Lapped Transforms based Image Recovery for Block Compressed Sensing

U. L. Wijewardhana* and M. Codreanu†

*Department of Electrical and Electronic
Faculty of Engineering
University of Sri Jayewardenepura
Nugegoda, Sri Lanka
uditha@sjp.ac.lk

†Centre for Wireless Communications
University of Oulu
Oulu, 90570, Finland
codreanu@oulu.fi

The compressed sensing (CS) theory asserts that, under certain conditions, a high dimensional signal can be reconstructed from a small number of random linear projections by utilizing computationally efficient recovery algorithms. Generally, these recovery algorithms process the entire set of measurements associated with the signal of interest at once. Even though such a method is feasible for a relatively small image, as the image size increases, this becomes quickly prohibitively complex. The block compressed sensing (BCS) is a method used to reduce this complexity for larger images. In BCS, the image is divided into small disjoint blocks and each block is acquired independently. The standard BCS algorithms recover each image block independently and then use post-processing techniques to reduce the blocking artifacts affecting the reconstructed image.

In contrast, we propose a post-processing free image reconstruction method for BCS which, in order to reduce the blocking artifacts, uses a *lapped transforms* based sparse image representation. Inspired by the graphical model associated to the lapped transform, we derived an iterative reconstruction technique where a small number of adjacent measurement blocks are jointly processed for recovering each image block. We further derived a Kalman-like implementation, where the preliminary information obtained in the preceding processing intervals is efficiently reused to refine the estimation of the transform domain coefficient blocks in the current estimation interval.

Figure 1: **left:** original image (*Lily*); **middle:** independent block reconstruction; **right:** proposed method.

This research was supported by Academy of Finland and Infotech Oulu Doctoral Program. At the time this research was carried out, U. L. Wijewardhana was affiliated with University of Oulu.

2375-0359/18/$31.00 ©2018 IEEE
DOI 10.1109/DCC.2018.00085