Fast Depth Intra Coding based on Layer-classification and CNN for 3D-HEVC

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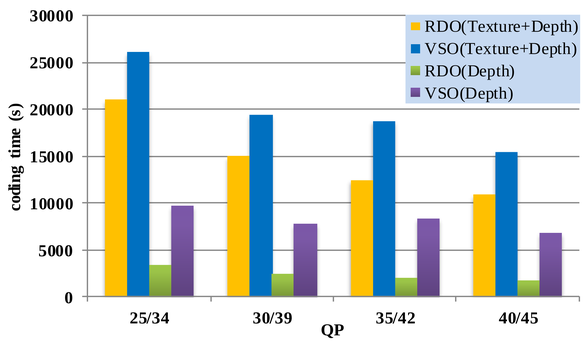
1. INTRODUCTION

- The user's immersive ascension will gradually increase as the number of views increase, but the amount of data will be multiplied. In order to reduce the increased data, more effective 3D video coding scheme is needed to adopt. The emergence of multi-view video plus depth (MVD) format effectively alleviates this problem. However, the view synthesis process of coding is relatively complex.
- **Motivation:** In order to solve the above problems, it is necessary to design the rapid depth map coding technology based on 3D-HEVC to accelerate the view synthesis speed and improve the real-time coding. Most recently, considering that convolutional neural network (CNN) is suitable for image and video processing, learning-based methods are introduced to reduce the encoding complexity.

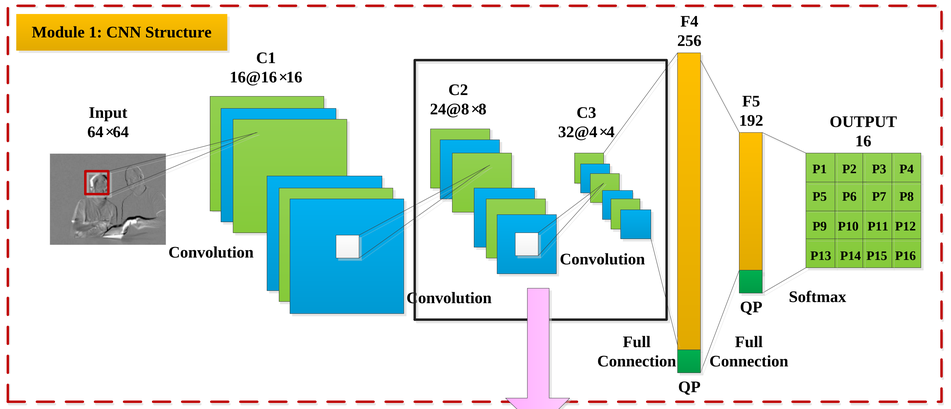


2. PROPOSED METHODS

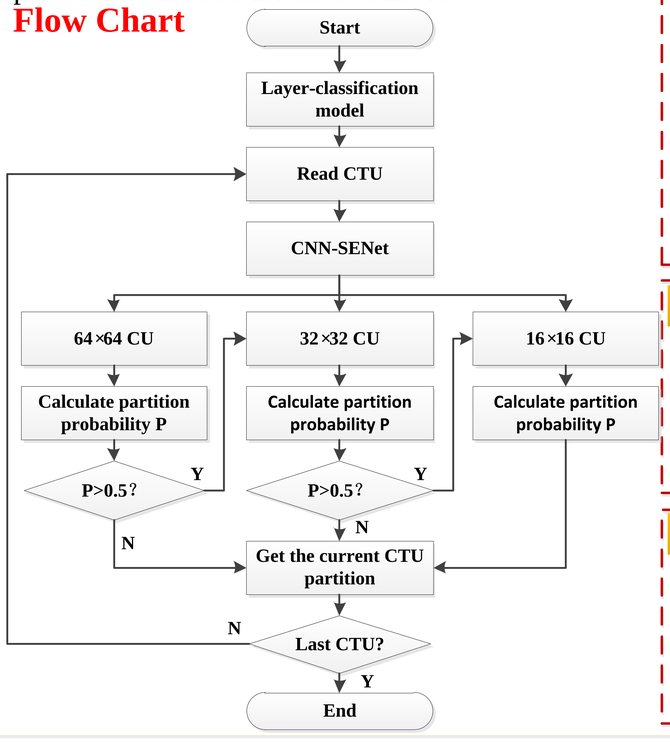
2.1 Layer-classification model

- Calculate the brightness difference between two adjacent CUs of depth map. Take the depth map corresponding to the minimum value as the prediction value of the CNN-SENet.

