

# CE6: Combinations of MPM derivation and remaining mode coding

*Ehsan Maani, Ali Tabatabai*

Proposal  
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# Outline

- This proposal
  - Deals with efficient coding of Intra modes
  
- Similar to JCTVC-G243, four modifications are proposed
  - Binarization (LC and HE)
  - Adaptation in LC
  - Adaptation in HE
  - Multiple MPMs

# HM4.0 Intra Mode Coding

- HM3.0 remainder of Intra modes coding (not MPMs)
  - For PUs smaller than 64x64 and larger than 2x2:
    - HE: Fixed length code
    - LC: Huffman codes (VLC tables)
- In LC, instead of coding a mode, its rank is determined from a rank array and then coded
  - The rank of mode is coded using Huffman codes
  - Adaptation is provided by swapping of ranks

# Proposed Binarization(LC and HE)

- Proposed binarization for LC and HE:
  - Includes codewords for MPMs (no MPM vs. remaining modes branch at parsing)

4x4 PUs

Rank range	Prefix (Unary code)	Remainder (fixed length)
0-1	0	x (1 bit)
2-5	10	xx (2 bits)
6-9	110	xx (2 bits)
10-18	111	xxx (3 bits)

8x8, 16x16, 32x32 PUs

Rank range	Prefix (Unary code)	Remainder (fixed length)
0-1	0	x (1 bit)
2-5	10	xx (2 bits)
6-13	110	xxx (3 bits)
14-21	1110	xxx (3 bits)
22-35	1111	xxxx (4 bits)

- Simple decoding:
  - Simpler decoding compared to Huffman codes (they require additional memory or for-loops over modespace as in current HM). All remainder bits go through by-pass mode in CABAC.

unary prefix

Parse Truncated Unary  
(max 3 or 4 based on PU)

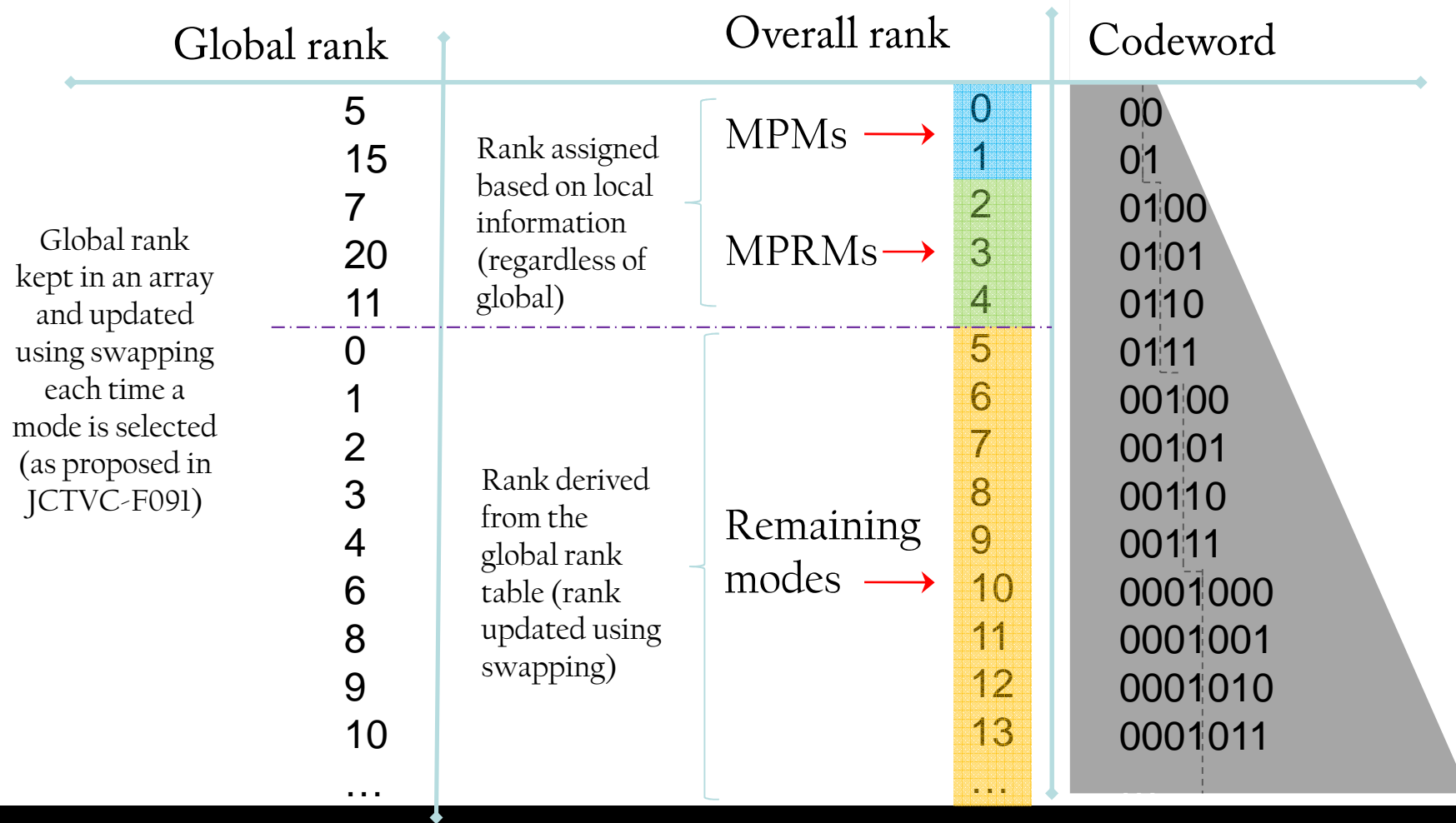
Remainder (fixed length part)

