

# *In-loop Deblocking Filtering for Intra Blocks*

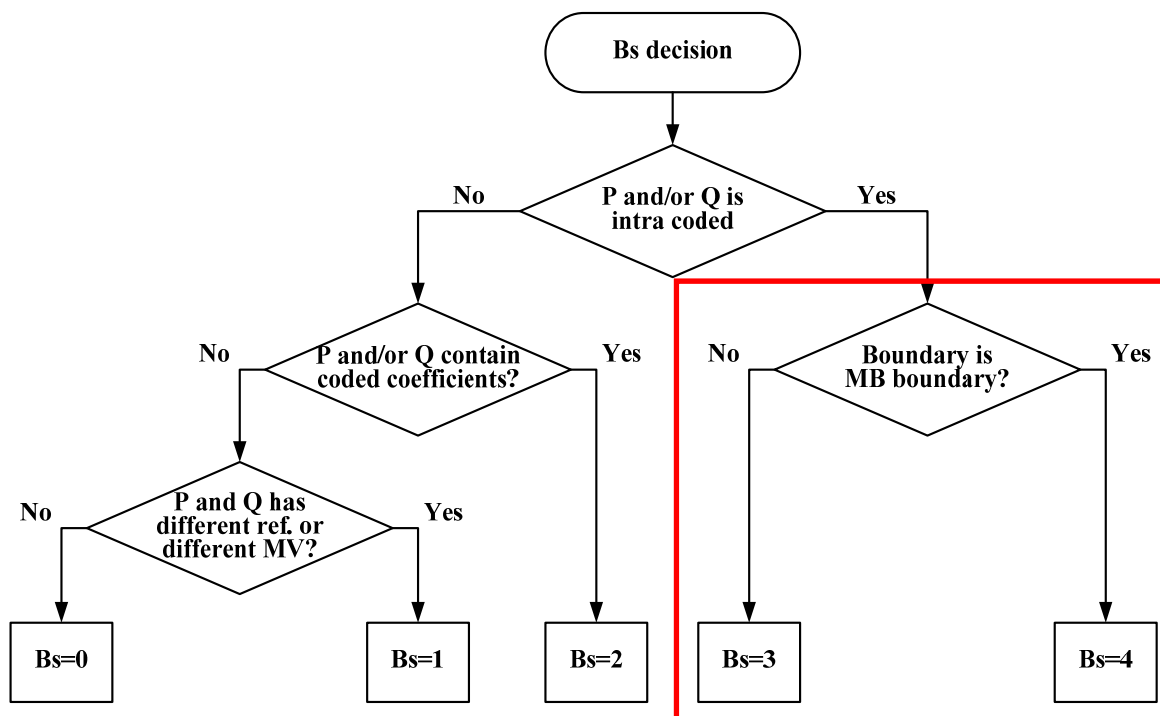
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# Introduction (1)

