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AN EFFICIENT DESIGN OF CONTEXT MODELER FOR CABAC ENCODER IN H.264

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Abstract. *Context-based adaptive binary arithmetic coding (CABAC) is a very important entropy coding technique defined in H.264. It is not easy to store and retrieve efficiently the previously encoded syntax elements especially when full hardwired VLSI implementation of CABAC is required. This paper presents an efficient design of context modeler which uses the well-organized location-index assignment and the copy-and-paste technique to locate, store and retrieve the needed syntax elements both easily and efficiently with less storage space. Synthesis results show that our CABAC encoder occupies 19339 gate counts and operates at 200 MHz by using the TSMC 0.13 μm CMOS technology. In the simulation, our design can perform the throughput of 166 Mbps, which is able to support H.264 CIF encoding in real time.*
Keywords: H.264, Context-based adaptive binary coding (CABAC), Context modeler

1. **Introduction.** To meet the increasing demand for flexible and efficient video compression standard, H.264/AVC [1] is developed by ITU-T Video Coding Experts Group (VCEG) and ISO/IEC Moving Picture Experts Group (MPEG). With the helps of some innovative techniques such as rate control [16], variable block size, intra prediction, deblocking filter [17], adaptive entropy coding and multiple reference frame motion estimation, H.264 provides the significant reduction in bit rate as compared with previous MPEG-4 [2] and H.263 [3] video coding standards.

Two advanced entropy coding techniques are defined in H.264. They are context-based adaptive variable length coding (CAVLC) and context-based adaptive binary arithmetic coding (CABAC). Both of which can achieve better coding efficiency than traditional entropy coding methods [4-6]. In [7], Marpe *et al.* have proved that CABAC averagely reduces the bit-rate of 9%∼14% over CAVLC for broadcast applications. We focus only on the design of CABAC in this paper.

In general, CABAC consists of three main components: binarizer, context modeler, and binary arithmetic coder. The meaningful information to be encoded by CABAC is named as the syntax element. CABAC achieves high compression rate through (1) selecting probability models for each syntax element according to the element's context, (2) adapting probability estimation based on local statistics, and (3) employing binary arithmetic coding.

For real-time and high-speed applications, a special-purpose VLSI design of CABAC is necessary. Recently, many VLSI designs for CABAC have been proposed in the literature