Parse Fixed Length  
1,2,3, or 4 bits based on *rank range*

# Mode coding using local and global info

- Global information
  - Utilizing the redundancies in the entire image/slice.
    - Patterns tend to repeat in an image or at least large areas of the image
    - Mode ranking with swapping is needed in this case
- Local information
  - Information (modes) based on immediate neighboring blocks
    - This includes the concept of MPMs and modes close to the MPMs
      - MPRMs, and differential coding based on MPMs
- Best solution uses both global and local information
  - Shortest codewords will be assigned to local predictors (regardless of global rank)
  - Other modes will be ranked based on global information (global rank table)

# Ranking and coding



# Mode Global Rank Initialization

- In both LC and HE 2 arrays hold the mode ranks
  - 1 array of size 17 for 4x4 PUs
  - 1 array of size 34 for 8x8/16x16/32x32 PUs
- Mode ranks are initialized to their mode number
  - Simple initialization rule, removes the need for explicit initialization tables

# Summary and Results

- Unified binarization in HE and LC
- Simple decoding (less memory/computation requirements compared to Huffman)
- No VLC tables in LC (memory saving > 200 bytes)
- Simple (based only on swapping) and unified adaptation in LC and HE
- No mode initialization tables in LC (memory saving > 200 bytes)
- No MPM vs. Remaining modes branching during parsing
  - Up to 5 modes based on local information (2 MPMs + up to 3 MPRMs)
- Coding gain:

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	-0.4%	-0.1%	-0.1%	-0.2%	-0.1%	-0.2%
Class B	-0.3%	-0.1%	0.0%	-0.3%	-0.2%	-0.2%
Class C	-0.4%	-0.1%	-0.2%	-0.3%	-0.3%	-0.3%
Class D	-0.3%	-0.1%	-0.2%	-0.2%	-0.1%	-0.2%
Class E	-0.5%	-0.1%	-0.1%	-0.4%	-0.3%	-0.2%
<b>Overall</b>	-0.4%	-0.1%	-0.1%	-0.3%	-0.2%	-0.2%
	-0.4%	-0.1%	-0.1%	-0.3%	-0.2%	-0.2%
Enc Time[%]	100%			101%		
Dec Time[%]	100%			101%		



# Supplementary results

Global ranking + only 2MPMs (no MPRMs)

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	-0.4%	-0.1%	-0.1%	-0.2%	-0.1%	-0.1%
Class B	-0.2%	0.0%	0.0%	-0.2%	-0.2%	-0.2%
Class C	-0.3%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
Class D	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Class E	-0.2%	-0.1%	0.0%	-0.1%	0.0%	0.0%
<b>Overall</b>	-0.3%	-0.1%	-0.1%	-0.2%	-0.1%	-0.1%
	-0.3%	-0.1%	-0.1%	-0.2%	-0.1%	-0.1%
Enc Time[%]	101%			102%		
Dec Time[%]	100%			98%		

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