A Novel Multiple Description Video Codec Based on Slepian-Wolf Coding∗

Yuhua Fan1,2 Jia Wang1,2 Jun Sun1,2 Peng Wang1,2 Songyu Yu1,2

1 Image Commun. and Inf. Process., Dept. of EE, Shanghai Jiao Tong University
2 Shanghai Key Laboratory of Digital Media Processing and Transmission
Email: {sjtuzych, jiawang, junsun, cnwangpeng, syyu}@sjtu.edu.cn

One major task in multiple description video coding is to prevent drift on packet loss channels, where transmission errors occur in each description. We propose a Distributed Multiple Description Video Coding (DMDVC) scheme excluding any prediction loops. The new codec suffers from no drift problem. In the two-channel mode of symmetry side informations (SI), one side decoder can use the SI of the other without any decoding quality degradation. Thereby, DMDVC achieves high robustness on packet loss channels.

We first present a code construction for the MDWZ problem [1] which can be viewed as a model for coding one frame in our video codec. Our code construction, SWC-MDQ, consists of a multiple description quantizer (MDQ) and two Slepian-Wolf codecs (SWC). Slepian-Wolf coding is applied to each of the two index vectors generated by the MDQ. A Lloyd-type algorithm is proposed to optimize the endpoints of the central quantizer. High-rate performance is analyzed. No motion vectors are transmitted by the video encoder of DMDVC, in which a pair of staggered quantizers is used as the MDQ for simplicity. In Fig.1, point A and B send two index vectors to produce hash signatures, one for each description. Point C and D output Slepian-Wolf encoded bit sequences. Coding parameters are selected based on the mean square errors of the two predictors found by performing block-matching in two previous decoded side frames. When the side video decoder of DMDVC decodes a macroblock, a group of predictors are tried. If the hash check of some decoding result succeeds, iteration stops. Otherwise error concealment is used. The central video decoder uses the SIs of both side video decoders. It is of vital importance to maintain symmetry between two descriptions to ensure high robustness.

We use QCIF Foreman sequence to test our algorithm, assuming two packets for each frame. The 62nd frame is intra-coded. The packet loss pattern in Fig. 2 is used in the comparison between DMDVC and MDTC [2]. Since MDTC suffers from the drift problem, its performance loss compared to DMDVC is large (See Fig. 3).

References

∗ This work is supported by National Natural Science Foundation of China (60332030, 60625103) and Science and Technology Commission of Municipality (05DZ22102).