1109/DCC.2014.26