

JCTVC-G496

Core transform design for HEVC with 7-bit coefficients

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Summary

- 7-bit version of HM core transforms
- Same properties as the HM (8-bit) transforms
- Minimal software changes
 - New transform matrices
 - New shift values (+1) between each transform stage
- Negligible BDR differences (-0.1% – +0.2%)
- Savings in hardware implementation costs: 9% - 23%

Examples

HM 4x4 transform (8-bit):

{64, 64, 64, 64}
{83, 36, -36, -83}
{64, -64, -64, 64}
{36, -83, 83, -36}

HM 8x8 transform (8-bit):

{64, 64, 64, 64, 64, 64, 64, 64}
{89, 75, 50, 18, -18, -50, -75, -89}
{83, 36, -36, -83, -83, -36, 36, 83}
{75, -18, -89, -50, 50, 89, 18, -75}
{64, -64, -64, 64, 64, -64, -64, 64}
{50, -89, 18, 75, -75, -18, 89, -50}
{36, -83, 83, -36, -36, 83, -83, 36}
{18, -50, 75, -89, 89, -75, 50, -18}

Proposed 4x4 transform (7-bit):

{32, 32, 32, 32}
{41, 19, -19, -41}
{32, -32, -32, 32}
{19, -41, 41, -19}

Proposed 8x8 transform (7-bit):

{32, 32, 32, 32, 32, 32, 32, 32}
{44, 38, 25, 9, -9, -25, -38, -44}
{41, 19, -19, -41, -41, -19, 19, 41}
{38, -9, -44, -25, 25, 44, 9, -38}
{32, -32, -32, 32, 32, -32, -32, 32}
{25, -44, 9, 38, -38, -9, 44, -25}
{19, -41, 41, -19, -19, 41, -41, 19}
{9, -25, 38, -44, 44, -38, 25, -9}

BD-rate results

	High efficiency			Low complexity		
	I	RA	LD	I	RA	LD
High QP (36,42,47,51)	0,0%	-0,1%	-0,1%	0,0%	0,0%	0,0%
Normal QP (22,27,32,37)	0,0%	0,0%	0,0%	0,1%	0,0%	0,0%
Low QP (1, 5, 9,13)	0,1%	0,0%	0,0%	0,2%	0,1%	0,0%

Hardware area savings

Frequency=300 MHz	HM4 (8-bit)	Proposed (7-bit)	Savings
32-pt inverse transform	140	126	10%
32-pt forward transform	157	126	20%
32-pt forward+inverse	169	151	11%

Conclusion

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- Proposal: To consider for adoption in HM & WD