

REDEFINING MOBILITY

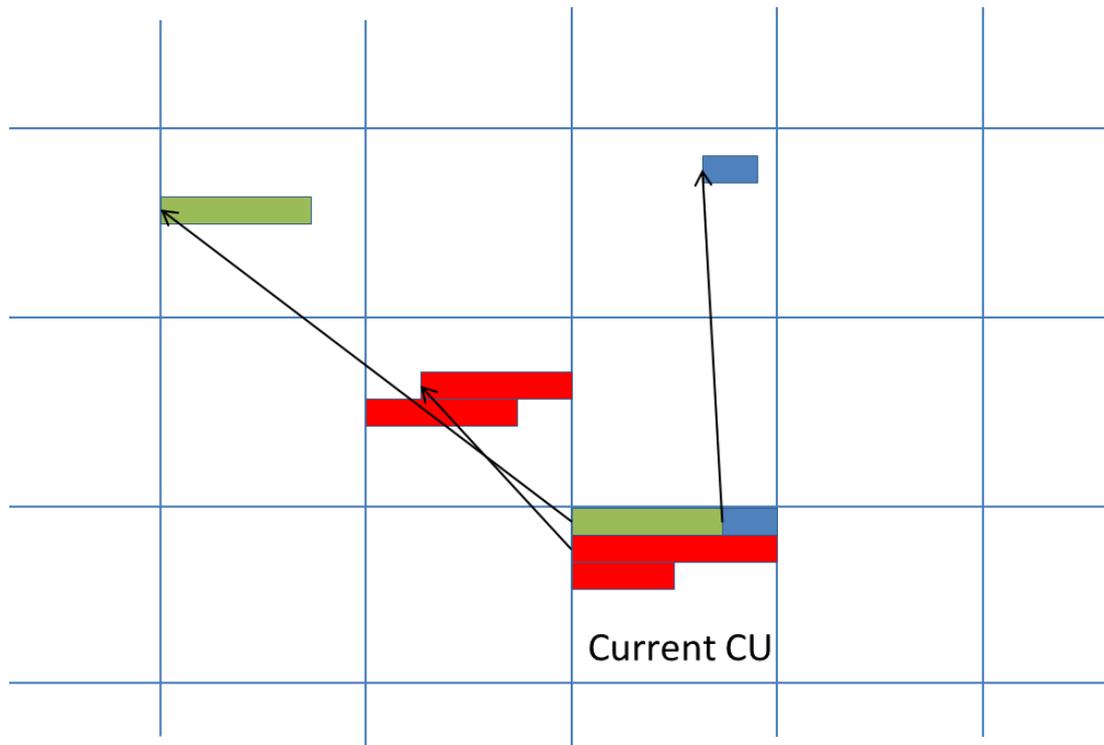


JCTVC-Q0149: Pixel based 1D Dictionary Coding

Feng Zou, Ying Chen, Chao Pang, Joel Sole, Marta Karczewicz

Basic idea of 1D dictionary coding

- 1D string matching from causal neighborhood area
- Hash function enables fast search (encoder only)
- Select the maximum matching length
- Transmit the relative position and matching length for each string



Prior Art on 1D Dictionary Coding (JCTVC-L0303)

- Sample based process
 - String matching
 - Hash calculation (encoder) -16bit CRC
- Vertical scan to process and arrange the dictionary
- Cross frame reference
- Limited matching length (up to 272)
- LCU based implementation

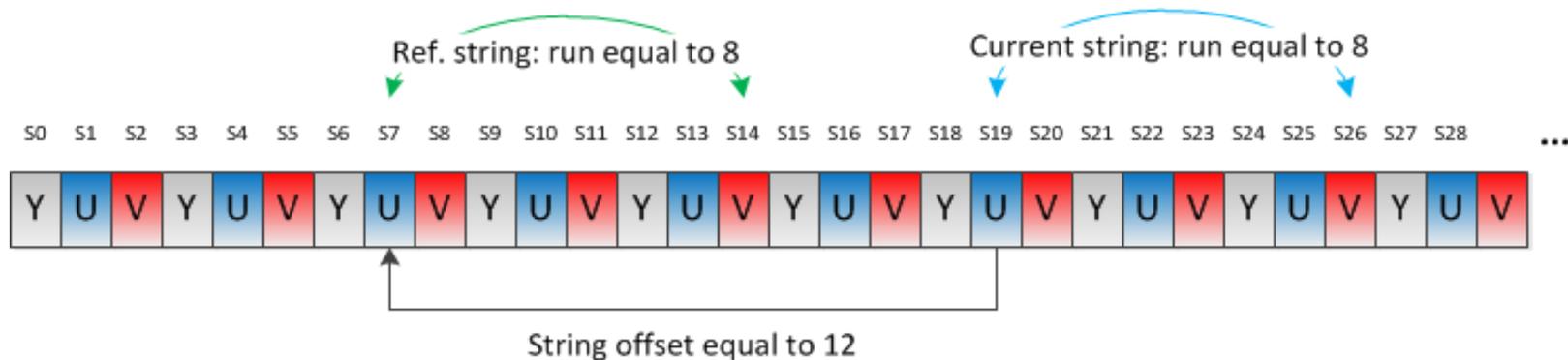


Fig 1. Sample based matching (cross pixels)

