FAST TEXTURE INTRA SIZE CODING BASED ON BIG DATA CLUSTERING FOR 3D-HEVC

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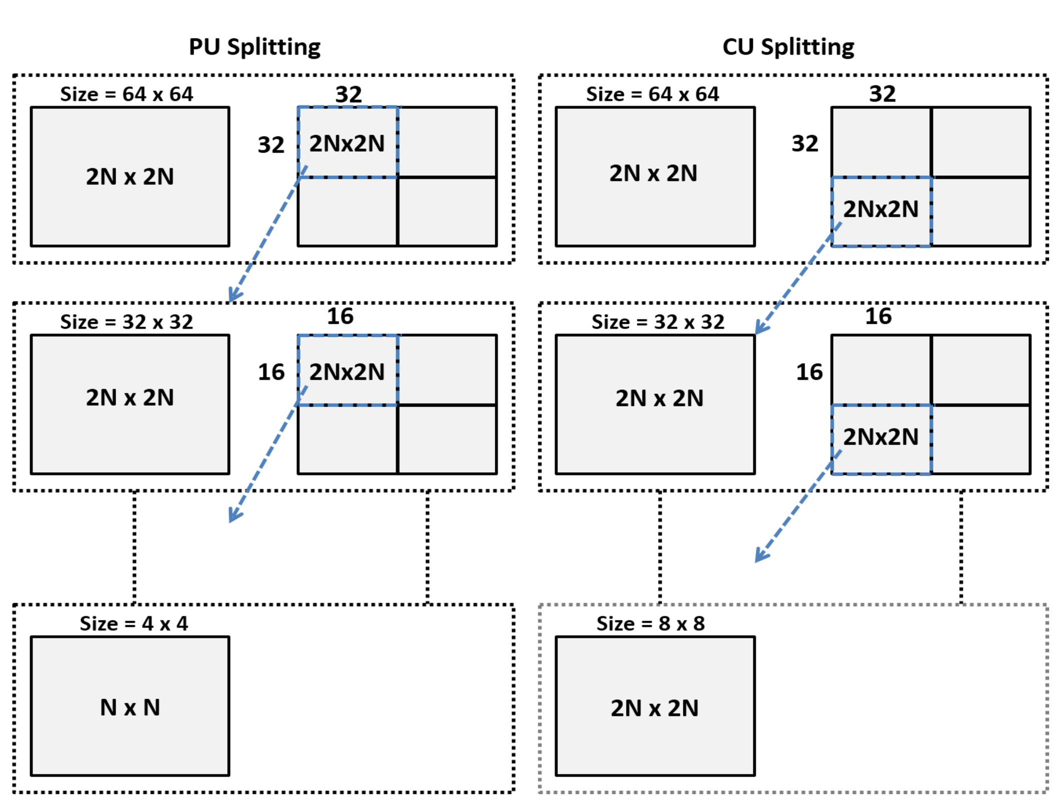
INTRODUCTION

- The 3D High Efficiency Video Coding (3D-HEVC) has recently been approved by the Joint Collaborative Team on 3D Video coding (JCT-3V) and standardized as an extension of HEVC.
- 3D-HEVC depth map intra size coding is a key factor in 3D video compression due to it complexity to select the best size.
- This paper proposes an efficient texture intra size coding based on the clustering method and big data analysis.

OVERVIEW OF 3D-HEVC INTRA SIZE CODING

- 3D-HEVC introduces a hierarchical structure subdivision using three units: coding unit (CU), prediction unit (PU) and transform unit (TU)..



CLUSTERING ALGORITHM

- Clustering analysis is a method to find groups within data with most similar objects in the same cluster. Automatic Merging Possibilistic Clustering (AM-PCM) is a robust clustering method proposed by [1].

