Temporal Redundancy Reduction in Compressive Video Sensing by using Moving Detection and Inter-Coding

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Compressed sensing-based CMOS image sensor (CS-CIS) has gained significant interest in the past few years. It can greatly reduce on-chip processor complexity, transmission cost, and storage requirement compared to conventional sampling method using Nyquist-Shannon rate. CS-CIS performs acquisition and compression simultaneously and transfers all heavy computation burden components to decoder, where the measurement streams can be processed and analyzed with unlimited resources, resulting in a low-complexity encoder. Thus, it is very suitable for transmitting only applications, where computational resource and power is limited [1]. However, spatial and temporal redundancy in measurement has become a primary concern which it is necessary to further compress.

In this paper, we proposed temporal redundancy reduction in compressive video sensing by using moving detection and inter-coding. Firstly, the moving detection is performed coding area extraction using local adaptive threshold to classify the measurement with an association of error distinction. However, false-positive detection could be occurred randomly, which transmission cost can be increasing uncertainty. To reduce transmission costs, the adaptive quantization parameters are adjusted by how frequently the area is detected. Moreover, we further compress the detected area by encoding the difference of current measurement and the best-matched measurement in neighboring frames. Finally, an efficient recovery algorithm of sparse signal is performed by using ℓ_1-minimization via primal-dual interior-point algorithm and reconstructed by inverse fast Walsh-Hadamard transform with horizontal kernel filter to prevent staircase artifacts simultaneously as shown in Fig. 1. The experimental results yield that our proposed can greatly reduce bandwidth usage in terms of BPP by 63.15%, improve in PSNR by 1.56dB, and SSIM by 14.81% on average when compared to the state-of-the-art works.

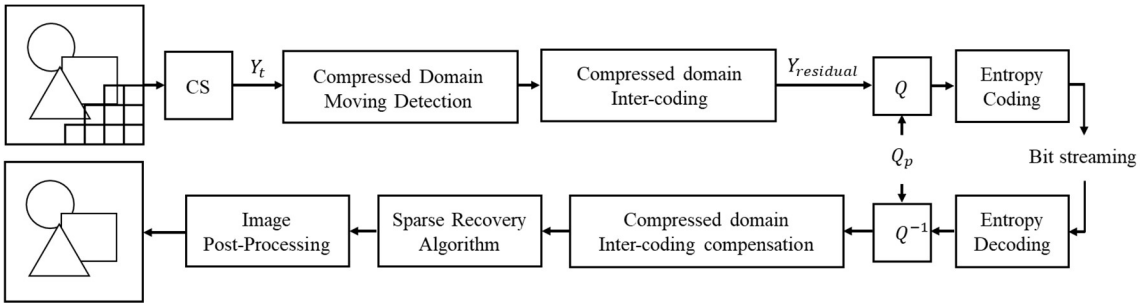

Figure 1. Proposed temporal redundancy reduction in compressive video sensing by using moving detection and inter-coding

Reference

[1] H. Jiang, et al, "Surveillance video analysis using compressive sensing with low latency," in Bell Labs Technical Journal, vol. 18, no. 4, pp. 63-74, March 2014.

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