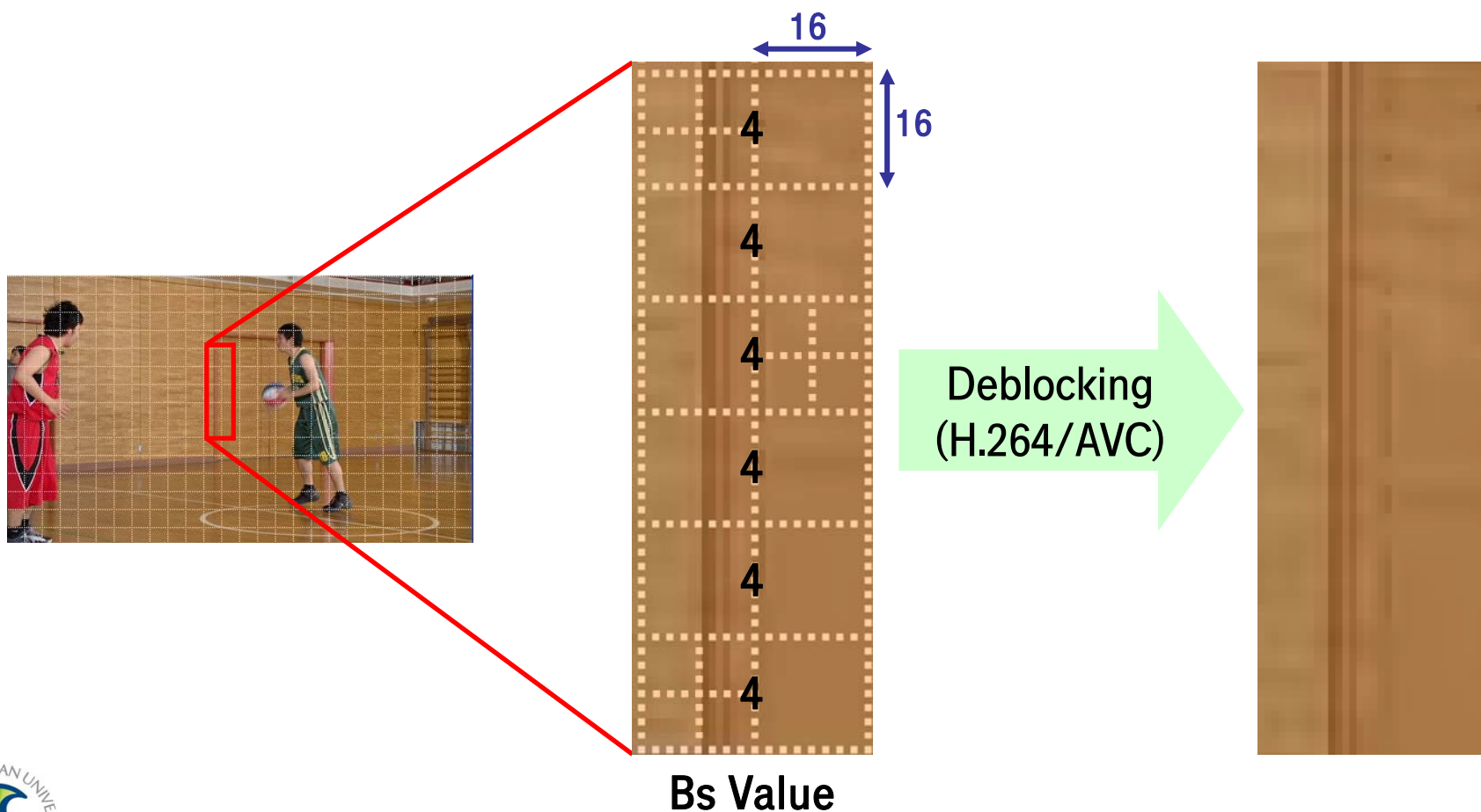
- Deblocking filter of H.264/AVC for intra block
  - Strong filter ( $Bs = 3, 4$ )
  - Without considering intra coding conditions such as intra prediction mode
  - May cause unintended distortion



