International Journal of Innovative
Computing, Information and Control
Volume **6**, Number **7**, July **2010**

 ISSN 1349-4198
pp. 3105–3120

# A FAST AND ROBUST MAP-BASED SUPERRESOLUTION RECONSTRUCTION METHOD USING CDHS AND BLOCK-WISE MOTION VECTOR SELECTION

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Received January 2009; revised June 2009

Abstract. *High computational complexity and occlusion including the extreme case of a scene change are the two most critical problems in superresolution (SR) reconstruction. In this paper, we adopted the Cross-Diamond-Hexagonal Search (CDHS) block-matching algorithm (BMA) to reduce the complexity significantly. The CDHS BMA reduced about 2/3 computation time without sacrificing the reconstruction quality comparable to the full search BMA but it has high noises, unqualified motion vectors, resulted from occlusion existing in each frame of a sequence. We further proposed a simple and robust block-wise motion vector selection (BWMVS) strategy that can remove occlusion effectively. The stability due to BWMVS was verified by the reconstruction results using the interpolation methods (nearest, bilinear, and bicubic). The experimental results showed that by combining the CDHS BMA and BWMVS, high quality images in SR reconstruction can be obtained without complex computation.*
**Keywords:** Occlusion, Superresolution (SR), Cross-diamond-hexagonal search (CDHS), Block-wise motion vector selection (BWMVS)

1. **Introduction.** The trailblazers of superresolution (SR), or high resolution (HR), restoration are Tsai and Hung [1]. They used the frequency domain approach to demonstrate the ability to reconstruct one improved resolution image from several under-sampling noise-free versions of it, based on the spatial aliasing effect. Kim *et al.* [2] extended this seminal frequency domain formulation by considering observation noises as well as spatial noises. The solution was calculated in terms of recursive least square (RSL) and a weighted RSL theory. And then Kim and Su [3] solved this problem with Tikhonov regularization since zeros in the discrete Fourier transform (DFT) domain of the blurring operator lead to an ill-posed problem. A discrete cosine transforms (DCT) based frequency domain method was developed in [4]. The spirit of SR reconstruction is to recover the high frequency as image enlarged, which is in contrast to the data hiding skill [5,6] that often emphases the low frequency part. Though the frequency domain approaches have the strength of theoretical simplicity and high computational efficiency [7,8], they are not able to incorporate spatial domain *a priori* knowledge and limited to the global translational motion model and linear space-invariant blur [7].

As contrasted with frequency domain approaches, many kinds of spatial domain approaches have been developed due to their abilities of being capable of covering almost any type of observation models easily, and being powerful for fusion of *a priori* information [9]. Based on Papoulis [10] and Yen [11], an alternative spatial domain generalized multi-channel sampling theorem was suggested by Ur and Gross [12]. The projection onto convex sets (POCS) was primarily applied in the extrapolation of band-limited signals