

Simulation Results of Adaptive Quantization Matrix Selection on KTA software

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Purpose

● Contribution of coding efficiency

➤ A simplified Adaptive Quantization Matrix Selection (AQMS) for D.266
(proposed at previous VCEG Geneva meeting)

➤ Simulation Results under KTA software based on VCEG-AA10 condition with the adaptive rounding offset

Summary

Proposal

Reducing the quantization matrix index from 4 (2 bits) to 2 (1 bit) for all macroblocks.

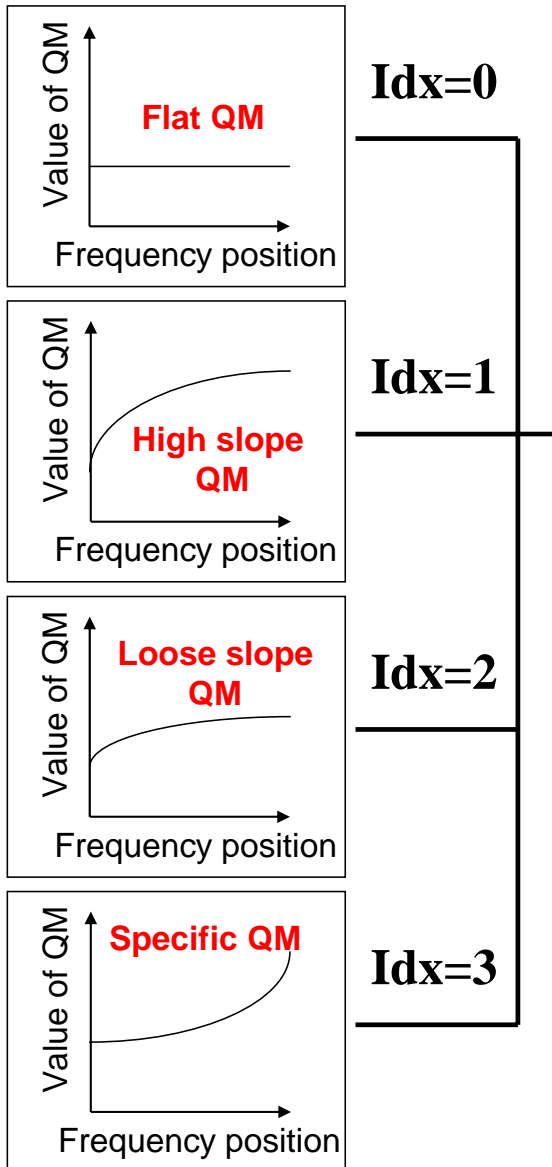
Results

Up to 7.28% bit reduction was achieved.

Background

- Adaptive Quantization Matrix Selection (AQMS)
- *Selecting optimal quantization matrix from 4 matrices at each macroblock using Rate-Distortion Optimization*

Previous AQMS (D.266)



Select the best quantization matrix index by using RDO method and add the best "idx" in the stream per macroblock.

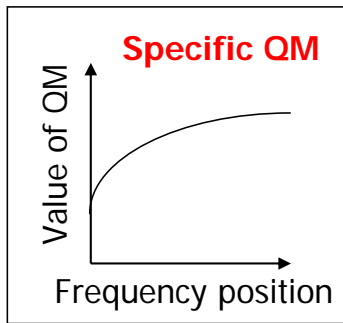
$$J = SSD + \lambda_{MODE} \times R$$

R: Generating bits

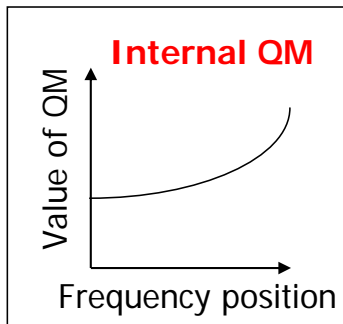
SSD: Sum of square difference of decoded image

J: RDO cost (Lagrange cost)

Simplified AQMS



Idx=0



Idx=1

Select the best quantization matrix index by using RDO method and add the best "idx" in the stream per macroblock.