Proposed Pixel based 1D Dictionary Coding

- Pixel based process
 - String matching
 - Hash function (encoder) – 21 bit (7 MSB from each component)
- Horizontal scan to process and arrange the dictionary
- No cross frame reference
- LCU based implementation
 - Matching length up to LCU sizes ($64 \times 64 = 4096$)
- Improved offset and length coding

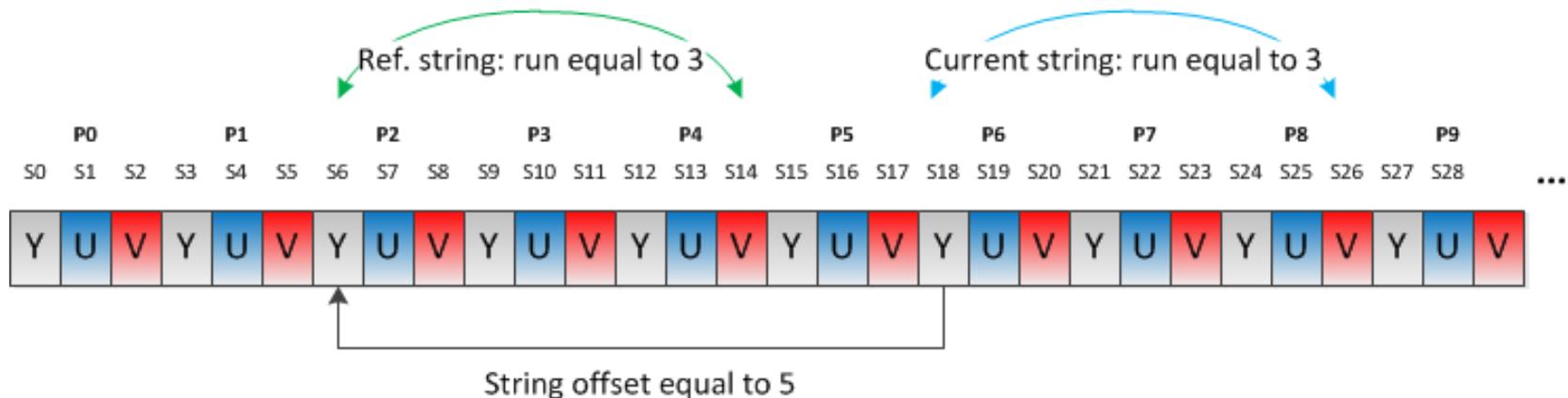


Fig 2. Pixel based matching

Proposed Pixel Based 1D Dictionary Coding

- Syntax Table

dictionary_syntax_table(){	
for(decPixelCnt=0; decPixelCnt < (1<<<(2* log2CbSize);) {	
matching_string_flag	ae(v)
if(matching_string_flag == 1) {	
matching_string_offset_use_recent_8_flag	ae(v)
if(matching_string_distance_use_recent_8_flag)	
matching_string_offset_recent_8_idx	ae(v)
else	
matching_string_offset_minus1	ae(v)
matching_string_length_minus1	ae(v)
decPixelCnt += (matching_string_length_minus1 + 1)	
}	
else {	
unmatchable_sample_value_component0	ae(v)
unmatchable_sample_value_component1	ae(v)
unmatchable_sample_value_component2	ae(v)
decPixelCnt ++	
}	
}	
}	

Simulation Results - Lossy Test

- SW: based on HM13.0-RExt6.0
- Common test condition:
 - Rext Ahg8 with SC sequences

