Improving SHVC Performance with a Block based Joint Layer Prediction Solution

Xiem HoangVan
VNU-University of Engineering and Technology, Hanoi
xiemhoang@vnu.edu.vn

***Abstract*—Considering for the need of a more powerful scalable video coding solution beyond the recent Scalable High Efficiency Video Coding (SHVC) standard, this paper proposes a novel joint layer prediction creation solution. In the proposed improvement solution, the temporal correlation is exploited in a new manner through a so-called decoder based motion compensated temporal interpolation (MCTI) approach. The MCTI frame is then adaptively combined with the base layer reconstruction through a linear combination algorithm. Finally, to achieve the highest compression efficiency, the fused frame is treated as an additional reference and adaptively selected using a rate distortion optimization (RDO) mechanism. Experiments conducted for a rich set of test conditions have shown that significant compression efficiency gains can be achieved with the proposed improvement solution, notably up to 4.5 % in BD-Rate savings regarding the standard SHVC quality scalable codec.**

Keywords*— *HEVC, SHVC, best prediction, joint layer mode

I. Introduction

Our recent works [1] have shown a significant compression gain can be achieved for SVC standard with a decoder based side information creation solution. However, the work in [1] considered only the available information from the enhancement layer, i.e., forward and backward references, $\hat{X}_E^f, \hat{X}_E^b$ to create an additional prediction, P_{MCTI}. In this paper, we propose a novel joint layer prediction solution which takes into account not only the available information from the enhancement layer (EL) through a motion compensated temporal interpolation (MCTI) approach but also from the base layer (BL) reconstruction, $\hat{X}_B^c$ to create a novel joint layer prediction, P_{Joint}, as shown in Fig. 1.

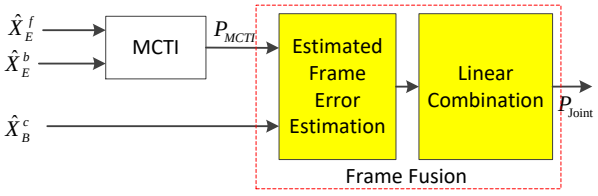

Fig.1. Proposed Joint Layer Prediction Creation

Moreover, the proposed joint layer prediction solution is integrated into the most recent Scalable High Efficiency Video Coding (SHVC) standard [2], which has demonstrated a significant compression gain regarding SVC. Finally, the joint layer prediction is adaptively selected using a RDO mechanism. To create a similar prediction at the decoder, a binary flag is added to the bitstream to indicate the selected coding mode.

II. Primarily Results and Discussions

To assess the SHVC performance with proposed joint layer prediction solution, five video test sequences obtained from JCT-VC common test conditions were used. The conventional SHVC is considered as a coding benchmark and the popular Bjøntegaard Delta (BD) [3] rate is computed.

Experimental results shown in Table 1 and Fig. 2 proved that a significant SHVC compression performance gain can be achieved with the proposed joint coding mode, notably up to 4.5% BD-Rate reduction regarding the SHVC standard. Besides, the proposed frame fusion also improves the prediction quality as compared to the prior MCTI solution [1].

Table 1. BD-Rate Saving [%] with the proposed SHVC solution

Sequences		**Proposed SHVC vs. SHVC standard**	
		EL Only	**BL + EL**
Class D	RaceHorses	4.08	0.67
	BlowingBubbles	1.74	0.12
	BasketballPass	**4.54**	**0.89**
Class C	BasketballDrill	2.28	0.54
	PartyScene	1.98	0.29
Average		***2.92***	***0.50***

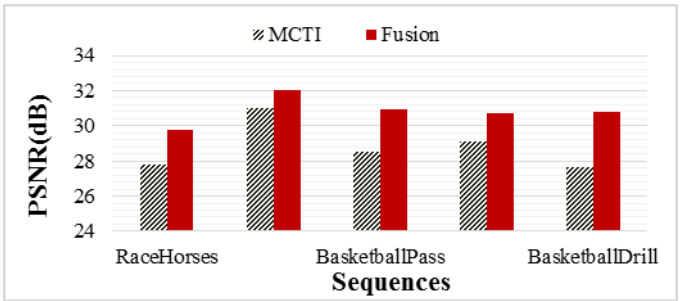

Fig.2. Joint layer prediction frame quality comparison

References

[1] Xiem HV, et al. "Improving scalable video coding performance with decoder side information", *Picture Coding Symposium*, San Jose, CA, USA, Dec. 2013.

[2] J. M. Boyce, et al., "Overview of SHVC: Scalable Extensions of the Highe Efficiency Video Coding Standard", *IEEE TCSVT*, pp. 20-34, vol. 26, no. 1, Jan. 2016.

[3] G. BjØntegaard, "Calculation of average PSNR differences between RD curves," Doc. VCEG-M33, 13th ITU-T VCEG Meeting, Austin, TX, USA, Apr. 2001.