
JVET-J0040

SET OF TRANSFORMS (SOT)

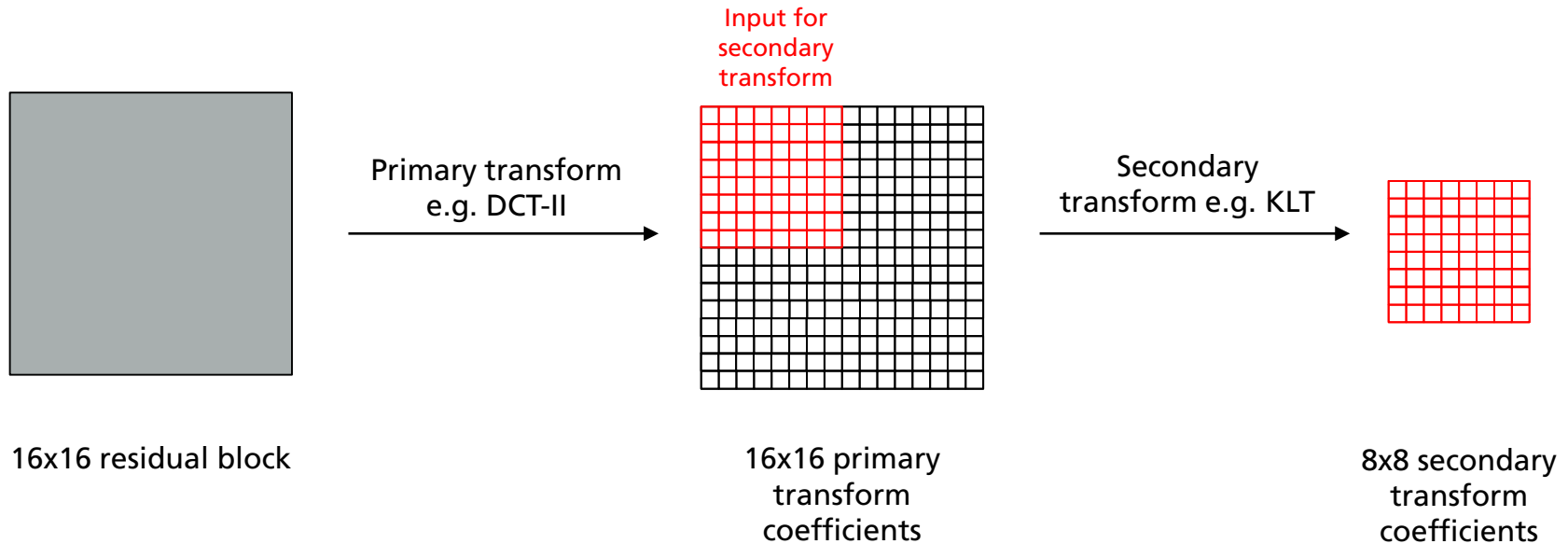
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Basic concept

- 5 transform candidates for each residual block
- One of the 5 transforms is chosen by the encoder and signaled in the bitstream
- Combinations of EMT and NSST (both from JEM) and additional trained transforms
- List of candidates depends on prediction mode, channel type and block size
- Primary and secondary transforms
 - Blocks larger than 8x8 blocks: Secondary transform applied to the low-frequency part of the primary transform coefficients
 - Secondary transform size = $\min(8, W) \times \min(8, H)$

Primary/secondary transform example

Secondary transform sizes: 4x4, 4x8, 8x4, 8x8



Transform candidates for prediction modes

- For coding units with inter predicted modes
 - DCT-II transform plus the 4 transforms defined by EMT (as in JEM)
- For DC, Planar and Angular modes
 - Transforms defined by EMT and NSST can serve as candidates
 - Additional secondary transforms with sizes 4x8, 8x8 and 8x4 for non-quadratic TUs
 - Look-up table for mapping from block size and intra mode to candidate list (the 5 entries experimentally determined)
 - Example:



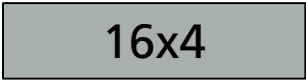
transform ² candidate	16x4 ³ primary ² transform	8x4 ³ secondary ² transform
0	DCT-II	none
1	EMT3	NSST2
2	DCT-II	KLT1
3	EMT1	none
4	DCT-II	KLT2

Transform candidates for prediction modes

- For intraNN prediction modes
 - 4 trained primary transforms for each size 4x4, 4x8, 8x8 and 8x4
 - Trained secondary transforms with sizes 4x8, 8x8 and 8x4 in combination with DCT-II as their primary transform
 - Candidate list includes the DCT-II plus 4 transforms from the intraNN set



transform ² candidate	8x8 ¹ primary ² transform	8x8 ³ secondary ² transform
0	DCT-II	none
1	KLT1	none
2	KLT2	none
3	KLT3	none
4	KLT4	none