$$J = SSD + \lambda_{MODE} \times R$$

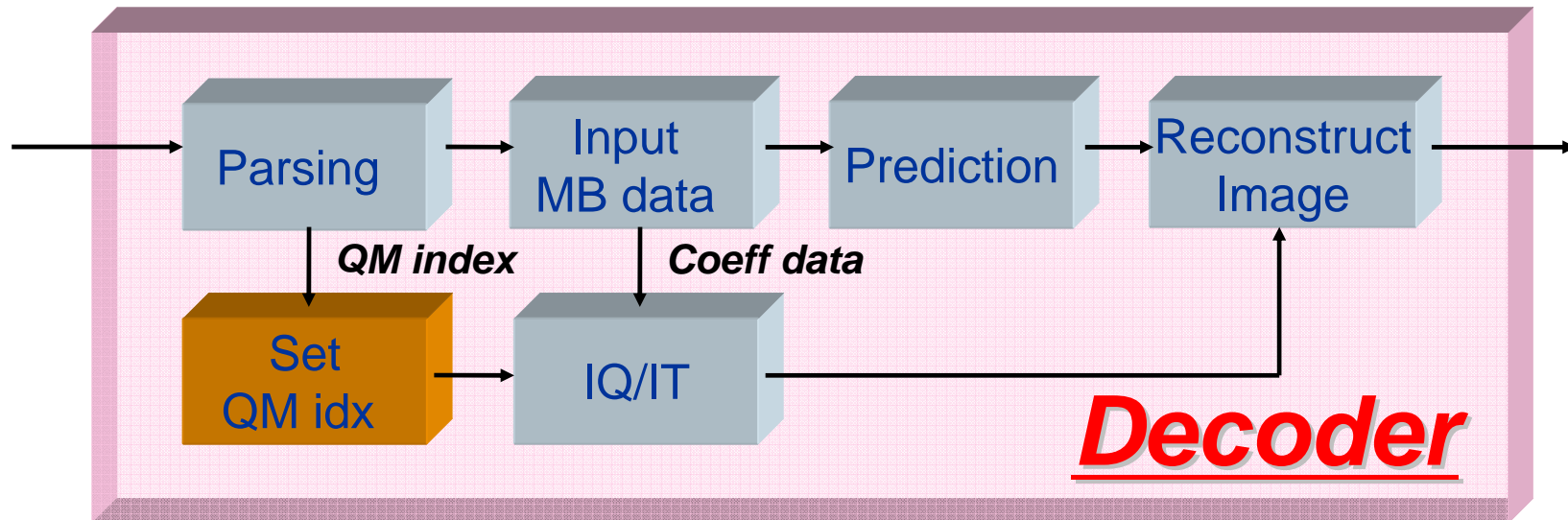
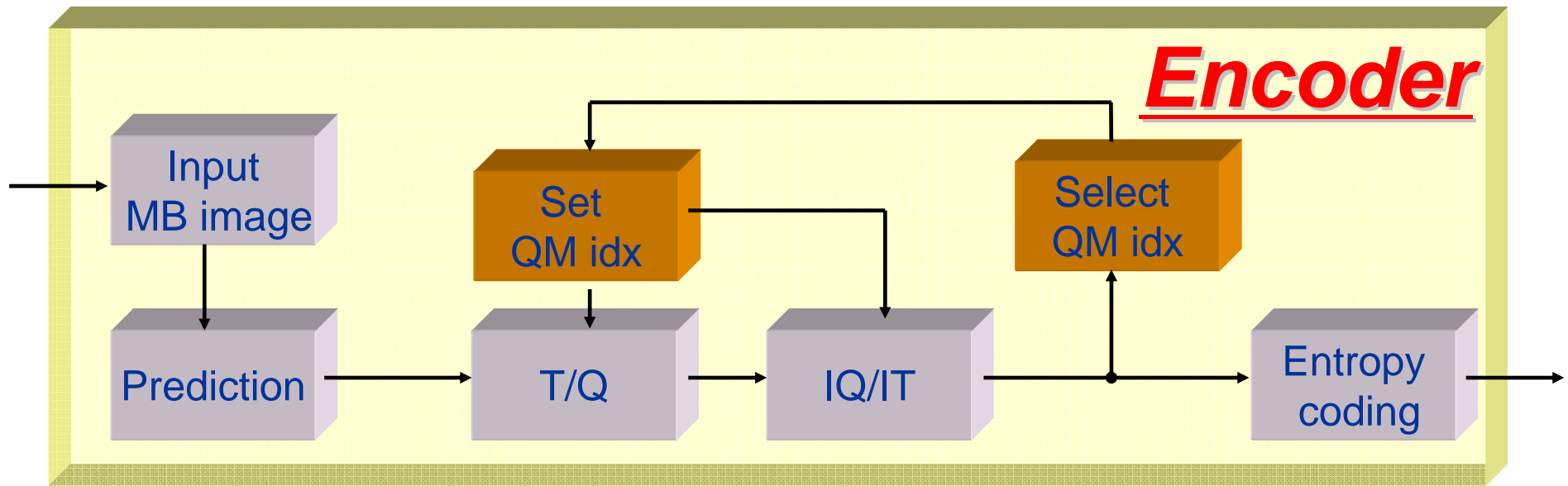
R: Generating bits

