

JVET-J0016

**Description of SDR video coding
technology proposal by KDDI**

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- The proposal is implemented based on the top-of-JEM software.

■ Intra Prediction

- Cross-component reference prediction
- Inter-residual prediction of chroma components

■ Transform

- Shrink transform
- Block-size dependent coefficient scanning

■ In-loop filter

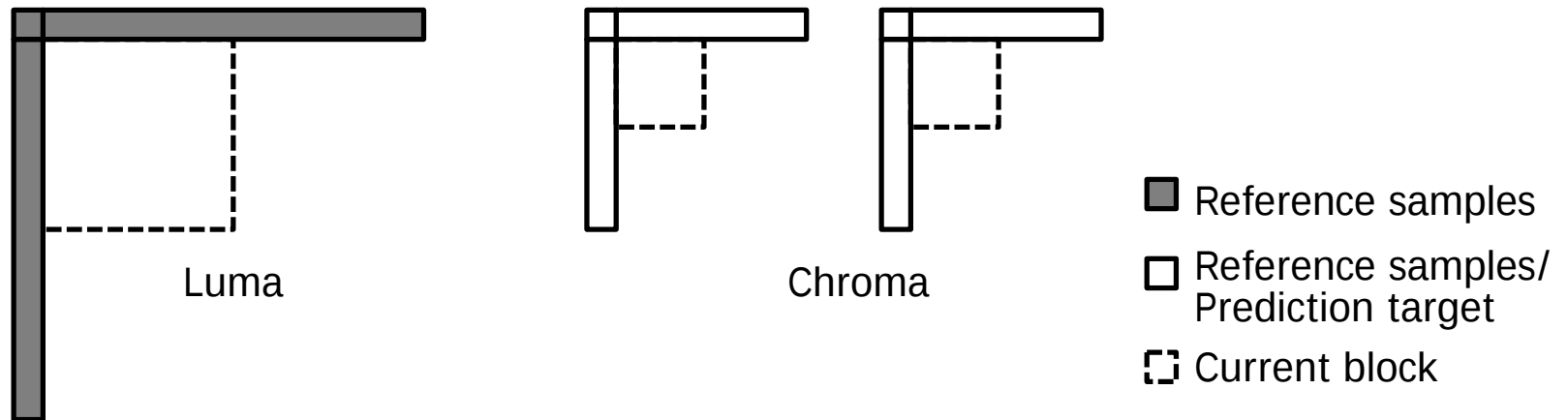
- Extended deblocking filter
- CNN-based filter

■ Performance

- -0.51%, -0.62%, and -0.17% for SDR-A@CS1, SDR-B@CS1, and SDR-B@CS2.
- Encoding runtime is 108% and 102% for CS1 and CS2.
- Decoding runtime is 19 times and 3 times for CS1 and CS2.

■ Cross-component reference prediction

- A chroma-intra-prediction mode is added.
- Chroma reference sample is replaced by luma sample with a linear model. Actual chroma-intra-prediction mode is borrowed from that of luma.



■ Inter-residual prediction of chroma components

- Flexibility of CCLM Cb-to-Cr/Cr-to-Cb is added by an additional flag.
- Encoder only optimization for fast RDO is introduced.

■ Shrink transform

- 128x128 transform block size is enabled.
- When TBS is equal to or larger than 64, inverse transform is implemented by two steps; inverse transform with half size and then up-sampling.
- Zero padding of half high-frequency-coefficients is also remained.

■ Block-size dependent coefficient scanning

- A block-size based decision is introduced.
- When Block aspect ratio is greater than four, MDCS is applied.
- Otherwise, the diagonal scan is applied.

	4	8	16	32	64	128
4	M	M	D	D	D	D
8	M	M	D	D	D	D
16	D	D	D	D	D	D
32	D	D	D	D	D	D
64	D	D	D	D	D	D
128	D	D	D	D	D	D

Original MDCS

	4	8	16	32	64	128
4	M	M	D	D	D	D
8	M	M	D	M	M	M
16	D	D	D	D	M	M
32	D	M	D	D	D	M
64	D	M	M	D	D	D
128	D	M	M	M	D	D

Proposed CS

■ Extended deblocking filter to improve subjective quality

- When an edge boundary is located between two blocks of which an edge length is equal to or longer than 16, the extended filter is applied.
- The number of filtering taps is extended from five to 11.

