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A Novel Framework for Compressed Sensing based Scalable Video Coding

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Abstract

Considering high throughput values as specified by modern video processing standards, Scalable Video Coding (SVC) systems intended for such standards are generally implemented by means of dedicated hardware. However, the high computational complexity associated with the current Compressed Sensing (CS) based video coding schemes makes their hardware realization considerably challenging. In this paper, we present a novel CS based SVC framework that is amenable to real-time VLSI implementation. At the encoder, after applying the Three-Dimensional Discrete Wavelet Transform (3-D DWT) on the input video frames, a novel Adaptive Measurement Scheme (AMS) in CS is introduced, which is applied on the high frequency sub-bands of the 3-D DWT frames. The proposed AMS along with 3-D DWT not only achieves scalability and better compression ratio, but also reduces the overall computational complexity of the system. We have also proposed an Enhanced Approximate Message Passing (EAMP) algorithm to reconstruct the high frequency sub-bands from the CS measurements at the decoder. The proposed EAMP procedure combines the benefits of Approximate Message Passing (AMP) and Iterative Hard Thresholding (IHT) algorithms thereby simultaneously achieving sparsity measurement trade-off and good reconstruction quality. We have carried out the detailed complexity analysis and simulations to demonstrate the superiority of the proposed framework over the existing schemes.

Keywords: Scalable Video Coding (SVC), Compressed Sensing (CS), 3-D wavelets, Approximate Message Passing (AMP).

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