SSD: Sum of square difference of decoded image

J: RDO cost (Lagrange cost)

The number of matrices is reduced from 4 (2 bits) to 2 (1 bit) for all slice types

Encoder and Decoder diagram



Experiment conditions

Common test parameters(based on VCEG-AA10*)

Encoder	KTA software encoder (JM ver10.1)
MV search range	± 32 pels for CIF/QCIF (Full Search) ± 64 pels for 720p60 (Fast ME)
Iterated BiPred ME	Used (Search range $\pm 32/ \pm 64$ pels)
Entropy coding mode	CABAC
Number of Reference frames	4
Picture type	I-B-B-P- (M=3)
QP	QPI = (22,27,32,37) Fixed QPP=QPI+1, QPB=QPP+1
Adaptive Rounding Offset	Used (for Luma and Chroma)
Weighted Prediction	Used (MultiplePPS enable)
Thresholding of Coefficient	Used
Rate-Distortion Optimization	Used (BSkipRDO enable)
Quantization Scaling List	Not used(Objective), Used(Subjective)

Experimental results

BD-SNR/BR for all CIF/QCIF sequences

<u>Test Sequence</u>	Size	Frame Rate	Coding Frame	Δ Bitrate(%)	Δ PSNR(dB)
container_qcif	176x144	15	148	4.05	0.19
foreman_qcif	176x144	15	148	4.05	0.20
silent_qcif	176x144	15	148	7.28	0.37
paris_cif	352x288	15	148	4.41	0.24
foreman_cif	352x288	30	298	3.13	0.14
mobile_cif	352x288	30	298	3.21	0.19
tempete_cif	352x288	30	258	2.97	0.15
Total average				4.16	0.21