p6 = 3,5,2,1,1,1,1,1,0,0,0,0,0,0,0

p5 = 1,2,5,2,1,1,1,1,1,0,0,0,0,0,0

p4 = 0,1,3,3,3,1,1,1,1,1,0,0,0,0,0

p3 = 0,1,2,2,2,2,2,1,1,1,1,0,0,0,0

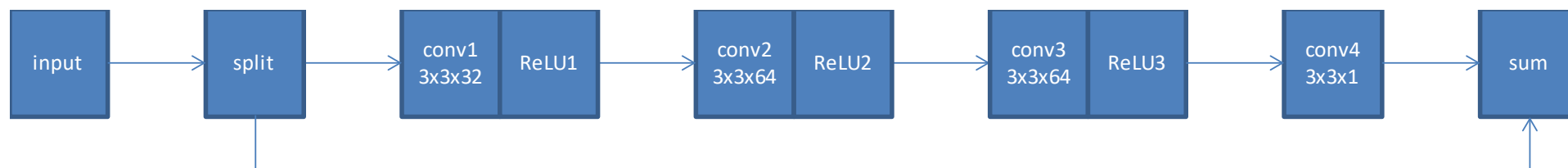
p2 = 0,0,1,2,2,2,2,2,2,1,1,1,0,0,0

p1 = 0,0,1,1,2,2,2,2,2,2,1,1,0,0,0

p0 = 0,0,0,1,2,2,2,2,2,2,2,1,0,0,0

■ Convolutional-Neural-Network based filter

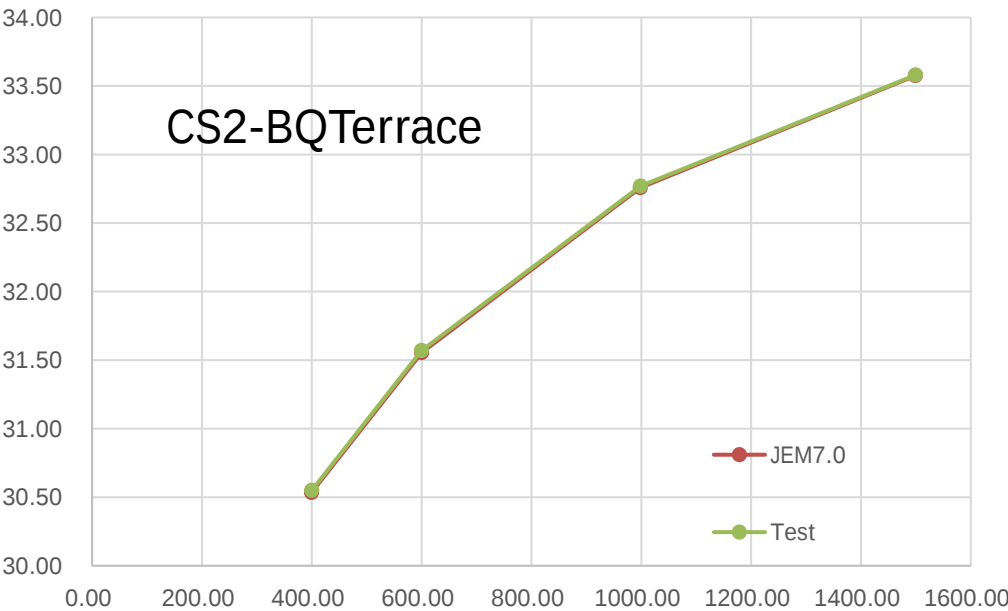
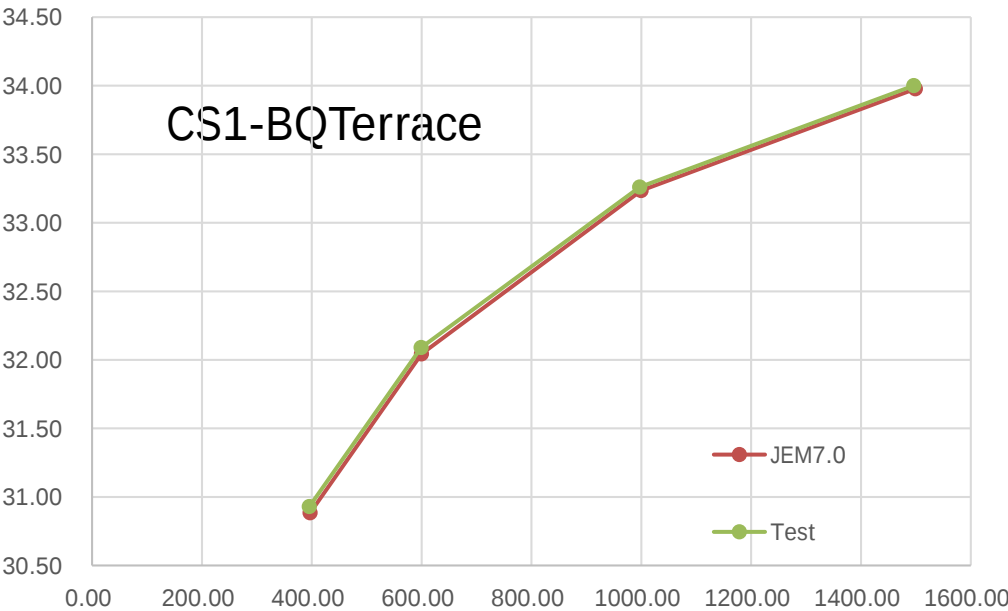
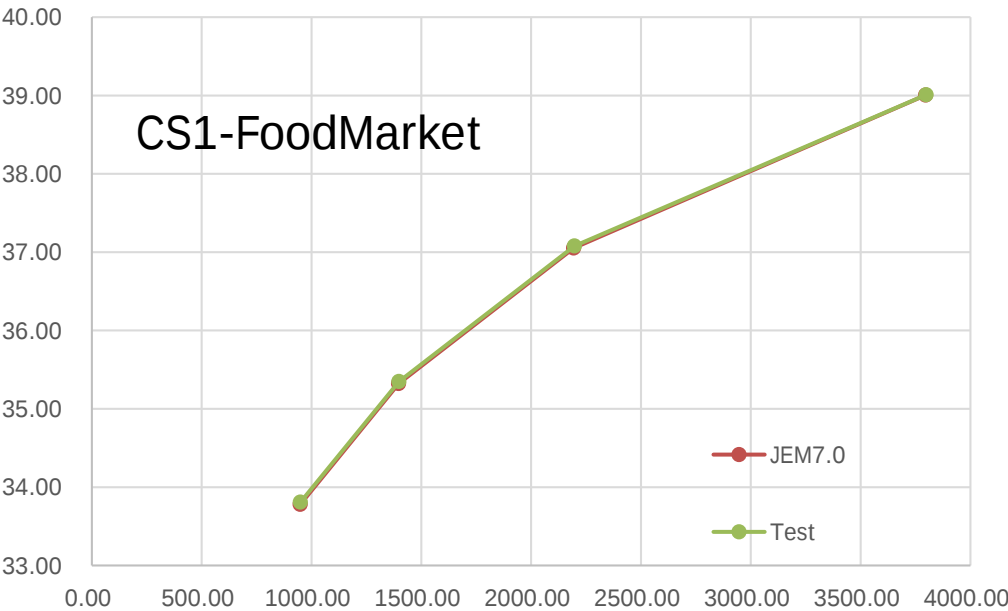
- CNN filter with four layers are introduced only for intra slice before all in-loop filtering.
- The model is designed for QP32, strength of filter is controlled by the block QP.



