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JCTVC-M0223
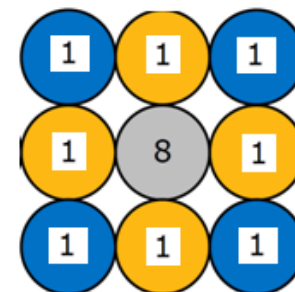# Non-SCE4.1: Fixed Inter-layer Filter for SNR Scalability with Only One Non-unity Coefficient

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Presented by PoLin Lai
14th JCT-VC Meeting in Incheon
Apr., 2013

Overall Summary

- Fixed SNR interlayer filter
  - 3×3 footprint, only one non-unity coefficient

- Filter complexity, only for IntraBL blocks
  - Multiplications: Only 1 (center coefficients 8)
  - Additions: 9 adds, includes adding offset

3x3-{8,1,1}

- BD-rate and average complexity results:

	SNR			Enc	Dec	Complexity				
	Y	U	V	Time	Time	8b/8b	64b/256b	64b/512b	Mults	Adds
RA	-0.8%	0.4%	0.5%	102.0%	101.4%	100%	99%	99%	100%	104%
LD-P	-2.1%	-0.2%	-0.1%	101.9%	101.6%	99%	99%	99%	99%	110%
LD-B	-0.8%	0.0%	0.1%	101.3%	101.6%	99%	99%	99%	99%	105%

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The Proposed SNR Interlayer Filter

- Fixed SNR interlayer filter
  - 3×3 footprint, only one non-unity coefficient

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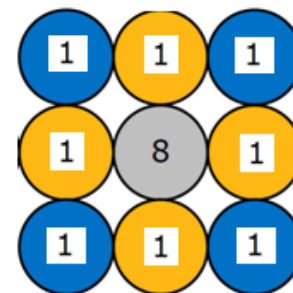 - Additions: 9 adds, includes adding offset

3x3-{8,1,1}

Other SNR interlayer filter proposals:

- SCE4.1, JCT-M0087, 2D separable:
  - {-1, 3, 12, 3, -1} / 16.

- SCE4.1, JCT-M0058, 2D non-separable:
  - 5×5 diamond footprint, dyadic coefficients

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Performance and Complexity Comparison

	M0087-Y 2D separable {-1, 3, 12, 3, -1}/16					M0058-YUV 2D non-sep 5x5 diamond, 13 tap					M0223-YUV 2D non-sep 3x3 square, 9 tap				
Filter 1 pixel	6 (10) mult, 9 adds					2 (13) mult, 13 adds					1 mult (9), 9 adds				
Memory BW	2 additional line of each side of CU					2 additional line of each side of CU					1 additional line of each side of CU				
Average Complexity	Complexity					Complexity					Complexity				
	8b/8b	64b/256b	64b/512b	Mults	Adds	8b/8b	64b/256b	64b/512b	Mults	Adds	8b/8b	64b/256b	64b/512b	Mults	Adds
	101%	100%	100%	104%	104%	105%	103%	103%	102%	108%	100%	99%	99%	100%	104%
	103%	101%	101%	109%	108%	110%	106%	106%	104%	119%	99%	99%	99%	99%	110%
	101%	100%	100%	104%	104%	105%	103%	103%	102%	109%	99%	99%	99%	99%	105%
	Y	U	V	Enc	Dec	Y	U	V	Enc	Dec	Y	U	V	Enc	Dec
RA	-1.8%	-0.1%	0.0%	102.0%	103.6%	-1.6%	-0.2%	0.0%	102.3%	113.3%	-0.8%	0.4%	0.5%	102.0%	101.4%
LD-P	-2.4%	-0.1%	0.2%	102.1%	102.7%	-2.6%	-0.5%	-0.2%	103.5%	115.1%	-2.1%	-0.2%	-0.1%	101.9%	101.6%
LD-B	-1.5%	-0.3%	-0.1%	101.5%	103.4%	-1.5%	-0.4%	-0.1%	101.3%	119.9%	-0.8%	0.0%	0.1%	101.3%	101.6%

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Detailed Results

	RA HEVC SNR		
	Y	U	V
Class A	-1.3%	0.7%	0.8%
Class B	-0.6%	0.2%	0.3%
Overall (Test vs Ref)	-0.8%	0.4%	0.5%
Overall (Test vs single layer)	13.9%	29.4%	33.3%
EL only (Test vs Ref)	-0.4%	0.8%	0.9%
Enc Time[%]	102.0%		
Dec Time[%]	101.4%		
Enc Mem[%]	#DIV/0!		
BL Match	Matched		

	RA HEVC SNR				
	8b/8b	64b/2	64b/5	Mults	Adds
Class A	100%	99%	99%	100%	106%
Class B	100%	99%	99%	100%	103%
Overall	**100%**	**99%**	**99%**	**100%**	**104%**

	LD-P HEVC SNR		
	Y	U	V
Class A	-3.3%	0.1%	0.4%
Class B	-1.6%	-0.3%	-0.3%
Overall (Test vs Ref)	-2.1%	-0.2%	-0.1%
Overall (Test vs single layer)	19.7%	34.2%	39.1%
EL only (Test vs Ref)	-2.4%	-0.4%	-0.3%
Enc Time[%]	101.9%		
Dec Time[%]	101.6%		
Enc Mem[%]	#DIV/0!		
BL Match	Matched		

	LD-P HEVC SNR				
	8b/8b	64b/2	64b/5	Mults	Adds
Class A	99%	98%	98%	99%	114%
Class B	99%	99%	99%	100%	108%
Overall	**99%**	**99%**	**99%**	**99%**	**110%**

	LD-B HEVC SNR		
	Y	U	V
Class A	-1.5%	0.4%	0.5%
Class B	-0.6%	-0.1%	-0.1%
Overall (Test vs Ref)	-0.8%	0.0%	0.1%
Overall (Test vs single layer)	22.7%	33.6%	37.3%
EL only (Test vs Ref)	-0.7%	0.2%	0.2%
Enc Time[%]	101.3%		
Dec Time[%]	101.6%		
Enc Mem[%]	#DIV/0!		
BL Match	Matched		

	LD-B HEVC SNR				
	8b/8b	64b/2	64b/5	Mults	Adds
Class A	99%	98%	98%	100%	107%
Class B	99%	99%	99%	99%	103%
Overall	**99%**	**99%**	**99%**	**99%**	**105%**

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Conclusions

- Fixed SNR interlayer filter
  - 3×3 footprint, only one non-unity coefficient
  - Multiplications: Only 1 (center coefficients 8)
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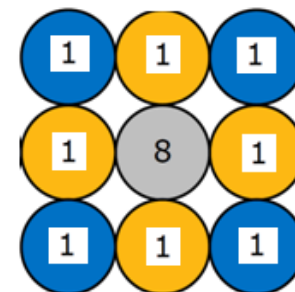
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	Y	U	V	Time	Time	8b/8b	64b/256b	64b/512b	Mults	Adds
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LD-P	-2.1%	-0.2%	-0.1%	101.9%	101.6%	99%	99%	99%	99%	110%
LD-B	-0.8%	0.0%	0.1%	101.3%	101.6%	99%	99%	99%	99%	105%

- Thank Intel for cross-checking!

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