✓ **Total Average of 4.16% bit reduction at same PSNR**

Experimental results

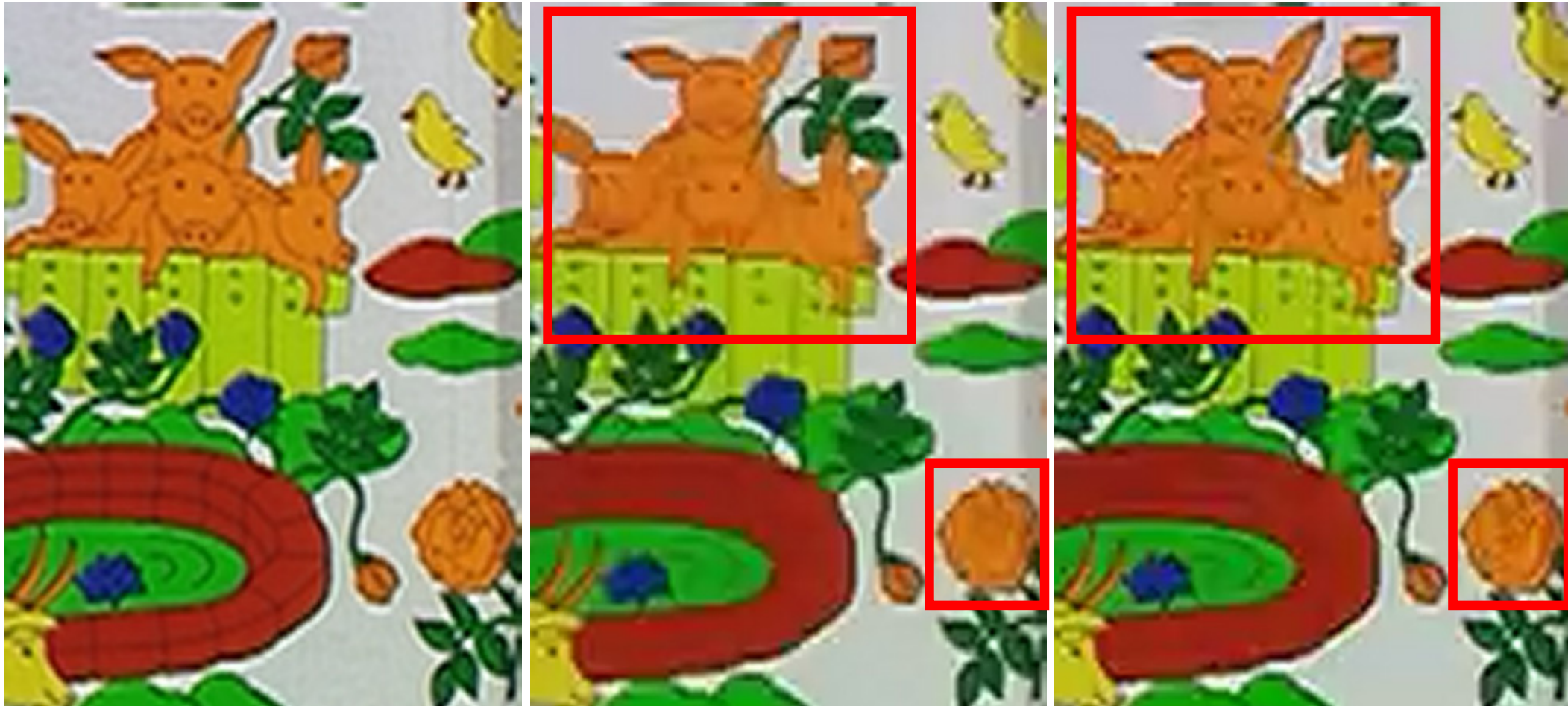
BD-SNR/BR for all 720p60 sequences

<u>Test Sequence</u>	Size	Frame Rate	Coding Frame	Δ Bitrate(%)	Δ PSNR(dB)
BigShips	1280x720	60	73	2.21	0.08
City	1280x720	60	73	1.69	0.07
Crew	1280x720	60	73	3.37	0.10
Night	1280x720	60	73	2.42	0.10
ShuttleStart	1280x720	60	73	2.36	0.08
Total average				2.41	0.09

✓ **Total Average of 2.41% bit reduction at same PSNR**

Subjective Quality (1/3)

VCEG image (mobile&calender CIF)



