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PARALLEL H.264/AVC RATE-DISTORTION OPTIMIZATION BASELINE PROFILE ENCODER ON DISTRIBUTED SHARE MEMORY SYSTEM

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Abstract. *The H.264/AVC video coding standard incorporates many coding tools into its design to improve its compression performance, which dramatically raises computation complexity. In a H.264/AVC rate-distortion optimization (RDO) encoder, computation time is primarily spent on calculating the rate-distortion cost of choosing the best coding mode. Parallel computation is one of the ways to speed up the encoder. However, calculating the rate-distortion costs requires lots of reference data of the macroblocks obtained from the encoded adjacent macroblocks to maintain the coding efficiency. This is not a good property for any parallel computing strategy, especially distributed share memory (DSM) system. To investigate this problem, this study proposes the parallel H.264/AVC RDO encoder architecture to obtain more speedup and parallel slice scheme (PSS) to parallel the modules of H.264/AVC RDO encoder and maintain the video quality. The proposed schemes are executed over a DSM system consisting with 5 PC computers (one master node with four slave processing nodes) and each computer has two dual-core processors. The reduction of rate-distortion curve in slow motion sequence such as Akiyo is slight. The maximum speedup of PSS is 4.22 in n=5/p=1 (five computers are used and each computer only uses one core). The final the PSS combined with wavefront order scheme in n=5/p=4 had executed in this paper.*

Keywords: H.264/AVC, Rate-distortion optimization, Distributed shared memory system, Parallel video encoder

1. **Introduction.** H.264/AVC [1] [2] is a video coding standard which has a high coding efficiency using several tools. These tools include intra prediction, multiple reference frames, variable block sizes for inter prediction, in-loop deblocking filtering and so on. H.264/AVC also adopts rate-distortion optimization (RDO) algorithm extracted form H.263 [3] for getting more coding efficiency. The RDO algorithm calculates the rate-distortion (RD) cost of each coding block mode and chooses the optimal coding block mode with the minimum RD cost for each macroblock (MB). This algorithm has to obtain the exact number of encoded bits and the reconstructed image to calculate its RD cost for each possible coding block mode in the coding process. The number of coding block mode in intra prediction are 9 coding block modes for 4x4 luminance block, 4 coding block modes for 16x16 luminance block and 4 coding block modes for 8x8 chrominance block. There are even more coding block modes in inter prediction. Obviously, this algorithm can be very computationally intensive.