

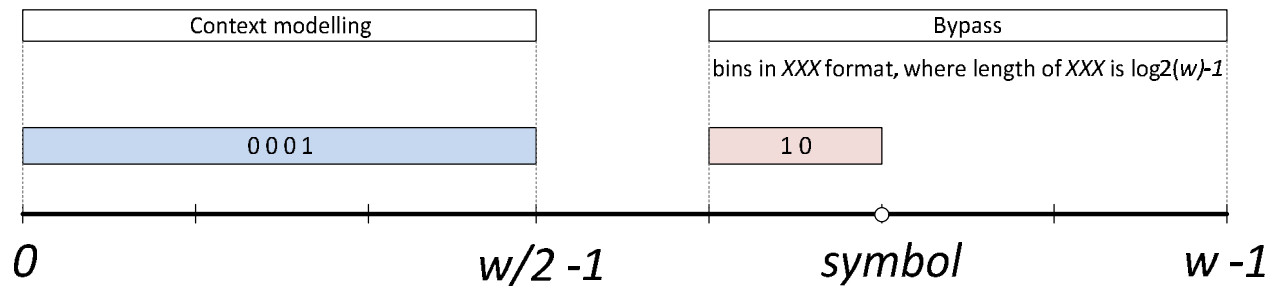
Grouping of bypass bins for last position coding of transform coefficients

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Last position coding

❖ HM-4.0

- First $width/2$ bins of x and first $height/2$ bins of y
 - Coded with **context modelling**.
- If $x \geq width/2$ or $y \geq height/2$
 - Then $x = x - width/2$, $y = y - height/2$.
 - New x and y are represented with **fixed binary** with $\log_2(width) - 1$ and $\log_2(height) - 1$ bins length and coded with **bypass mode**.



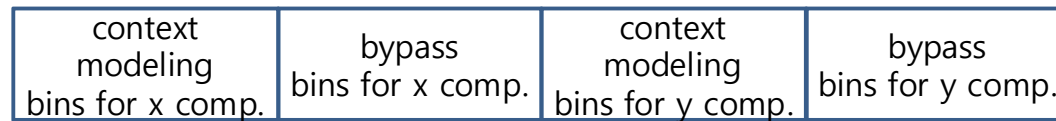
w is TU width, which is power of 2
 $0 \leq symbol < w$ is going to be coded

Binarization process for last position coding for high efficiency configuration

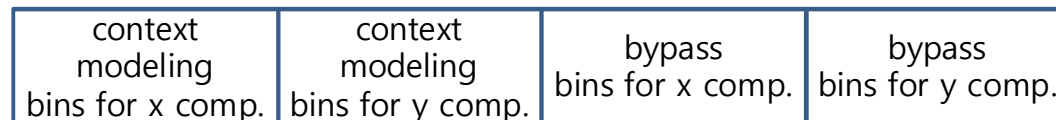
Grouping of bypass bins

❖ Proposed method

- **Bypass bins are group together** and encoded after all context modelled bins are encoded.
- By grouping bypass bins, **several bins are processed at a time** since probability is fixed for bypass bins. This leads **increase of throughput**.



(a) Last position coding in HM-4.0



(b) Proposed last position coding (grouping bypass bins)

Last position coding in HM-4.0 and proposed last position coding by bypass bin grouping

Test Results

- ❖ Test results under common test condition (JCTVC-F900)
 - Exactly same results with anchor

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	101%			101%		
	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class E						
Overall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	100%			99%		
	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	99%			100%		

Conclusions

- ❖ **Grouping of bypass bins** for last position coding of transform coefficients was proposed for CABAC entropy coding.
- ❖ By grouping bypass bins, **several bins are processed at a time** since probability is fixed for bypass bins. This leads **increase of throughput**.
- ❖ **Exactly same results** with HM-4.0 anchor are observed in the experiment.
- ❖ It is recommended to adopt this grouping method in the next version of WD and HM.
- ❖ **Same method is proposed in JCTVC-G201(MediaTek), JCTVC-G370(Sony)**