Original

Anchor

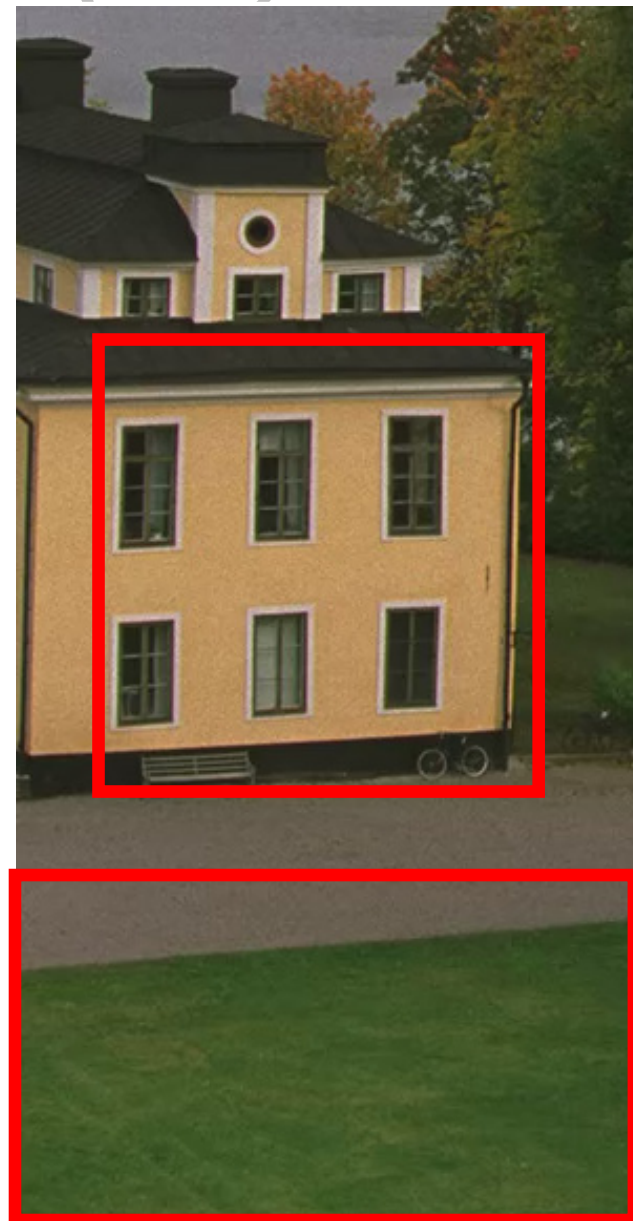
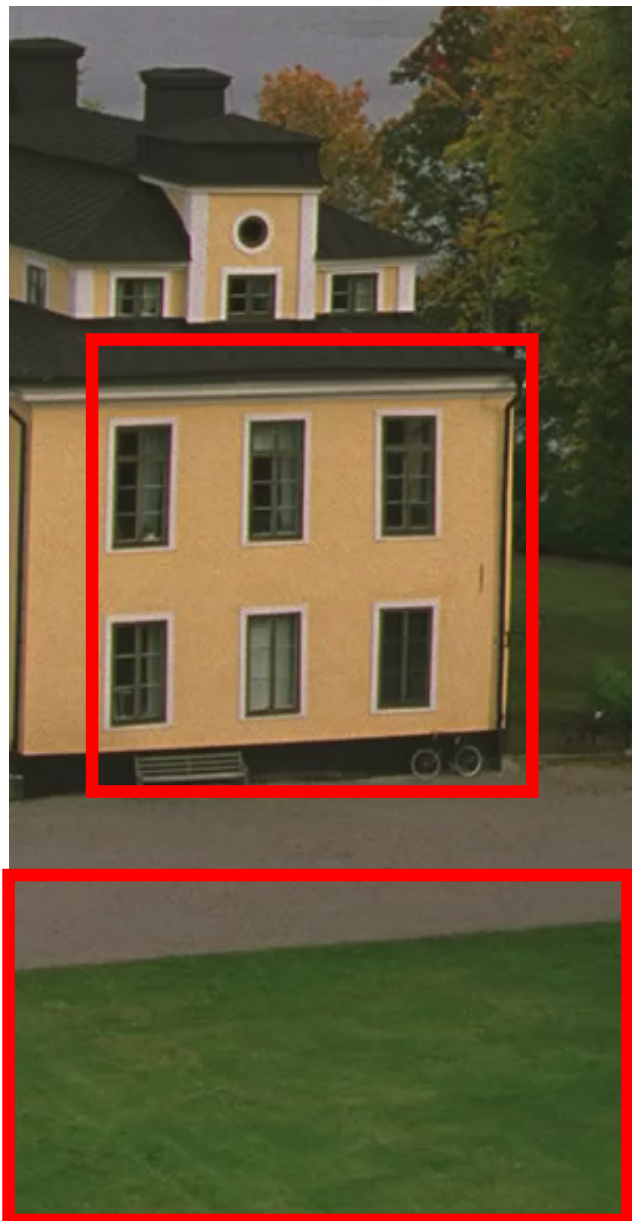
Proposal

Subjective Quality (2/3)



SVT image (InToTree1080p50 [4:2:0])

Subjective Quality (3/3)



Original

on Results of Adap

Anchor

Selection on KTA software

Proposal

Conclusion

Proposal

Simplified Adaptive Quantization Matrix Selection macroblock by macroblock.

Results

- ✓ *AQMS is integrated to KTA software and is tested on VCEG coding condition completely.*
- ✓ *Up to 7.28% bit reduction is achieved.*
- ✓ *Subjective quality is also improved.*