*Bs decision  
for intra block*

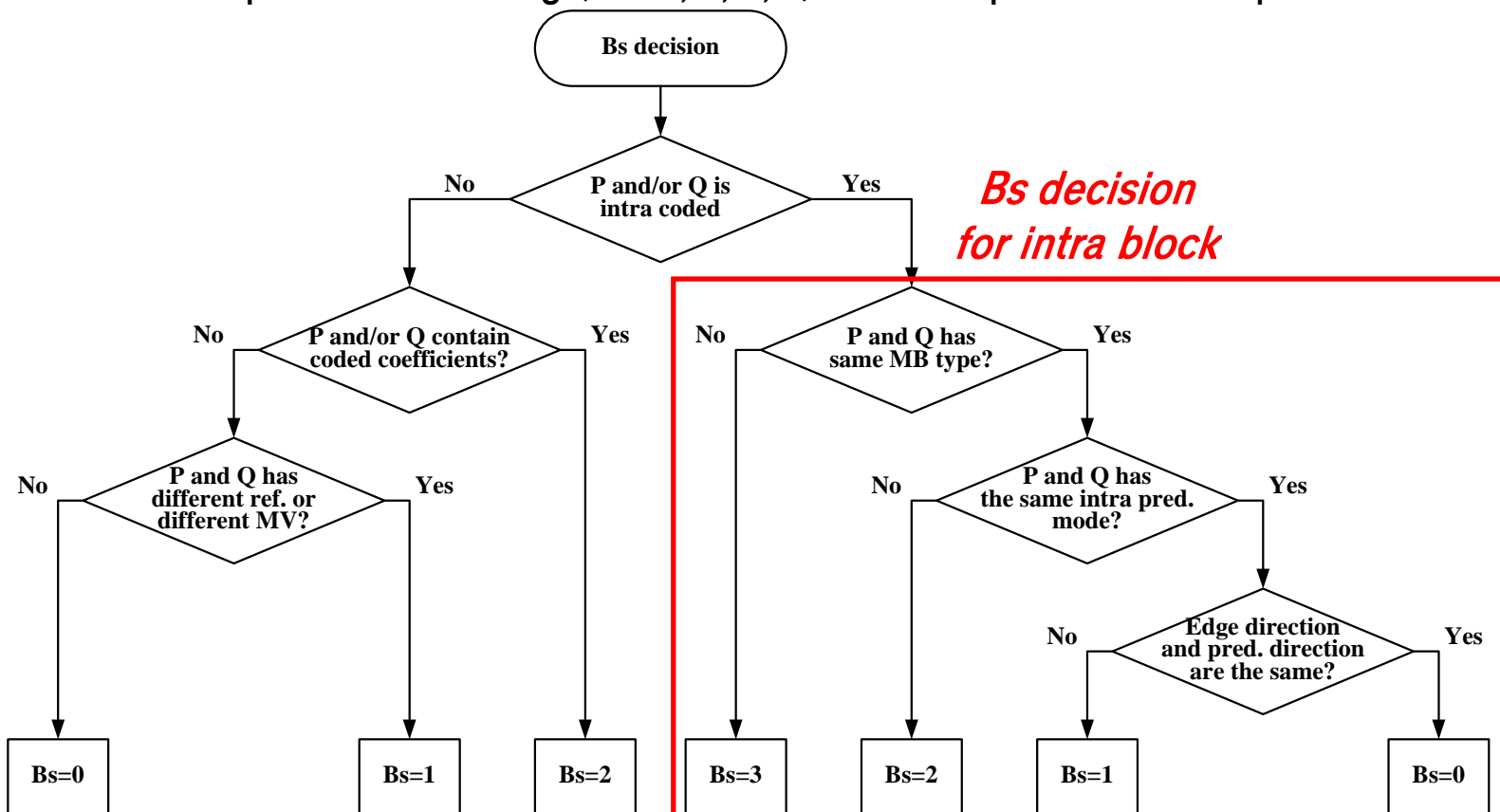
# Introduction (2)

- Example of deblocking filter of H.264/AVC for intra block
  - 39<sup>th</sup> frame of BasketballPass\_416x240 (intra coded with QP30)