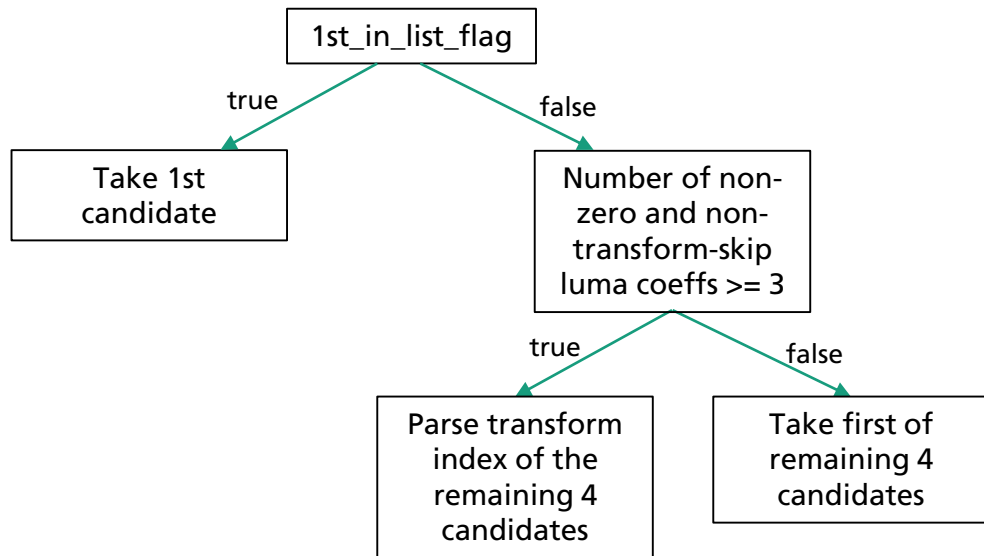


transform ² candidate	16x4 ¹ primary ² transform	8x4 ³ secondary ² transform
0	DCT-II	none
1	DCT-II	KLT1
2	DCT-II	KLT2
3	DCT-II	KLT3
4	DCT-II	KLT4

Signaling of the selected transform candidate

- Signaling of transform index of inter predicted CUs like in JEM
- Signaling for intra predicted CUs
 - Coding of 1st_in_list_flag with one context model for different block sizes
 - Coding of transform index by a fixed length code with 2 context modeled bins

Signaling for intra coded blocks



Experimental results: Configuration Settings

- Reference: NextSoftware with partitioning only (QT+BTS, see JVET-J0035)
- Partitioning used: Width and height of blocks are integer powers of 2
- Three settings are tested on top this configuration:
 - EMT+NSST(JEM): each transform defined by EMT can be combined with each secondary transform of NSST, EMT-Fast-Mode enabled (see JVET-G1001)
 - EMT+NSST(NEXT): restriction to DCT-II as primary transform for NSST (EMT and NSST are tested exclusively), EMT-Fast-Mode enabled
 - SOT: reduced set of transforms as described
- A test set consisting of the sequences from the JVET Common Test Conditions (CTC) as well as the Call for Proposals (CfP) is used.
- The first 49 frames of the sequences are encoded.

Experimental results: Summary

	Y	Cb	Cr	EncTime	DecTime	Y	Cb	Cr	EncTime	DecTime
	Intra Only - QP values 22, 27, 32, 37					Intra Only - QP values 27, 32, 37, 42				
EMT+NSST (JEM)	-5.69%	-5.70%	-6.56%	418%	111%	-5.62%	-7.01%	-7.56%	348%	112%
EMT+NSST (NEXT)	-5.25%	-6.03%	-7.02%	262%	111%	-5.27%	-7.47%	-8.17%	230%	112%
SOT (v.2)	-6.02%	-6.67%	-7.46%	250%	113%	-6.18%	-7.94%	-8.39%	235%	112%
	Random Access - QP values 22, 27, 32, 37					Random Access - QP values 27, 32, 37, 42				
EMT+NSST (JEM)	-3.89%	-3.74%	-4.15%	266%	107%	-3.82%	-4.90%	-4.98%	244%	107%
EMT+NSST (NEXT)	-3.60%	-3.96%	-4.29%	190%	107%	-3.57%	-5.25%	-5.33%	180%	108%
SOT (v.2)	-4.06%	-3.68%	-4.10%	164%	105%	-4.10%	-4.70%	-5.02%	156%	105%
	Low Delay - QP values 22, 27, 32, 37					Low Delay - QP values 27, 32, 37, 42				
EMT+NSST (JEM)	-3.13%	-2.34%	-3.08%	225%	108%	-3.01%	-3.07%	-3.99%	217%	111%
EMT+NSST (NEXT)	-2.87%	-2.84%	-3.42%	175%	107%	-2.75%	-3.49%	-4.21%	168%	109%
SOT (v.2)	-3.15%	-2.73%	-2.84%	158%	109%	-3.12%	-3.32%	-3.62%	152%	110%

BD-rates and run-time comparison on the bases of the CfP test conditions restricted to 49 frames