



CREATING THE LIVING NETWORK™

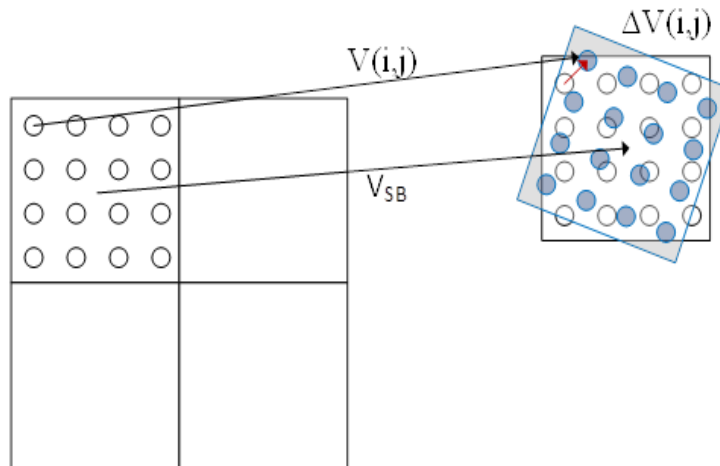
JVET-00583

CE4-related: Prediction refinement with optical flow for chroma components for affine mode

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Introduction

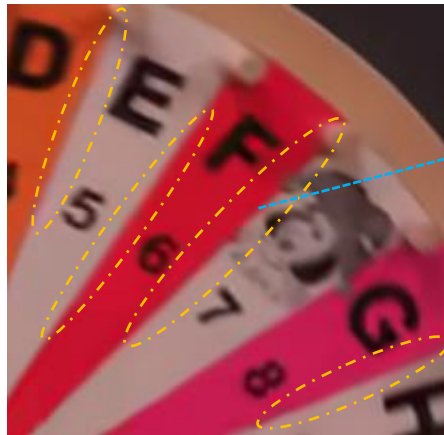
- CE4-2.1: prediction refinement with optical flow for affine mode
 - Sub-block based MV is different from sample based MV
 - The sub-block based prediction is refined with optical flow
$$\Delta I(i,j) = g_x(i,j) * \Delta v_x(i,j) + g_y(i,j) * \Delta v_y(i,j)$$
 - PROF is only applied to luma component
 - 4x4 sub-block MC is applied to chroma component



Introduction

- Observation of CE4-2.1
 - In luma component, the edge discontinuity artifacts almost disappear
 - In chroma components, the edge discontinuity artifacts are still visible
 - One 4x4 chroma sub-block corresponds to one 8x8 luma region
 - The edge of luma and chroma are not aligned
- Proposal
 - Extend PROF to chroma components
 - Always use 4x4 sub-block size for chroma PROF

Frame 16 of
CatRobot coded
in RA with QP 37



Black spots caused by the
edge discontinuity in
chroma components

Simulations

- The luma edge and chroma edge are aligned
- The edge discontinuity artifacts in chroma components are reduced

Frame 16 of CatRobot coded in RA with QP 37



Simulations

Test 1: CE4-2.1a + chroma PROF

	Random Access Main 10					Low delay B Main10				
	Over VTM-5.0					Over VTM-5.0				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	-0.16%	-0.19%	-0.19%	101%	101%	-	-	-	-	-
Class A2	-1.00%	-0.79%	-0.99%	102%	101%	-	-	-	-	-
Class B	-0.62%	-0.72%	-0.87%	101%	102%	-0.41%	-0.20%	-0.39%	101%	100%
Class C	-0.32%	-0.44%	-0.60%	101%	102%	-0.28%	-0.52%	-0.65%	102%	103%
Class E	-	-	-	-	-	-0.25%	-0.18%	-1.49%	103%	102%
Overall	-0.53%	-0.56%	-0.69%	101%	102%	-0.33%	-0.30%	-0.75%	102%	101%
Class D	-0.56%	-0.52%	-0.40%	101%	102%	-0.44%	-0.82%	-0.27%	101%	103%
Class F	-0.92%	-1.08%	-1.11%	101%	102%	-1.38%	-1.48%	-1.81%	102%	99%

