JOINT SOURCE/CHANNEL CODING FOR MULTIPLE VIDEO SEQUENCES WITH JPEG2000

Zhenyu Wu, Radhika Jandhyala, Ali Bilgin and Michael W. Marcellin

Dept. of Electrical and Computer Engineering, The University of Arizona, Tucson, AZ 85721.

With the rapid advances in channel spectrum utilization and data compression techniques, many communication channels are now capable of delivering several compressed images and video sequences concurrently. There has been a lot of research in joint source/channel coding (JSCC) directed towards allocating resources between source and channel coders to improve overall performance. However, most existing JSCC schemes in the literature only consider the coding of one image or video sequence. Meanwhile, the problem of multiplexing multiple video sequences has also been studied. However, these schemes fail to take channel coding into account.

Motion JPEG2000 (MJP2) is an extension of JPEG2000 for intra-frame based video coding. It can provide competitive performance to motion compensation based video coding standards in applications requiring high quality or high resolution. In addition, it can provide highly scalable bitstreams, which is desirable for applications such as HDTV digital broadcast [1].

In [2], joint source/channel coding was considered for transmission of multiple images sharing a common channel. Given a transmission channel and a total bit rate, rate-distortion diversity of different images was exploited to give multiplexing gains (in terms of MSE), in addition to the conventional unequal error protection (UEP) gains. In this work, we extend the methods of [2] to video coding. The proposed algorithm considers the transmission of one or more MJP2 coded video sequence(s) over a constant bit rate channel. Rate distortion diversity over several dimensions is exploited. This work demonstrates that by minimizing the expected overall distortion at the receiver, both improved average quality of the frames (quality multiplexing gain), as well as more uniform quality across the frames (variance multiplexing gain) can be achieved.

Experimental results illustrate the efficiency of the proposed methods. Three progressive HDTV sequences Blue_sky, River_bed and Tractor are chosen as our test sequences. Only the luminance components of the first 200 frames from each sequence are considered, where each component is a 1920×1080 8-bit gray-level image. The compressed data are protected by rate compatible punctured turbo codes and transmitted over a BSC with $\epsilon = 0.1$. For a total bit rate of 25 Mbps, an average PSNR gain of 0.32 to 0.79 dB is obtained. At the same time the quality variance is reduced by 68% to 83% across frames at the receiver. For a total bit rate of 50 Mbps, an average PSNR gain of 0.52 to 0.76 dB is obtained and the quality variance is reduced by 87% to 92%.

1. REFERENCES

[1] K. Ramchandran, A. Ortega, K. M. Uz, and M. Vetterli, "Multiresolution broadcast for digital HDTV using joint source/channel coding," *IEEE Trans. Selected Areas in Commun.*, pp. 6–23, Jan. 1993.

[2] Z. Wu, A. Bilgin, and M. W. Marcellin, "Joint source/channel coding for multiple images," in *Proc. IEEE Global Telecommunications Conference (Globecom)*, Dec. 2004.