FEATURES SELECTION AND PROPODE METHOD

1. Create data training from multiple sequences, where it composed by the 64x64 CU (4000 vectors).
2. For each CU we compute the Variance and the ASMCV.
3. Next we cluster this training data to get the center cluster totally of 976 cluster centers.
4. Create our big data from all 64x64 CU from all test sequences including the variance, ASMCV and the size flag.
5. Combine all big data with the cluster centers based on Euclidian distance.
6. Compute the distribution of each size in each cluster center.
7. Based on the distribution we combine the cluster centre how has the same distribution (Table 1).
8. Create our texture intra size model. (Table 2)

Index	QP	Coding Unit Size				
		64×64	32×32	16×16	8×8	4×4
1	25	96.60%	3.40%	0.00%	0.00%	0.00%
	30	97.56%	2.39%	0.04%	0.00%	0.00%
	35	96.66%	3.34%	0.00%	0.00%	0.00%
	40	93.40%	6.16%	0.42%	0.03%	0.00%
2	25	52.32%	41.18%	6.07%	0.33%	0.10%
	30	67.48%	28.17%	3.85%	0.04%	0.10%
	35	72.21%	23.43%	3.59%	0.67%	0.10%
	40	70.51%	24.73%	4.07%	0.62%	0.08%
3	25	23.07%	52.63%	18.93%	4.43%	0.94%
	30	27.16%	47.07%	19.79%	5.08%	0.90%
	35	25.04%	46.80%	21.15%	6.05%	0.96%
	40	25.31%	47.94%	21.57%	4.82%	0.36%
4	25	10.91%	46.55%	28.49%	11.22%	2.83%
	30	11.54%	46.29%	29.72%	10.43%	2.03%
	35	11.72%	44.12%	29.78%	12.22%	2.15%
	40	8.92%	47.67%	33.79%	9.05%	0.58%
5	25	2.92%	32.10%	34.23%	21.53%	9.23%
	30	3.61%	33.29%	36.14%	20.51%	6.44%
	35	3.76%	34.78%	37.99%	19.13%	4.34%
	40	4.66%	39.05%	40.32%	14.68%	1.29%

Amp	Coding Unit Size				
	64×64	32×32	16×16	8×8	4×4
$Amp < Th1$	X	-	-	-	-
$Th1 \leq Amp < Th2$	X	X	-	-	-
$Th2 \leq Amp < Th3$	X	X	X	-	-
$Th3 \leq Amp < Th4$	-	X	X	X	-
$Amp \leq Th4$	-	X	X	X	X

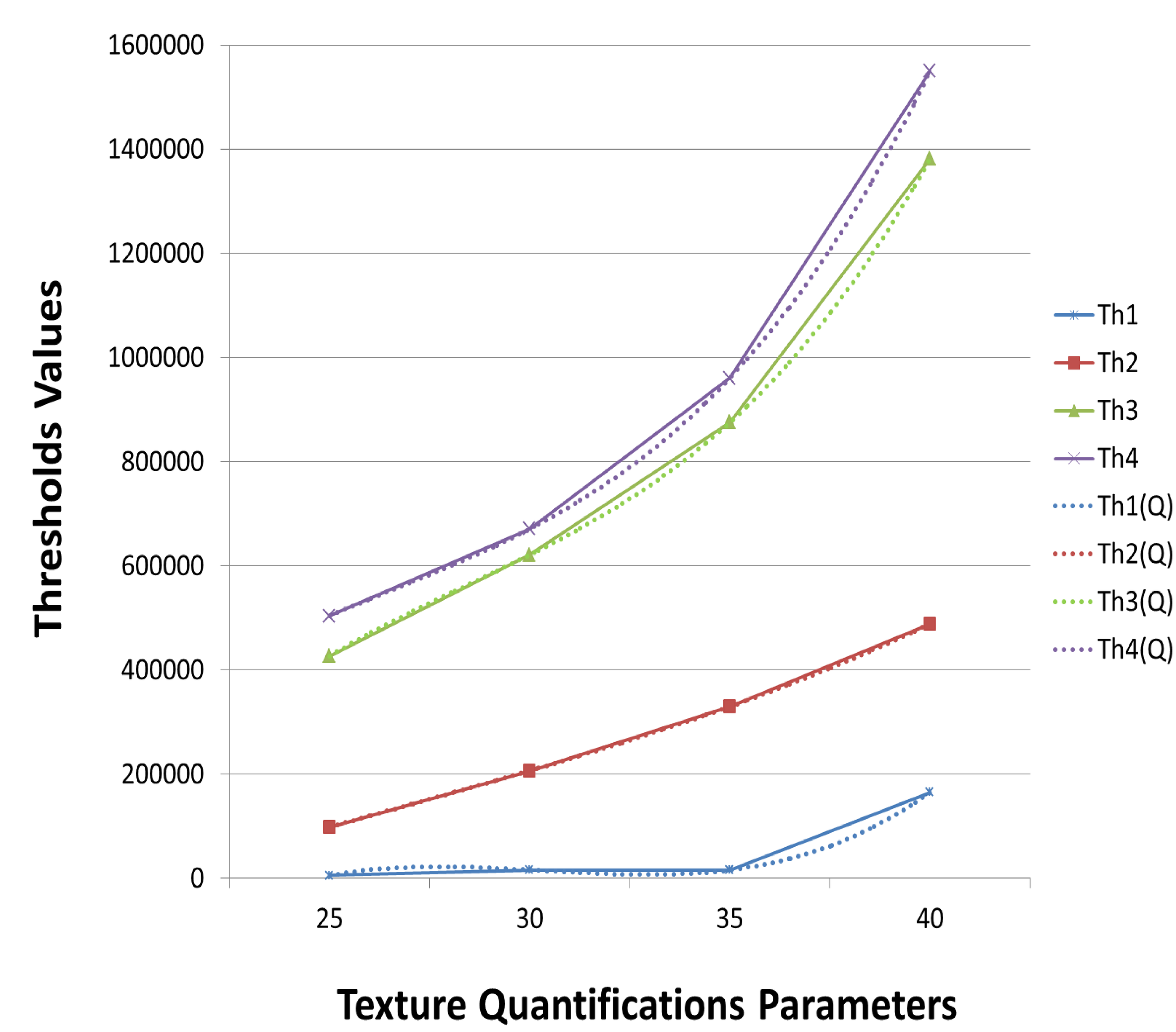
QP	Thresholds			
	Th1	Th2	Th3	Th4
25	5657.00	98727.6	426771.41	504187.06
30	16275.99	206813.62	621200.25	671023.108
35	16275.99	330096.36	875510.53	960894.37
40	165472.06	488527.10	1381988.19	1550151.40