	Random Access Main 10					Low delay B Main10				
	Over CE4-2.1a					Over CE4-2.1a				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	-0.04%	-0.03%	-0.30%	100%	101%	-	-	-	-	-
Class A2	-0.15%	-1.06%	-1.15%	100%	100%	-	-	-	-	-
Class B	-0.01%	-0.44%	-0.68%	100%	102%	0.00%	-0.15%	-0.11%	100%	99%
Class C	-0.01%	-0.37%	-0.39%	100%	102%	-0.06%	-0.57%	-0.49%	100%	103%
Class E	-	-	-	-	-	0.05%	-0.04%	-0.70%	100%	103%
Overall	-0.04%	-0.46%	-0.62%	100%	101%	-0.01%	-0.26%	-0.39%	100%	101%
Class D	-0.02%	-0.39%	-0.44%	100%	102%	-0.07%	-0.47%	-1.38%	100%	104%
Class F	-0.07%	-0.64%	-0.64%	100%	102%	-0.05%	-0.15%	-0.89%	100%	100%

Simulations

Test 2: CE4-2.1b + chroma PROF: over VTM-5.0, RA {-0.45%, -0.43%, -0.49%}, LD {-0.28%, -0.33%, -0.54%}

	Random Access Main 10					Low delay B Main10				
	Over CE4-2.1b					Over CE4-2.1b				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	-0.02%	-0.11%	-0.14%	100%	99%	-	-	-	-	-
Class A2	-0.16%	-0.98%	-0.94%	100%	99%	-	-	-	-	-
Class B	-0.02%	-0.41%	-0.65%	101%	100%	0.02%	-0.17%	-0.09%	99%	98%
Class C	-0.02%	-0.22%	-0.28%	101%	101%	-0.06%	-0.53%	-0.09%	100%	99%
Class E	-	-	-	-	-	0.00%	-0.40%	-1.03%	100%	99%
Overall	-0.05%	-0.41%	-0.51%	100%	100%	-0.01%	-0.35%	-0.32%	99%	99%
Class D	-0.02%	-0.31%	-0.44%	101%	102%	-0.03%	-0.18%	-0.54%	100%	102%
Class F	-0.05%	-0.67%	-0.67%	101%	101%	-0.15%	-0.37%	-0.45%	100%	99%

Test 3: CE4-2.1c + chroma PROF over VTM-5.0, RA {-0.50%, -0.51%, -0.55%}, LD {-0.35%, -0.27%, -0.71%}

	Random Access Main 10					Low delay B Main10				
	Over CE4-2.1c					Over CE4-2.1c				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	0.00%	-0.20%	-0.25%	99%	100%	-	-	-	-	-
Class A2	-0.16%	-1.05%	-0.94%	99%	100%	-	-	-	-	-
Class B	0.00%	-0.59%	-0.56%	100%	100%	-0.02%	-0.33%	-0.51%	99%	98%
Class C	-0.03%	-0.08%	-0.22%	100%	102%	-0.02%	-0.17%	-0.68%	99%	99%
Class E	-	-	-	-	-	0.06%	-0.05%	-0.20%	99%	99%
Overall	-0.04%	-0.47%	-0.48%	100%	101%	0.00%	-0.20%	-0.49%	99%	99%
Class D	0.00%	-0.22%	-0.32%	100%	103%	0.02%	0.49%	-0.53%	100%	100%
Class F	-0.03%	-0.63%	-0.68%	100%	101%	0.00%	-0.66%	-1.34%	99%	99%

Conclusions

- PROF for chroma components can reduce edge discontinuity and align the chroma edge and luma edge
- It can also improve the coding efficiency
 - Compared to CE4-2.1a, RA: {-0.04%, -0.46%, -0.62%}; LD: {-0.01%, -0.26%, -0.39%}
 - Compared to VTM-5.0, RA: {-0.53%, -0.56%, -0.69%}; LD: {-0.33%, -0.30%, -0.75%}

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