# Proposed Method (1)

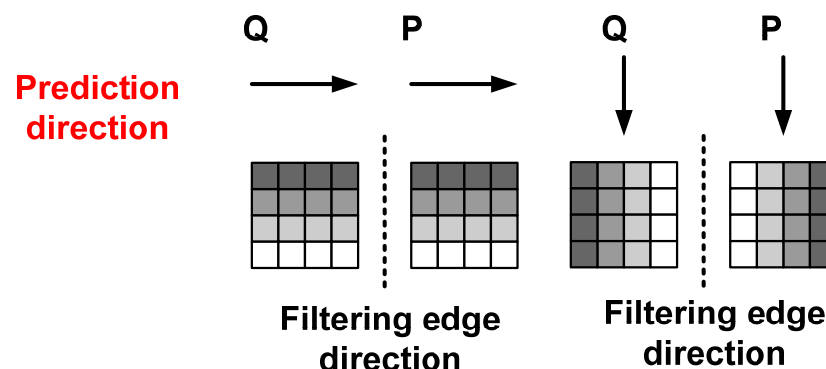
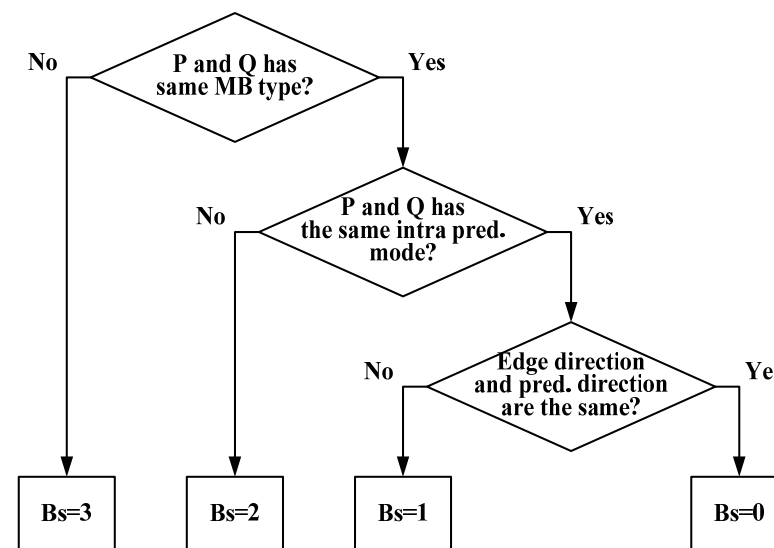
- Deblocking filter of the proposed method for intra block
  - Consider intra coding conditions in deblocking filtering for intra-coded blocks
  - Can adopt various filtering ( $Bs=0, 1, 2, 3$ ) which depends on intra prediction mode



