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Model-based Transrating of H.264 Coded Video

Naama Hait and David Malah

Abstract

This paper presents a model-based transrating (bit-rate reduction) system for H.264 coded video via requantization. In works related to previous standards, optimal requantization step-sizes were obtained via Lagrangian optimization that minimizes the distortion subject to a rate constraint. Due to H.264 advanced coding features, the choices of quantization step-size and coding modes are dependent and the rate control becomes computationally expensive. Therefore, optimal requantization algorithms developed for previous standards cannot be applied as is. Hence, previous works on transrating in H.264 focused on changing the input coding decisions rather on rate control, while requantization was addressed by a simple one-pass algorithm.

Here we propose new model-based optimal requantization algorithms for transrating of H.264 coded video. The optimal requantization goal is to achieve the target bit rate with minimal effect on video quality. Incorporation of the proposed models serves two goals. For intra-coded frames, a novel closed-loop statistical estimator that overcomes spatial neighbors dependencies is developed. For inter-coded frames, the proposed macroblock-level models reduce the computational burden of the optimization. Overall, as compared to re-encoding (cascaded decoder-encoder), the proposed system reduces the computational complexity by a factor of about 4, at an average PSNR loss of only 0.4[dB] for transrating CIF/SIF sequences from 2[Mbps] to 1[Mbps]. In comparison with a simple one-pass requantization, the proposed algorithm achieves better performance (an average PSNR gain of 0.45[dB]), at the cost of just twice the complexity.

Index Terms

Bit rate control, H.264 video coder, requantization, transrating.

I. Introduction

Video services and multimedia applications use pre-encoded video in different formats for storage and transmission. As various user types require different formats and bit rates, a single copy of the encoded video cannot satisfy all users. One could store many copies of the video in the server, each encoded at a different format or bit rate, and send the bitstream that best matches the requirements of the user. However, such a server would suffer from very high storage costs and the chosen bitstream may not meet the exact user requirements. Therefore, servers typically

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