Simulation Results (1 / 2)

2018/4/12

	Constraint Set 1						Constraint Set 2					
	Over JEM7.0						Over JEM7.0					
	BD-rate(Y)	BD-rate(U)	BD-rate(V)	BD-PSNR(Y)	BD-PSNR(U)	BD-PSNR(V)	BD-rate(Y)	BD-rate(U)	BD-rate(V)	BD-PSNR(Y)	BD-PSNR(U)	BD-PSNR(V)
FoodMarket4	-0.51%	0.84%	-0.08%	0.02	-0.02	0.00						
CatRobot1	-0.92%	-4.15%	-2.38%	0.02	0.04	0.04						
DaylightRoad2	-0.88%	1.01%	-2.51%	0.02	-0.01	0.03						
ParkRunning3	0.00%	-0.98%	-1.86%	0.00	0.01	0.02						
Campfire	-0.26%	0.15%	-1.35%	0.01	0.00	0.03						
BQTerrace	-1.73%	0.47%	-0.23%	0.04	-0.01	0.00	-0.56%	1.72%	-1.37%	0.01	-0.01	0.01
RitualDance	0.01%	-1.21%	-1.50%	0.00	0.02	0.04	0.00%	0.01%	0.27%	0.00	0.00	0.00
MarketPlace	-0.27%	1.47%	2.30%	0.01	-0.02	-0.03	0.15%	0.32%	-0.30%	0.00	0.00	0.00
BasketballDrive	-0.08%	-2.00%	-2.65%	0.00	0.03	0.06	0.12%	-0.55%	-0.35%	0.00	0.01	0.01
Cactus	-1.05%	-0.78%	-2.71%	0.03	0.01	0.05	-0.54%	0.41%	-0.21%	0.02	0.00	0.00
Average SDR-A	-0.51%	-0.63%	-1.64%	0.01	0.00	0.03						
Average SDR-B	-0.62%	-0.41%	-0.96%	0.02	0.01	0.02	-0.17%	0.38%	-0.40%	0.00	0.00	0.00
Average all	-0.57%	-0.52%	-1.30%	0.01	0.01	0.02						
Enc Time[%]	108%						102%					
Dec Time[%]	1867%						297%					



- **KDDI response proposed six coding tools.**
 - Two chroma-intra prediction,
 - Shrink transform and coefficient scanning,
 - Two in-loop filtering.

- **Decoder runtime increase is caused by the CPU based CNN implementation. Independent consideration and/or GPU acceleration are encouraged.**