Video Coding for Streaming Media Delivery on the Internet

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We provide an overview of an architecture of today's Internet streaming media delivery networks and describe various problems that such systems pose with regard to video coding. We demonstrate that based on the distribution model (live or on-demand), the type of network delivery mechanism (unicast vs. multicast), and the optimization criteria associated with particular segments of the network (e.g. minimization of distortion for a given connection rate, minimization of traffic in the dedicated delivery network, etc.), it is possible to identify several models of communication that require different treatment from both source and channel coding perspectives.

We explain how some of these problems can be addressed using a conventional framework of temporal motion-compensated, transform-based video compression algorithm, supported by appropriate channel-adaptation mechanisms in client and server components of a streaming media system.

Most of these techniques have already been implemented in RealNetworks RealSystem™ 8 and its RealVideo™ 8 codec, which we are using to illustrate our results.

We also provide a comparative study of the efficiency of our RealVideo™ 8 algorithm, and report improvements on the order of 0.5-2.0 dB relative to ITU-T H.263+ algorithm, and around 0.5-1.0 dB compared to ISO MPEG-4 codec (see Fig. 1.).

In our tests, the MPEG-4 bit streams were created using the latest MoMuSys reference software (Version FPDAM1-1.0-000608) with all implemented and relevant tools of the Advanced Coding Efficiency profile: quarter-pel motion compensation, AC/DC prediction, 4-MV, unrestricted motion vectors. To produce H.263+ bit streams we used the TMN10 model with enabled Annexes I, J, and T. All codecs used fixed frame rate and fixed quantization (no rate control) mode, and motion search was restricted to ±16 pixels range. Both MPEG-4 and H.263+ codecs used exhaustive search.