Priority Encoding Transmission Based Multiple Description Video Coding over Packet Loss Network*

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FEC-based multiple description coding (FEC-MDC) is an attractive approach for robust transmission over packet loss network. The basic idea is to partition a source bit stream into segments with different importance, and protect these segments using different amounts of FEC channel codes, so as to convert a prioritized bit stream into multiple non-prioritized segments. However, current versions of FEC-MDC are mainly limited to the scalable video coders.

Inspired by priority encoding transmission, in this paper, we attempt to overcome the limitation of specific scalable video codec and apply FEC-MDC to a common video coder, such as the standard H.264. The proposed scheme is explained as follows. Firstly, according to motion vector changes, an original video sequence is divided into several sub-sequences as messages, so in each message better temporal correlation can be maintained for better estimation when information losses occur. Secondly, the standard H.264 encoder is used to encode the messages. Thirdly, based on priority encoding transmission, unequal protections are assigned in each message. Lastly, at the decoder, the segments whose priorities are not higher than the fraction of packets received can be recover totally. Otherwise, error concealment should be used to estimate the lost frames.

It is noted that the priority can be designed in view of packet loss rate of channels and the significance of bit streams. Let us assume that $PSNR(I)$, $PSNR(P)$ and $PSNR(B)$ denote the contribution of I, P and B frames respectively, so their priorities can be computed, e.g. the priority of I frame:

$$I\_pri = K_{const} \times \frac{1}{PSNR(I)} \Big/ \left(\frac{1}{PSNR(I)} + \frac{1}{PSNR(P)} + \frac{1}{PSNR(B)}\right)$$

Here, the parameter K_{const} can be adjusted to satisfy the bit rate. If the largest packet loss rate of channels is PLR and the acceptable lowest reconstruction quality is higher than $PSNR(I)$, then I_pri can be updated by $1-PLR$ and the priorities of P and B frames can be computed from I_pri according to their relationship.

Experimental results based on the standard video sequence “coastguard.qcif” show that at the same bit rate, when the packet loss rate is lower than 61% the performance of equal protection surpasses the proposed scheme and the largest gap between the two schemes is about 2 dB. However, at the packet loss rate 61%, the proposed scheme can degrade gracefully while the equal protection has a sharp transition. Here, the largest gap that the proposed scheme surpasses the equal protection is about 8 dB. This is just a global comparison for the average reconstruction of the whole video. In fact, individual frames may achieve more advantages over the equal protection. At the packet loss rate 61%, almost 70% frames are corrupted in the equal protection and for some frames the proposed scheme has over 10 dB improvements.

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