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JCTVC-M0143:
Non-SCE3: Quantized GRP

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Agenda

- Introduction / Problem Statement
- Proposed Method
- Simulation Condition
- Simulation Result
- Discussion
- Conclusion

Introduction / Problem Statement

- In scalable coding, if the performance of prediction in the base layer is poor, it tends to be also poor in the enhancement layer.
- To improve coding efficiency of such area residual prediction is an effective tool.
  - Generalized Residual Prediction (GRP) has been studied in SCE3.
  - A proposal on single-loop scalability JCTVC-L0154 also contains prediction with residue from the base layer.
- When the input pixel is in 8-bit depth, the residue becomes 9-bit depth.
  - Taking byte-alignment into account, 16-bit depth would be needed to store residual, which causes increase in buffer size.

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Proposed Method

- To solve this problem quantized residual prediction is proposed as follows:
  - when the residue is stored >>1 operation is conducted,
  - and <<1 operation is conducted when it is extracted from the buffer
  - (if the input signal is in 8-bit depth)

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Simulation Condition

- SHM-1.0 is used as anchor.
- On top of the anchor src proposed method of SCE3.3.6 has been implemented and provided to the author. The proposed method of this contribution has been implemented on SCE3.3.6 src.
- To make comparison result of SCE3.3.6 is also shown.
- Class A and B sequences have been tested with {RA, LP}_{2x,1.5x,SNR} conditions.

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Simulation Result [1/]

Anchor: SHM-1.0
Tested: SCE3.3.6 + Proposed Method

	RA HEVC 2x			RA HEVC 1.5x			RA HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	-2.0%	-3.5%	-3.3%				-1.0%	-2.0%	-2.3%
Class B	-1.7%	-2.3%	-2.5%	-2.8%	-3.4%	-3.6%	-1.8%	-3.0%	-3.5%
Overall (Test vs Ref)	-1.8%	-2.6%	-2.7%	-2.8%	-3.4%	-3.6%	-1.6%	-2.7%	-3.1%
Overall (Test vs single layer)	17.1%	28.5%	29.4%	13.2%	24.1%	26.2%	13.0%	25.3%	28.5%
EL only (Test vs Ref)	-3.1%	-4.0%	-4.1%	-5.2%	-5.8%	-6.0%	-2.4%	-3.6%	-4.1%
Enc Time[%]	124.6%			118.3%			118.3%		
Dec Time[%]	103.9%			102.9%			102.1%		
Enc Mem[%]	#DIV/0!			#DIV/0!			#DIV/0!		
BL Match	Matched			Matched			Matched		

	LD-P HEVC 2x			LD-P HEVC 1.5x			LD-P HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	-2.4%	-3.8%	-3.3%				-1.6%	-2.7%	-2.7%
Class B	-2.1%	-1.5%	-1.1%	-3.2%	-3.2%	-2.4%	-2.3%	-3.2%	-3.3%
Overall (Test vs Ref)	-2.2%	-2.2%	-1.7%	-3.2%	-3.2%	-2.4%	-2.1%	-3.1%	-3.2%
Overall (Test vs single layer)	23.2%	33.3%	35.7%	18.6%	28.7%	32.7%	19.8%	30.2%	34.7%
EL only (Test vs Ref)	-3.8%	-3.8%	-3.3%	-6.1%	-6.2%	-5.4%	-3.4%	-4.4%	-4.5%
Enc Time[%]	121.5%			114.8%			117.0%		
Dec Time[%]	103.1%			102.9%			102.2%		
Enc Mem[%]	#DIV/0!			#DIV/0!			#DIV/0!		
BL Match	Matched			Matched			Matched		

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Simulation Result [2/]

Anchor: SHM-1.0
Tested: SCE3.3.6

	RA HEVC 2x			RA HEVC 1.5x			RA HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	-2.2%	-5.0%	-5.1%				-1.2%	-3.1%	-3.4%
Class B	-2.0%	-2.9%	-3.4%	-3.3%	-4.7%	-5.4%	-2.1%	-3.4%	-4.2%
Overall (Test vs Ref)	-2.1%	-3.5%	-3.9%	-3.3%	-4.7%	-5.4%	-1.8%	-3.3%	-4.0%
Overall (Test vs single layer)	16.8%	27.2%	27.8%	12.6%	22.5%	23.9%	12.7%	24.5%	27.4%
EL only (Test vs Ref)	-3.7%	-5.2%	-5.5%	-6.5%	-8.0%	-8.8%	-2.8%	-4.5%	-5.1%
Enc Time[%]	123.6%			117.1%			117.9%		
Dec Time[%]	103.6%			104.0%			102.3%		
Enc Mem[%]	#DIV/0!			#DIV/0!			#DIV/0!		
BL Match	Matched			Matched			Matched		

	LD-P HEVC 2x			LD-P HEVC 1.5x			LD-P HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	-2.6%	-4.7%	-4.5%				-1.7%	-3.3%	-3.4%
Class B	-2.4%	-1.8%	-1.7%	-3.7%	-4.0%	-3.8%	-2.5%	-3.2%	-3.6%
Overall (Test vs Ref)	-2.5%	-2.6%	-2.5%	-3.7%	-4.0%	-3.8%	-2.2%	-3.2%	-3.5%
Overall (Test vs single layer)	22.9%	32.7%	34.6%	17.8%	27.7%	30.9%	19.6%	30.0%	34.2%
EL only (Test vs Ref)	-4.3%	-4.5%	-4.3%	-7.7%	-7.9%	-7.7%	-3.6%	-4.7%	-5.0%
Enc Time[%]	120.5%			113.1%			116.6%		
Dec Time[%]	103.4%			103.6%			96.6%		
Enc Mem[%]	#DIV/0!			#DIV/0!			#DIV/0!		
BL Match	Matched			Matched			Matched		

Discussion

- Compared with SCE3.3.6, loss of the proposed method is 0.3%, 0.5%, 0.2%, 0.3%, 0.5% and 0.1% with RA_2x, RA_1.5x, RA_SNR, LD_2x, LD_1.5x and LD_SNR cases respectively.
- Compared with SHM the proposed method brings gain by -1.8%, -2.8%, -1.6%, -2.2%, -3.2% and -2.1% with RA_2x, RA_1.5x, RA_SNR, LD_2x, LD_1.5x and LD_SNR cases respectively.

Conclusion

- Residue signal prediction is an effective tool to improve coding efficiency.
- However, when the input pixel is in 8-bit depth, the residue becomes 9-bit depth.
  - Taking byte-alignment into account, 16-bit depth would be needed to store residual. So residual prediction will cause increase in buffer size.
- To solve the problem quantized residue prediction is proposed.
- The proposed method has been tested on top of SCE3.3.6.
  - Compared with SHM the proposed method brings gain by -1.8%, -2.8%, -1.6%, -2.2%, -3.2% and -2.1% with RA_2x, RA_1.5x, RA_SNR, LD_2x, LD_1.5x and LD_SNR cases respectively.
- We propose the proposed method be investigated under SCE.

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