2.2 CNN-SENet architecture



2.3 Flow Chart



3. RESULTS

3.1 Comparison of Complexity Reduction

Sequences	QP	Coding Time (s)			ΔT_1 (%)	ΔT_2 (%)
		Original	[15]	Proposed method		
Balloons	(25, 34)	2048.7140	1763.1230	1652.1660	19.4	6.3
	(30, 39)	2165.4970	1868.6219	1703.9750	21.3	8.8
	(35, 42)	2166.6470	1897.7074	1696.0190	21.7	12.6
	(40, 45)	2191.4180	2001.5970	1749.9350	20.2	12.6
Kendo	(25, 34)	1908.9490	1613.8007	1518.7080	20.4	5.9
	(30, 39)	2013.1110	1756.2975	1608.6930	20.1	8.4
	(35, 42)	2014.7910	1696.0597	1598.7050	20.7	5.7
	(40, 45)	2119.9560	1731.1571	1663.6870	21.5	3.9
Poznan_Hall2	(25, 34)	4605.7930	3991.5266	3540.9400	23.1	11.3
	(30, 39)	4897.1340	4404.3205	3719.2050	24.1	15.6
	(35, 42)	4895.8400	4482.4965	3914.7770	20.1	12.7
	(40, 45)	5457.2290	4819.6724	4116.4380	24.5	14.6
PoznanStreet	(25, 34)	7379.7950	7145.7595	5951.7040	19.4	16.7
	(30, 39)	7462.3270	6802.1880	5788.8240	22.4	14.9
	(35, 42)	6421.9440	5570.6224	5065.7090	21.1	9.1
	(40, 45)	6017.8040	4877.5370	4744.8982	21.2	2.8
Undo-Dancer	(25, 34)	5687.2920	4758.9306	4618.7580	18.7	2.9
	(30, 39)	5383.3720	4510.2279	4410.6640	18.1	2.2
	(35, 42)	5314.5220	4416.1474	4275.0780	19.6	3.2
	(40, 45)	5351.1440	4383.6930	4271.4720	20.2	2.6
Average					20.9	8.7

3.2 Comparison of RD Performance

Sequences	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate
Balloons	0.0%	0.0%	0.0%	0.0%	0.5%	8.3%
Kendo	0.0%	0.0%	0.0%	0.0%	0.5%	3.9%
Poznan_Hall2	0.0%	0.0%	0.0%	0.0%	0.1%	3.8%
PoznanStreet	0.0%	0.0%	0.0%	0.0%	0.2%	3.3%
Undo-Dancer	0.0%	0.0%	0.0%	0.0%	0.2%	6.4%
1024×768	0.0%	0.0%	0.0%	0.0%	0.5%	6.1%
1920×1088	0.0%	0.0%	0.0%	0.0%	0.1%	4.5%
Average	0.0%	0.0%	0.0%	0.0%	0.3%	5.2%

4. CONCLUSIONS

- This paper studies the problem of VSO-based iterative search of all possible quad-tree partitions and proposes a CNN scheme based on layer-classification for fast depth intra coding.
- By combining the layer-classification model and CNN-SENet to predict the CU partition of all coding units (CUs) for depth map at a specific view, video coding complexity is reduced.
- Experimental results show that the proposed method can reduce 20.9% encoding time without any significant loss for the 3D video quality.

5. REFERENCES

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6. ACKNOWLEDGEMENTS

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