

Further study on compact representation of quantization matrices

JVTV C-F085

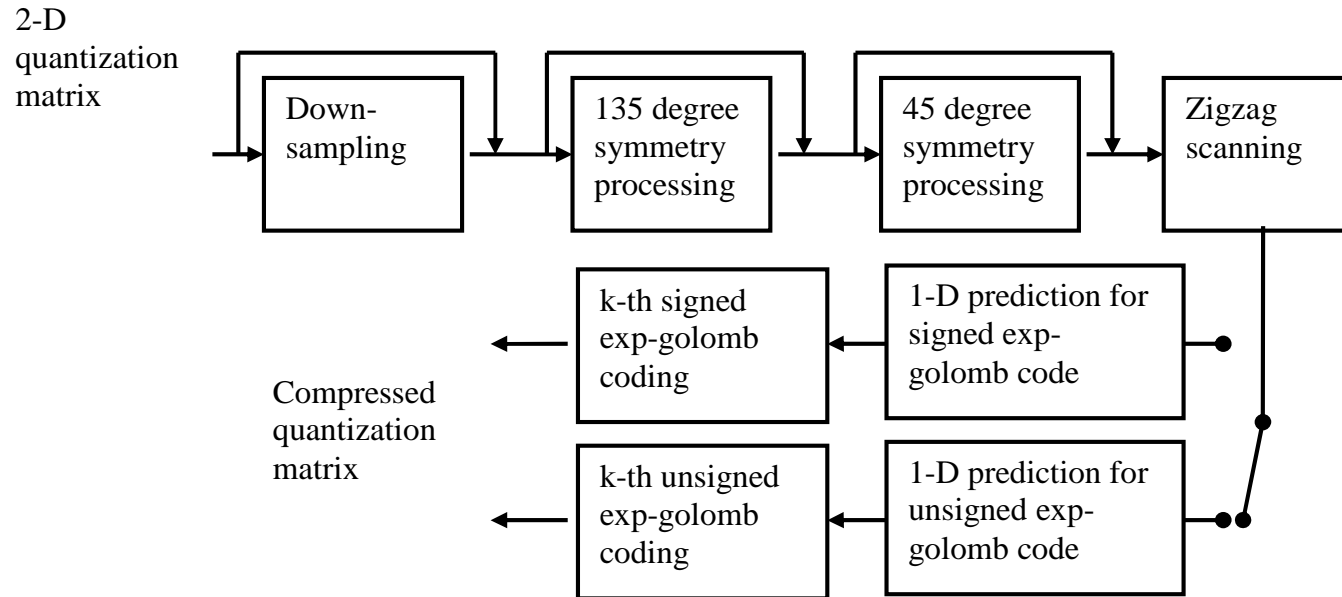
Minhua Zhou, Vivienne Sze

(Texas Instruments Inc., USA)

Background

- At Daegu meeting JCTVC-D024 was proposed to compress quantization matrices for large block sizes
- The proposed algorithm contains the following four tools
 - quantization matrix down-sampling (down-sample)
 - 135 degree symmetry processing (sym135)
 - 45 degree symmetry processing with offset (sym45)
 - unsigned exp-golomb coding (UEK)
- The algorithm is integrated into HM3.0 and further study is conducted by using quantization matrices provided by SONY

Diagram of proposed algorithm



- The algorithm is backward compatible to the AVC method
- Arbitrary combinations of proposed tools are allowed

Test quantization matrices

- Symmetry matrices (qmatrix_symmetry1.txt)
 - INTRA4x4 (Y, U, V), INTER8x8 (Y, U, V)
 - INTRA8x8 (Y, U, V), INTER8x8 (Y, U, V)
 - INTRA8x8 (Y, U, V), INTER8x8 (Y, U, V)
 - INTRA8x8 (Y, U, V), INTER8x8 (Y, U, V)
- Asymmetry matrices (qmatrix_asymmetry1.txt)
 - INTRA4x4 (Y, U, V), INTER8x8 (Y, U, V)
 - INTRA8x8 (Y, U, V), INTER8x8 (Y, U, V)
 - INTRA8x8 (Y, U, V), INTER8x8 (Y, U, V)
 - INTRA8x8 (Y, U, V), INTER8x8 (Y, U, V)
- Matrices for Y, U, V of a same block size are the same

Test results

Qmatx_compression_ID				Symmetry matrices			Asymmetry matrices		
Down sample	UEK	sym45	sym135	Number of bits	Comp. ratio	Avg. error	Number of bits	Comp. ratio	Avg. error
0	0	0	0	26408	1.00	0.00	28376	1.00	0.00
0	0	0	1	14432	1.83	0.00	14522	1.95	3.53
0	0	1	0	14996	1.76	5.06	13514	2.10	3.14
0	0	1	1	8396	3.15	5.06	7718	3.68	5.25
0	1	0	0	10010	2.64	3.78	10166	2.79	6.68
0	1	0	1	6146	4.30	3.53	6218	4.56	6.83
0	1	1	0	5876	4.49	7.91	5744	4.94	6.90
0	1	1	1	3896	6.78	7.52	3698	7.67	6.95
1	0	0	0	10682	2.47	0.43	11192	2.54	0.32
1	0	0	1	6224	4.24	0.43	6122	4.64	3.76
1	0	1	0	6620	3.99	4.73	5600	5.07	3.54
1	0	1	1	4028	6.56	4.73	3572	7.94	5.52
1	1	0	0	3884	6.80	3.96	3980	7.13	6.35
1	1	0	1	2792	9.46	3.47	2834	10.01	6.65
1	1	1	0	2558	10.32	7.29	2492	11.39	6.81
1	1	1	1	2006	13.16	6.73	1886	15.05	7.07

Summary

- Due to transform and quantization of large block size, quantization matrices can become a significant overhead
- Recommend to adopt AVC quantization matrix compression algorithm into the HEVC test model
- Launch a CE to evaluate proposed methods and specify more efficient quantization matrix representation format for HEVC