

AHG5: Recommended profiling of range extension coding tools

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- At the 14th JCT-VC meeting in Vienna, five profiles for HEVC range extensions were defined – Main 12, Main 4:2:2 10/12, and Main 4:4:4 10/12.
- At the 15th JCT-VC meeting in Geneva, the profiling of range extension coding tools was discussed and it was agreed to disable the coding tools effective only for screen content coding (SCC) from Main 12 and Main 4:2:2 10/12.
- However, consensus on proposed changes to Main 4:4:4 10/12 could not be reached, since time was not available to discuss the input documents related to the profiles of HEVC range extensions.
- We suggest that profiling of range extension coding tools should use a similar evidence-based decision process to that used for HEVC v1, based on an evaluation under the range extension common test conditions.
- A mapping between the coding tools and profiles is proposed in this contribution, based on the results of testing under AHG5 CTC and the stated purpose of the profiles.



- Test conditions: HEVC range extension CTC [9]
- Anchor: HM12.0-RExt5.1
- Tested results: HM12.0-RExt5.1 without each coding tool
 - 1) Implicit RDPCM
 - 2) Explicit RDPCM
 - 3) Residual rotation
 - 4) Single context model for significance map coding in TS block
 - 5) Intra block copy
 - 6) Rice parameter adaptation
 - 7) Cross component de-correlation

Test 1: Implicit RDPCM off



- Anchor: HM12.0-RExt5.1
- Tested results: HM12.0-RExt5.1, implicit RDPCM off
- Literally no gain for camera-captured test sequences in AHG5 CTC

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
RGB 4:4:4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:2:2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%	100%	100%	100%	100%	100%	100%
Dec Time[%]	100%	100%	100%	99%	100%	100%	101%

Test 2: Explicit RDPCM off



- Anchor: HM12.0-RExt5.1
- Tested results: HM12.0-RExt5.1, explicit RDPCM off
- Almost no gain for camera-captured test sequences in AHG5 CTC

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
RGB 4:4:4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
YCbCr 4:2:2	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%
Overall	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Enc Time[%]	96%	96%	97%	87%	88%	89%	90%
Dec Time[%]	99%	100%	100%	100%	100%	100%	100%

Test 3: Residual rotation off



- Anchor: HM12.0-RExt5.1
- Tested results: HM12.0-RExt5.1, residual rotation off
- Almost no gain for camera-captured test sequences in AHG5 CTC

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
RGB 4:4:4	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
YCbCr 4:4:4	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%
YCbCr 4:2:2	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%
Overall	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Enc Time[%]	100%	100%	100%	100%	100%	100%	100%
Dec Time[%]	100%	100%	100%	99%	99%	100%	100%

Test 4: Single ctx for sigmap in TS off



- Anchor: HM12.0-RExt5.1
- Tested results: HM12.0-RExt5.1, single context model for the significance flag coding in TS block
- Almost no gain for camera-captured test sequences in AHG5 CTC

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
RGB 4:4:4	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%
YCbCr 4:4:4	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%
YCbCr 4:2:2	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.2%
Overall	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Enc Time[%]	100%	100%	100%	100%	100%	100%	100%
Dec Time[%]	100%	100%	100%	99%	99%	100%	101%

Test 5: Intra block copy off



- Anchor: HM12.0-RExt5.1
- Tested results: HM12.0-RExt5.1, intra block copy off
- Small coding gain at the cost of significant increase in encoder complexity

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
RGB 4:4:4	0.5%	0.2%	0.1%	0.3%	0.1%	0.1%	0.1%
YCbCr 4:4:4	0.3%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%
YCbCr 4:2:2	0.3%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%
Overall	0.4%	0.2%	0.1%	0.2%	0.1%	0.1%	0.0%
Enc Time[%]	70%	69%	69%	97%	96%	97%	96%
Dec Time[%]	100%	100%	100%	100%	100%	100%	100%

Test 6: Rice parameter adaptation off



- Anchor: HM12.0-RExt5.1
- Tested results: HM12.0-RExt5.1, Rice parameter adaptation off
- Literally no gain for camera-captured test sequences in AHG5 CTC

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
RGB 4:4:4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:2:2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%	100%	100%	100%	100%	100%	100%
Dec Time[%]	100%	100%	100%	100%	100%	100%	100%

Test 7: Cross component de-correlation off



- Anchor: HM12.0-RExt5.1
- Tested results: HM12.0-RExt5.1, cross component de-correlation off
- The only range extension coding tool which provides a beneficial trade-off between performance and complexity with generic video sequences.

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
RGB 4:4:4	25.6%	19.5%	13.7%	18.0%	14.0%	15.1%	11.7%
YCbCr 4:4:4	1.4%	1.8%	1.9%	0.5%	0.8%	0.2%	0.6%
YCbCr 4:2:2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	9.7%	7.7%	5.6%	6.7%	5.3%	5.6%	4.5%
Enc Time[%]	93%	92%	92%	96%	94%	96%	93%
Dec Time[%]	101%	101%	101%	101%	101%	101%	101%

- The stated purpose of Amd1 is to extend HEVC to 4:4:4, 4:2:2 and greater sample accuracy in the professional and high end consumer environment.
- It is therefore suggested to include only cross component de-correlation in Main 4:4:4 10/12 in Amd1.
- It is suggested that the other coding tools in the draft RExt text should be included in Test Model 1 for SC 4:4:4, resulting from the SCC CfP.

Range extension coding tools	Main 12	Main 4:2:2		Main 4:4:4		TM1 for SC 4:4:4	
		10	12	10	12	8	10
Implicit RDPCM	✗	✗	✗	✗	✗	✓	✓
Explicit RDPCM	✗	✗	✗	✗	✗	✓	✓
Residual rotation	✗	✗	✗	✗	✗	✓	✓
Single ctx for TS	✗	✗	✗	✗	✗	✓	✓
Intra block copy	✗	✗	✗	✗	✗	✓	✓
Rice parm. adapt.	✗	✗	✗	✗	✗	✓	✓
Cross comp. de-cor.	✗	✗	✗	✓	✓	✓	✓



- The profiling of range extension coding tools should use a similar evidence-based decision process to that which was used for HEVC v1, based on testing under the range extension common test conditions (AHG5 CTC)
- Test results show that cross component de-correlation is the only additional coding tool in the draft RExt text that provides a beneficial trade-off between performance and complexity with generic video content
- There is an immediate market requirement for HEVC range extensions which fulfill the stated purpose of Amd 1: to support high fidelity video signals in the high end consumer and professional environment.
- It is proposed that the Main 4:4:4 profiles in Amd 1 should include cross component de-correlation but not coding tools that are beneficial only for screen content.
- It is proposed that separate 4:4:4 profiles for screen content should be developed, in coordination with the SCC CfP to be launched at this meeting.
- It would be appropriate to include all of the additional coding tools in the draft RExt text in the initial test model for this new activity.

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THANK YOU





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