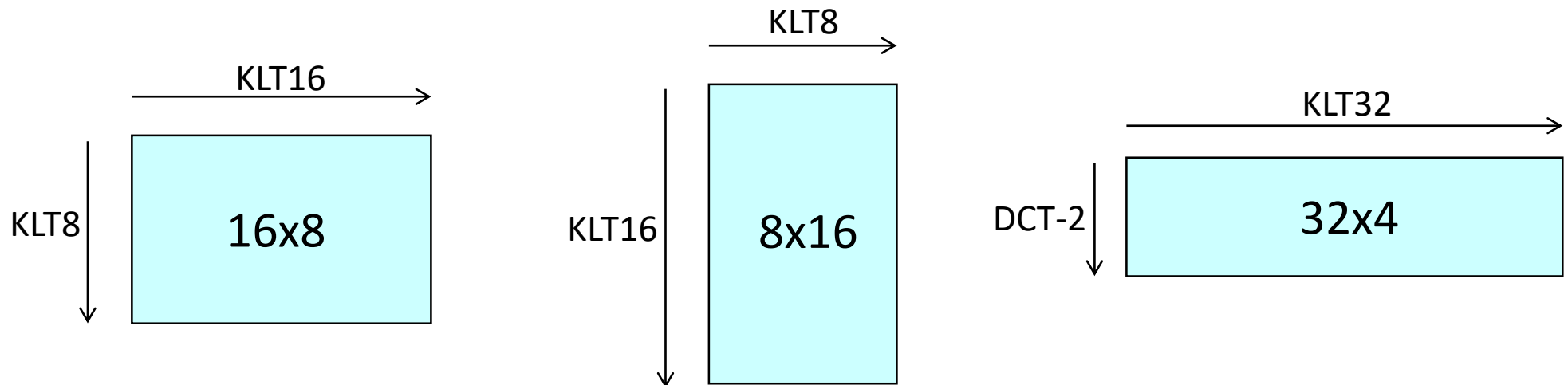


Non-EE2: Separable KLT for intra coding (JVET-AB0100)

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Proposed architecture [1/2]

- Three KLT kernels of length 8, 16, and 32 for intra-coded CU are proposed.
 - KLT8, KLT16, and KLT32 with 8x8, 16x16, and 32x32 matrix dimension, respectively, which were trained from non-CTC sequences.
 - Used for separable primary transform on top of adaptive MTS
 - One flag is added to indicate which of the two is applied.
 - Commonly applied to MxN blocks ($4 \leq M, N \leq 32$) except 4x4 block
 - Applied to the segment of length N for 4xN/Nx4 blocks ($N > 4$) with DCT-2 for the other



Proposed architecture [2/2]

- Newly employed separable transform pairs with the proposed KLTs
 - Up to three pairs: (KLT, KLT), (KLT, DCT-2), and (DCT-2, KLT)
 - Selected from index signalling (context coded)
 - Only one pair is possible for $4 \times N/N \times 4$ blocks ($N > 4$): (KLT, DCT-2) or (DCT-2, KLT)
 - The proposed KLT pairs are disabled (not applied) if absolute sum of transform coefficient is less than or equal to 6.
- Memory usage for kernels
 - $(8 \times 8 + 16 \times 16 + 32 \times 32) = 1,344$ bytes
 - ~ 5 times less than that of adaptive MTS.
 - Adaptive MTS includes five types of trigonometric transforms (DCT-8, DST-7, DCT-5, DST-4, and DST-1), each of which consists of kernels of length 4, 8, 16, and 32.

Experimental results

- 0.10% BD-rate reduction for AI, relative to ECM-6.0 anchor
 - Encoder speed may be improved to achieve better trade-off.

	All Intra Main10				
	Over ECM-6.0 CTC				
	Y	U	V	EncT	DecT
Class A1	-0.11%	0.08%	0.09%	110%	100%
Class A2	-0.14%	0.09%	-0.06%	111%	100%
Class B	-0.11%	0.10%	0.06%	114%	100%
Class C	-0.05%	0.11%	0.04%	114%	100%
Class E	-0.10%	0.11%	0.03%	113%	100%
Overall	-0.10%	0.10%	0.04%	113%	100%
Class D	-0.04%	0.15%	-0.11%	115%	101%
Class F	-0.02%	0.04%	0.00%	107%	100%

Conclusion

- The separable KLTs for lengths of 8, 16, and 32 that can be applied to primary transform pairs are proposed for intra coding.
 - The existing adaptive MTS is unchanged, and the new KLTs provides additional coding performance improvement.
- It is recommended the proposed KLT based architecture to be investigated through EE2.

Appendix

- Signalling for the proposed Intra KLTs
 - One flag (IKLT_flag) and one index (IKLT_index) are added (yellow shaded).
 - If absolute sum of transform coefficients ≤ 6 , IKLT_flag is inferred as 0.
 - The IKLT_index consisting of two context-coded bins indicate a transform pair among (KLT, KLT), (KLT, DCT-2) and (DCT-2, KLT).
 - First bin: {(KLT, KLT)} vs. {(KLT, DCT-2), (DCT-2, KLT)}
 - Second bin: (KLT, DCT-2) vs. (DCT-2, KLT), signalled only if the first bin is equal to 1
 - For 4xN/Nx4 blocks ($N > 4$), the IKLT_index need not be signalled.

