

# Efficient Side-Information Context Description for Context-Based Adaptive Entropy Coders

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The design of context-based adaptive entropy coders is non-trivial due to the balance that must be struck between the benefits associated with using a large number of conditioning classes, or contexts, and the penalties resulting from data dilution. We have recently proposed in [1] an iterative algorithm that begins with a large number of conditioning classes and then uses a clustering procedure to group them into a desired size. This method performs very well in contrast to the more usual approach of defining contexts in an ad-hoc manner. However, the cost of sending context descriptions to the decoder as side information is also very high. Of course, an alternative is to use training data to design a fixed *context book*; nevertheless, this approach can result in a large reduction in the coding efficiency in the case of mis-matched statistics. In this paper, we present two techniques for efficiently describing the context book.

The context book is a table with  $M$  entries, which are the context indices, organized into  $N$  rows corresponding to the  $N$ -partition of the context space. One approach for reducing the side information is to decrease  $M$ , the size of the context space. We present an algorithm, named *coarse context quantization*, which is to design a set of coarse quantizers that if applied to the symbols that form the context will automatically construct a new context space with fewer contexts. We also allow some sub-optimal groupings if this does not have a significant impact on the data rate required for the data-stream. Another approach to reduce the side information is to decrease the amount of bits spent on the individual entries in the context book. We propose a method to achieve this goal indirectly. The *classification map*, which is a sequence of  $M$  group indices, is sent as side information instead of sending the context book. Group indices are much smaller than the context indices. These  $M$  group indices will be transmitted in some order such that the context book can be built on the fly instead of being sent as side information.

The experiments have shown the amount of side information can be dramatically reduced. Compared with the direct strategy of binary code for each context label, the side information is decreased by 90%-95% when the classification map strategy is applied. It can be further compressed if the coarse context quantization method is used. We believe that these techniques have great potential for improving the performance of data compression algorithms.

- [1] Jacques Vaisey and Tong Jin, "An Iterative Algorithm for Context Selection in Adaptive Entropy Coders", *International Conference on Image processing*, Sept. 2002, pp. III93-96.

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<sup>1</sup>This paper is in memory of Dr. Jacques Vaisey who has passed away recently.