$$Th1(Q) = 26636 \cdot Q^3 - 165125 \cdot Q^2 + 319542 \cdot Q - 175396.$$

$$Th2(Q) = 3325.2 \cdot Q^3 - 12353 \cdot Q^2 + 121868 \cdot Q - 14113.$$

$$Th3(Q) = 32048 \cdot Q^3 - 162345 \cdot Q^2 + 457131 \cdot Q + 99938.$$

$$Th4(Q) = 29392 \cdot Q^3 - 114833 \cdot Q^2 + 305593 \cdot Q + 284036.$$



EXPERIMENTAL RESULTS

- the experiments were carried out under the Common Testing Conditions (CTC) required by JCT-3V using the recent reference software HTM-16.2.
- The coding performance is evaluated based on Bjontegaard.

Sequences	BD-BR (%)	BD-PSNR (dB)	ΔBR (%)	ΔPSNR (dB)	ΔT (%)
Balloons	0.26	-0.013	0.12	-0.008	28.94
Kendo	0.43	-0.019	0.30	-0.007	33.45
Newspaper1	0.16	-0.010	0.08	-0.007	20.43
GTFly	1.93	-0.094	0.98	-0.044	47.25
PonznanHall2	1.04	-0.025	0.52	-0.014	54.12
PonznanStreet	0.34	-0.013	0.26	-0.009	29.49
UndoDancer	0.30	-0.016	0.12	-0.011	33.78
Shark	1.17	-0.049	0.36	-0.033	43.21
1024x768	0.28	-0.030	0.17	-0.007	27.61
1920x1088	0.95	-0.039	0.45	-0.022	41.57
Average	0.70	-0.030	0.34	-0.017	36.33

QP	ΔBR (%)	ΔPSNR (dB)	ΔT (%)
25	0.12	-0.006	25.21
30	0.25	-0.011	31.97
35	0.37	-0.017	38.67
40	0.63	-0.032	49.48

CONCLUSION

The proposed method presented in this work performs the big data analysis based on Automatic Merging Possibilistic Clustering Method to extract a CU size model decision for texture intra coding. Based on this model, we predict CU splitting flags and then reduce the computational complexity of the encoder.

[1]: M. S. Yang and C. Y. Lai, "A Robust Automatic Merging Possibilistic Clustering Method, " in IEEE Transactions on Fuzzy Systems, vol. 19, no. 1, pp. 26-41, Feb. 2011.