	All Intra		
	Y	U	V
RGB, text & graphics with motion, 1080p	-17.0%	-18.1%	-17.7%
RGB, text & graphics with motion,720p	-12.6%	-12.8%	-12.7%
RGB, mixed content, 1440p	-2.3%	-2.3%	-2.3%
RGB, mixed content, 1080p	-0.8%	-0.8%	-0.8%
RGB, Animation, 720p	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-13.6%	-14.4%	-14.3%
YUV, text & graphics with motion,720p	-5.4%	-8.7%	-9.3%
YUV, mixed content, 1440p	-0.7%	-1.1%	-1.0%
YUV, mixed content, 1080p	-0.3%	-0.4%	-0.2%
YUV, Animation, 720p	0.0%	0.0%	0.0%
Enc Time[%]	113%		
Dec Time[%]	98%		
	Random Access		
	Y	U	V
RGB, text & graphics with motion, 1080p	-10.1%	-11.1%	-10.9%
RGB, text & graphics with motion,720p	-13.4%	-13.3%	-13.4%
RGB, mixed content, 1440p	-3.7%	-3.4%	-3.6%
RGB, mixed content, 1080p	-1.5%	-1.5%	-1.5%
RGB, Animation, 720p	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-8.8%	-12.0%	-11.6%
YUV, text & graphics with motion,720p	-6.8%	-10.9%	-11.6%
YUV, mixed content, 1440p	-1.1%	-2.2%	-2.0%
YUV, mixed content, 1080p	-0.6%	-1.0%	-0.8%
YUV, Animation, 720p	0.1%	0.1%	0.1%
Enc Time[%]	105%		
Dec Time[%]	106%		
	Low delay B		
	Y	U	V
RGB, text & graphics with motion, 1080p	-6.2%	-7.0%	-6.7%
RGB, text & graphics with motion,720p	-9.3%	-9.0%	-9.1%
RGB, mixed content, 1440p	-2.4%	-2.2%	-2.3%
RGB, mixed content, 1080p	-0.5%	-0.6%	-0.5%
RGB, Animation, 720p	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-4.3%	-7.1%	-6.8%
YUV, text & graphics with motion,720p	-3.5%	-6.5%	-7.1%
YUV, mixed content, 1440p	-1.0%	-2.2%	-2.0%
YUV, mixed content, 1080p	0.1%	0.0%	0.2%
YUV, Animation, 720p	0.1%	0.1%	0.1%
Enc Time[%]	107%		
Dec Time[%]	112%		

Simulation Results - Lossless Test

- SW: based on HM13.0-RExt6.0
- Common test condition:
 - Rext Ahg8 with SC sequences

Bit-rate savings	AI			
	Total	Average	Min	Max
RGB, text & graphics with motion, 1080p	33.0%	33.2%	24.2%	47.6%
RGB, text & graphics with motion,720p	13.3%	14.6%	0.3%	29.7%
RGB, mixed content, 1440p	4.9%	5.5%	3.1%	8.0%
RGB, mixed content, 1080p	9.7%	8.8%	6.7%	11.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	34.0%	34.5%	26.0%	51.5%
YUV, text & graphics with motion,720p	11.2%	14.7%	0.3%	37.9%
YUV, mixed content, 1440p	5.3%	5.5%	2.8%	9.1%
YUV, mixed content, 1080p	5.2%	8.8%	4.3%	7.1%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	122%			
Dec Time[%]	76%			
Bit-rate savings	RA			
	Total	Average	Min	Max
RGB, text & graphics with motion, 1080p	20.8%	21.7%	12.6%	31.3%
RGB, text & graphics with motion,720p	2.4%	9.1%	0.1%	29.2%
RGB, mixed content, 1440p	0.8%	0.8%	0.7%	0.9%
RGB, mixed content, 1080p	5.2%	3.4%	1.4%	5.5%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	19.1%	22.9%	14.0%	35.6%
YUV, text & graphics with motion,720p	2.1%	10.4%	0.1%	37.2%
YUV, mixed content, 1440p	0.8%	0.8%	0.8%	0.8%
YUV, mixed content, 1080p	1.3%	3.4%	1.2%	1.5%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	111%			
Dec Time[%]	95%			
Bit-rate savings	LB			
	Total	Average	Min	Max
RGB, text & graphics with motion, 1080p	20.3%	17.1%	10.9%	20.9%
RGB, text & graphics with motion,720p	1.5%	7.9%	0.1%	27.0%
RGB, mixed content, 1440p	0.3%	0.4%	0.2%	0.5%
RGB, mixed content, 1080p	4.9%	2.8%	0.5%	5.2%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	18.1%	17.9%	11.9%	23.4%
YUV, text & graphics with motion,720p	1.3%	9.3%	0.1%	34.6%
YUV, mixed content, 1440p	0.4%	0.4%	0.2%	0.6%
YUV, mixed content, 1080p	1.0%	2.8%	0.5%	1.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	109%			
Dec Time[%]	98%			

Conclusion

- Proposed pixel based 1D dictionary coding
 - 17%, 13.6% BD-rate savings on average for AI 1080p RGB and YUV respectively in lossy test condition
 - 33%, 34% BD-rate savings for AI 1080p RGB and YUV respectively in lossless test condition
- Recommend to set up Core Experiment for further study