# Proposed Method (2)

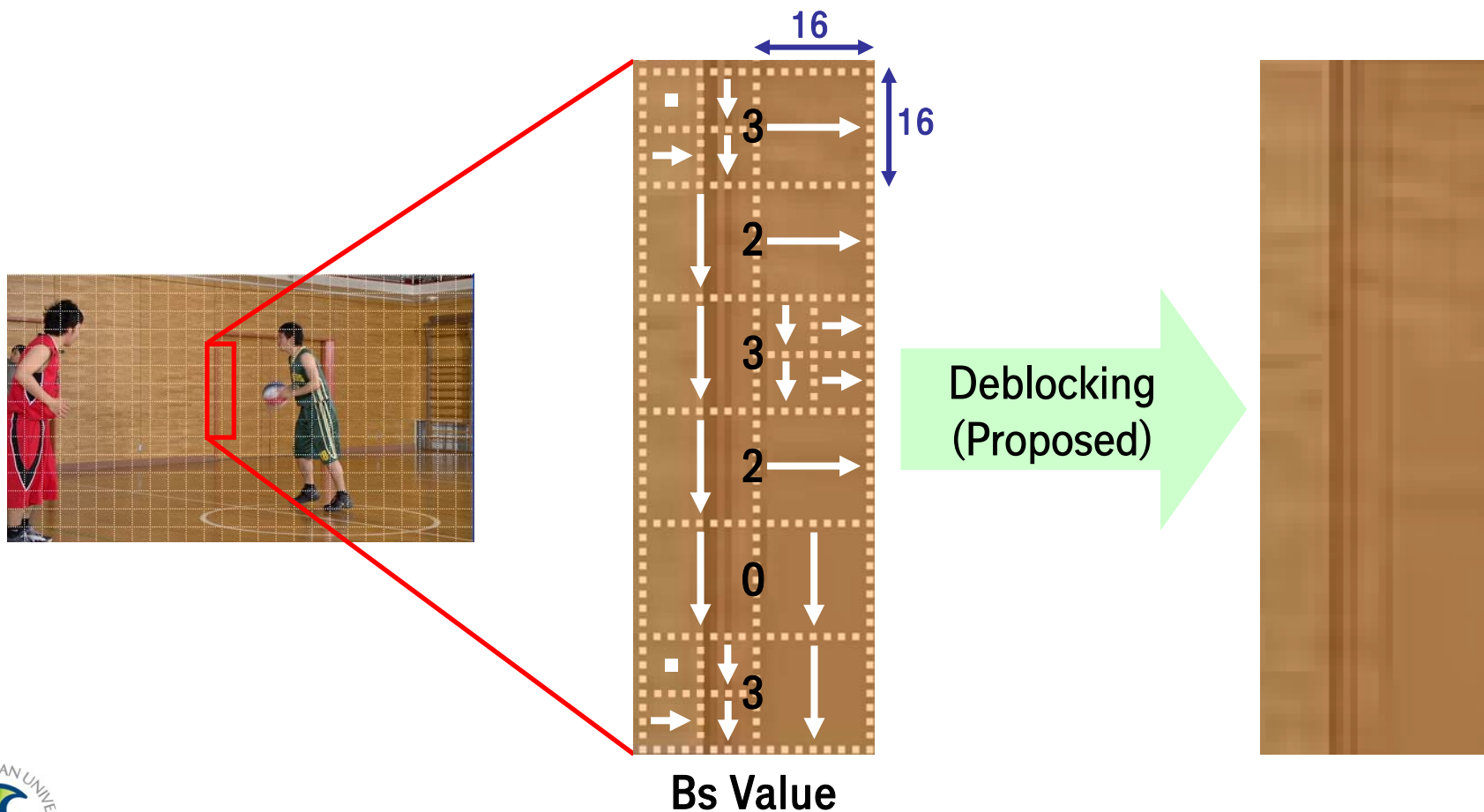
## Detailed Bs decision process

Conditions	Bs
P & Q have different MB type	3
P & Q have the same MB type, but they have different “intra pred. mode”	2
P & Q have “the same MB type and intra pred. mode”, but different “filtering edge direction” from “intra pred. direction”	1
Otherwise	0



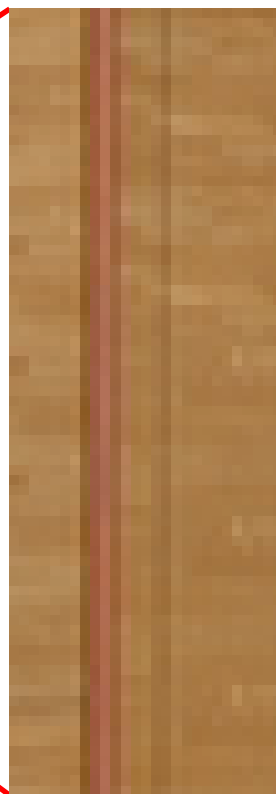
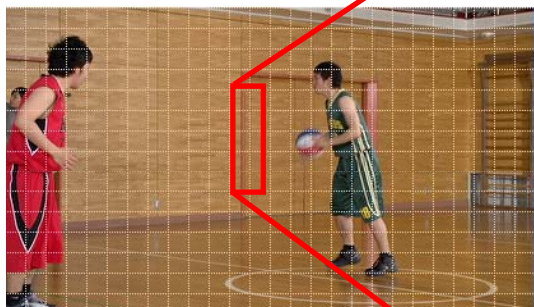
# Illustration (1)

- Example of deblocking filter of the proposed method for intra block
  - 39<sup>th</sup> frame of BasketballPass\_416x240 (intra coded with QP30)



