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Non-RCE4: Major color table propagation through non-palette CUs

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Overall Summary

- Propose to propagate the major color table (palette) through non-palette CUs

  – In RCE4 Test1 and Test2, the major color tables of neighboring CUs can be used to predict that of the current CU; if the neighboring CU is not coded in palette mode, the major color table is set to all zero, which prevents information propagation

  – Therefore, for a non-palette CU, the major color table of its left CU is proposed to be used as its major color table

- Results (SC YUV 444 sequences)

Lossy coding BD-rate	AI-MT	RA-MT	LB-MT
On top of RCE4 Test1	-2.7%	-2.3%	-1.5%
On top of RCE4 Test2	-1.4%	-1.3%	-0.6%
On top of RCE4 Test1, combined with P0152	-4.6%	-3.7%	-2.4%

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Major Color Table (Palette) Prediction

- In RCE4 Test1 and Test2, the major color tables of neighboring CUs can be used to predict that of the current CU

  - In RCE4 Test1, the major color tables of the left and above CUs are used.

  - In RCE4 Test2, the major color table of the left CU is used.

- If a neighboring CU is not coded in palette mode, the major color table of the neighboring CU is set to all zero, and the prior major color table cannot be propagated to following CUs.

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Proposed Method

- For a non-palette CU, the major color table of its left CU is used as its major color table

- This major color table can be a reference major color table for following CUs

- The prior major color table can be propagated through non-palette CUs

- In the implementation on top of RCE4 Test1, a non-normative encoder-only modification is also applied
  - The encoder will test using the major color table from the left or above CU as the major color table of the current CU

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Lossy Coding Results on Top of RCE4 Test1

- Anchor: RCE4 Test1

- 2.7% / 2.3% / 1.5% BD-rate savings for SC YUV 444 sequences under AI-MT / RA-MT / LB-MT

- Thank Microsoft for cross-verification (JCTVC-P0267)

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
Class F	-0.7%	-0.7%	-0.7%	-0.5%	-0.5%	-0.4%	-0.3%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC RGB 444	-2.5%	-2.5%	-2.3%	-2.0%	-2.0%	-1.8%	-1.9%
Animation RGB 444	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC YUV 444	-2.7%	-3.1%	-3.1%	-2.3%	-2.1%	-1.5%	-1.8%
Animation YUV 444	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC(444) GBR Opt.	-3.7%	-3.8%	-3.7%	-3.4%	-3.4%	-2.6%	-2.6%
SC(444) YUV Opt.	-5.2%	-6.1%	-6.4%	-3.9%	-4.8%	-3.5%	-3.9%

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Lossless Coding Results on Top of RCE4 Test1

- Anchor: RCE4 Test1

- 1.9% / 1.6% / 1.5% bit savings for YCbCr 444 SC sequences under AI / RA / LB

	AI	RA	LB
Class F	-0.2%	-0.1%	-0.1%
Class B	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-1.6%	-1.6%	-1.4%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-1.9%	-1.6%	-1.5%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-3.5%	-3.3%	-3.1%
YCbCr 4:4:4 SC (Optional)	-5.2%	-4.5%	-4.2%

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Lossy Coding Results on Top of RCE4 Test2

- Anchor: RCE4 Test2

- 1.4% / 1.3% / 0.6% BD-rate savings for SC YUV 444 sequences under AI-MT / RA-MT / LB-MT

- Thank Qualcomm for cross-verification (JCTVC-P0243)

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
Class F	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC RGB 444	-1.5%	-1.6%	-1.6%	-1.3%	-1.3%	-0.5%	-0.8%
Animation RGB 444	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC YUV 444	-1.4%	-1.6%	-1.6%	-1.3%	-1.3%	-0.6%	-0.6%
Animation YUV 444	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC(444) GBR Opt.	-4.5%	-4.6%	-4.9%	-3.6%	-4.0%	-1.9%	-2.5%
SC(444) YUV Opt.	-4.9%	-5.2%	-5.6%	-3.8%	-4.2%	-3.2%	-3.8%

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Lossless Coding Results on Top of RCE4 Test2

- Anchor: RCE4 Test2

- 1.1% / 1.2% / 1.6% bit savings for YCbCr 444 SC sequences under AI / RA / LB

	AI	RA	LB
Class F	0.0%	0.0%	0.0%
Class B	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-1.1%	-1.1%	-1.3%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-1.1%	-1.2%	-1.6%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-4.9%	-4.5%	-3.6%
YCbCr 4:4:4 SC (Optional)	-5.4%	-5.4%	-4.8%

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Combining JCTVC-P0152 on Top of RCE4 Test1

- The proposed method can be combined with the major color table merging in JCTVC-P0152

- Anchor: RCE4 Test1

- 4.6% / 3.7% / 2.4% BD-rate savings for SC YUV 444 sequences under AI-MT / RA-MT / LB-MT

BD-rate Y	AI-MT	AI-HT	AI-SHT	RA-MT	RA-HT	LB-MT	LB-HT
Class F	-1.6%	-1.5%	-1.3%	-1.2%	-1.0%	-0.7%	-0.6%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC RGB 444	-4.0%	-3.9%	-3.6%	-3.3%	-3.1%	-2.7%	-2.8%
Animation RGB 444	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC YUV 444	-4.6%	-4.8%	-4.6%	-3.7%	-3.4%	-2.4%	-2.8%
Animation YUV 444	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC(444) GBR Opt.	-7.7%	-7.7%	-7.4%	-6.7%	-6.8%	-5.3%	-5.6%
SC(444) YUV Opt.	-8.9%	-9.9%	-10.3%	-7.1%	-8.0%	-5.5%	-6.3%

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Combining JCTVC-P0152 on Top of RCE4 Test1

- Combined with the major color table merging in JCTVC-P0152

- Anchor: RCE4 Test1

- 2.8% / 2.3% / 2.3% bit savings for YCbCr 444 SC sequences under AI / RA / LB

	AI	RA	LB
Class F	-0.4%	-0.1%	-0.1%
Class B	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-2.5%	-2.3%	-2.1%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-2.8%	-2.3%	-2.3%
YCbCr 4:4:4 Animation	-0.1%	-0.1%	-0.1%
RangeExt	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-6.6%	-6.5%	-6.2%
YCbCr 4:4:4 SC (Optional)	-8.4%	-7.5%	-7.4%

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Conclusions

- It is proposed to propagate the major color table through non-palette CUs
    - For a non-palette CU, the major color table of its left CU is used as its major color table.
    - This major color table can be a reference major color table for following CUs.
    - The prior major color table can be propagated through non-palette CUs.

- Results (SC YUV 444 sequences)

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On top of RCE4 Test1, combined with P0152	-4.6%	-3.7%	-2.4%

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