## Illustration (2)

- Comparison of subjective quality
  - 39<sup>th</sup> frame of BasketballPass\_416x240 (intra coded with QP30)



Original



Anchor



Proposed

# Simulation Conditions

- Recommended test conditions of in-loop filtering AHG

Class B	Class C	Class D	Class E
Kimono ParkScene Cactus BasketballDrive BQTerrace	BasketballDrill BQMall PartyScene RaceHorses	BasketballPass BQSquare BlowingBubbles RaceHorses	Vidyo1 Vidyo3 Vidyo4
QPI = 26, 30, 34, 40 / QPP = QPI + 1 / QPB = QPI + 3			
CS1: Hierarchical B with GOP = 8 CS2: IPPP coding Intra-only: Intra-only coding			
MVComp. = 1, UseIntraMDDT = 1, UseHPFilter = 1, UseALF = 1, UseExtMB = 1, IBDI = 1			
Comparison	Anchor : KTA 2.6r1 S/W Proposed : Proposed method		



# Simulation Results (1)

Resolution	Sequence	CS1		CS2		Intra only	
		BDPSNR [dB]	BDBR (%)	BDPSNR [dB]	BDBR (%)	BDPSNR [dB]	BDBR (%)
Class B (1280)	ParkScene	0.055	-1.644	0.036	-1.161	0.106	-2.467
	Kimono	0.034	-0.976	0.015	-0.410	0.054	-1.345
	Cactus	0.026	-0.867	0.017	-0.578	0.059	-1.471
	BasketballDrive	0.048	-1.558	0.033	-1.174	0.105	-3.483
	BQSquare	0.027	-1.484	0.018	-0.945	0.113	-2.275
Avg. of Class B		0.038	-1.306	0.024	-0.854	0.087	-2.208
Class C (WVGA)	BasketballDrill	0.052	-1.281	0.026	-0.705	0.071	-1.575
	BQMall	0.028	-0.631	0.015	-0.349	0.087	-1.500
	PartyScene	0.031	-0.720	0.006	-0.103	0.075	-1.101
	RaceHorses	0.019	-0.469	0.013	-0.324	0.057	-0.921
Avg. of Class C		0.033	-0.775	0.015	-0.370	0.073	-1.274

# Simulation Results (2)

Resolution	Sequence	CS1		CS2		Intra only	
		BDPSNR [dB]	BDBR (%)	BDPSNR [dB]	BDBR (%)	BDPSNR [dB]	BDBR (%)
Class D (QWVGA)	BasketballPass	0.069	-1.507	0.057	-1.254	0.134	-2.496
	BQSquare	0.028	-0.630	0.005	-0.121	0.089	-1.074
	BlowingBubbles	0.021	-0.558	0.013	-0.355	0.077	-1.438
	RaceHorses	0.019	-0.417	0.017	-0.327	0.079	-1.293
Avg. of Class D		0.034	-0.778	0.023	-0.514	0.094	-1.575
Class E (720)	Vidyo1	N/A		0.051	-0.107	0.053	-0.937
	Vidyo3			0.014	-0.387	0.096	-1.558
	Vidyo4			0.013	-0.359	0.075	-1.523
	Avg. of Class E			0.026	-0.284	0.075	-1.339

# Simulation Results (3)

Results Summary	CS1		CS2		Intra only	
	BDPSNR [dB]	BDBR (%)	BDPSNR [dB]	BDBR (%)	BDPSNR [dB]	BDBR (%)
Avg. of Class B	0.038	-1.306	0.024	-0.854	0.087	-2.208
Avg. of Class C	0.033	-0.775	0.015	-0.370	0.073	-1.274
Avg. of Class D	0.034	-0.778	0.023	-0.514	0.094	-1.575
Avg. of Class E	N/A		0.026	-0.284	0.075	-1.339
Avg. of Overall	0.035	-0.953	0.022	-0.506	0.082	-1.599

# Visual Quality Comparison (1)



39th frame of BasketballPass\_416x240 (intra coded with QP30)

Anchor

Proposed

# Visual Quality Comparison (2)



14th frame of BQMall\_832x480 (intra coded with QP30)

Anchor

Proposed

# *Visual Quality Comparison (3)*

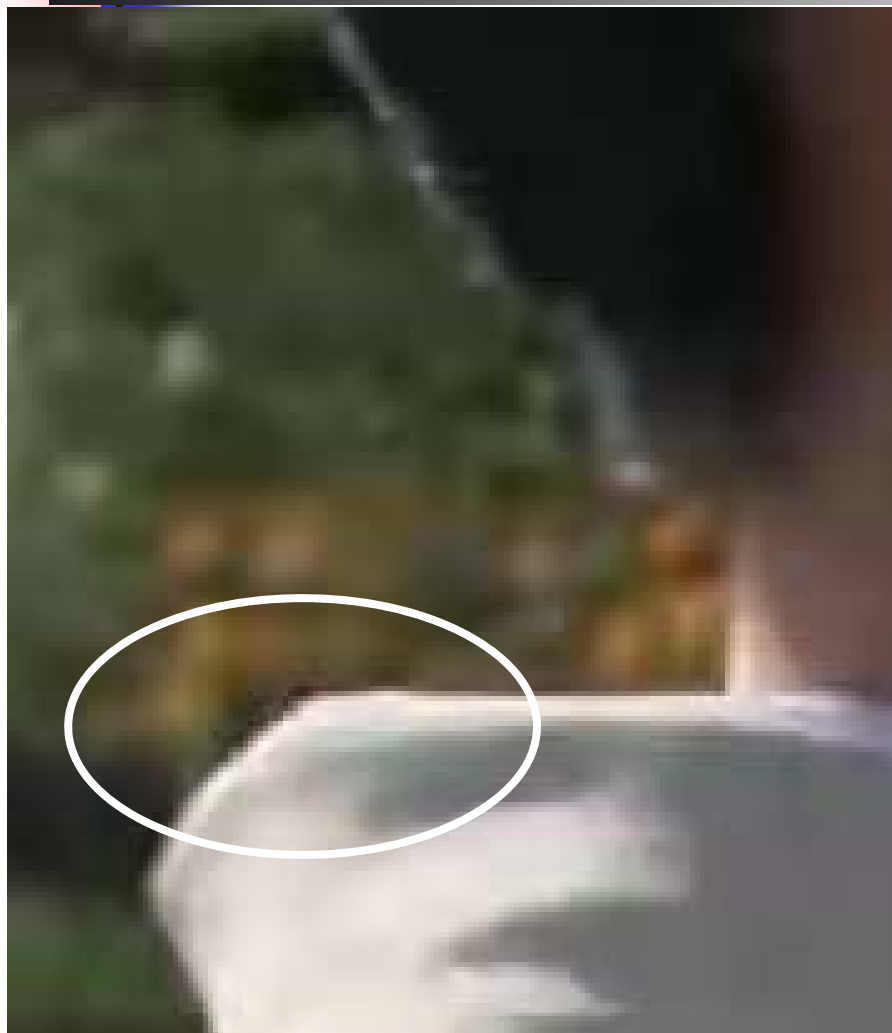


211st frame of ParkScene\_1920x1080 (intra coded with QP38)

Anchor

Proposed

# Visual Quality Comparison (4)



116th frame of Kimono\_1920x1080 (intra coded with QP38)

Anchor

Proposed



# Conclusion Remarks

- In this proposal, we have presented *a computationally very simple deblocking filter designed with special attention to intra blocks.*
- The presented method employs exactly the same filtering scheme as that in the H.264/AVC except Bs decision for intra blocks.
- *Even the small change of assigning different Bs values for intra-coded blocks have generated positive coding gain.*
- Recommended that the group should investigate more on this deblocking filter design for intra-coded blocks with utilizing various coding information