A TABLE-BASED DELTA QP CODING METHOD

JCTVC-F492

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BACKGROUND - ADAPTIVE QP

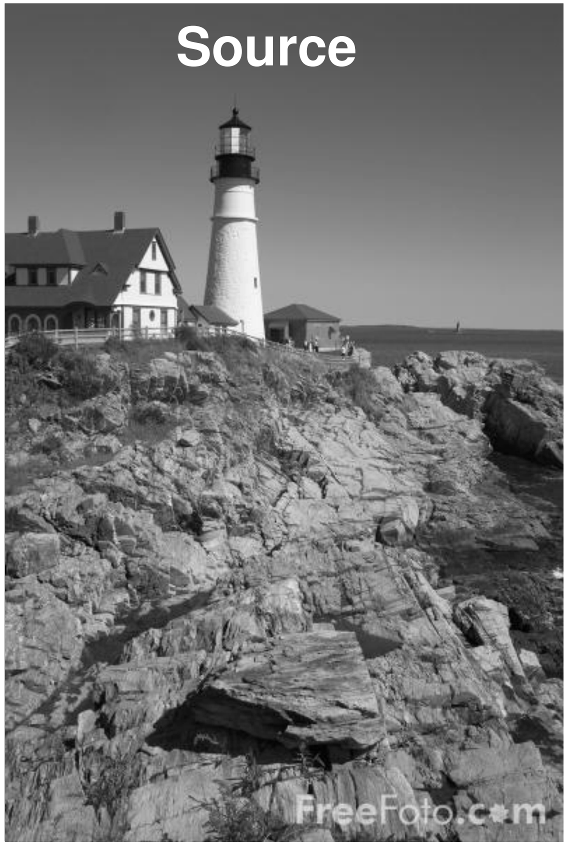
- Use lower QP on areas visually sensitive to encoding artifacts
- Use higher QP on less sensitive areas

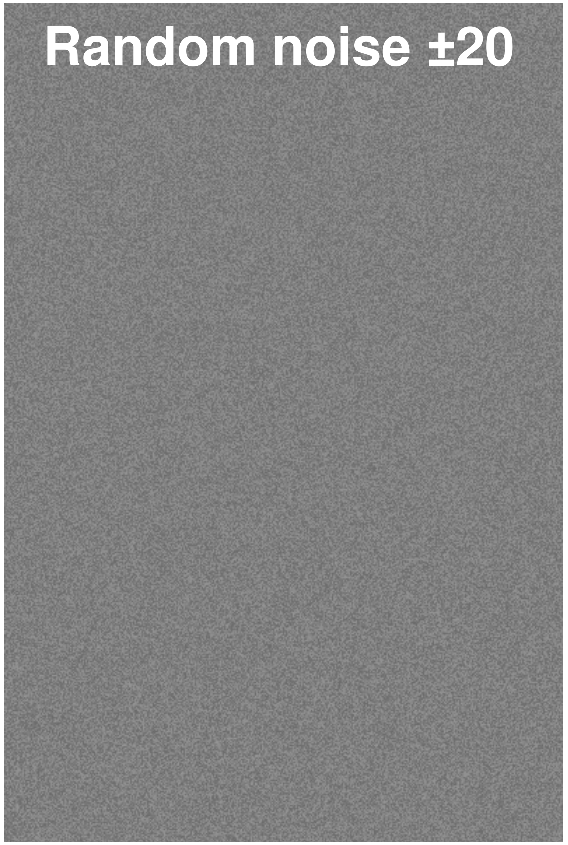
- Widely used in encoders
- Common to classify smooth/textured blocks into QP categories

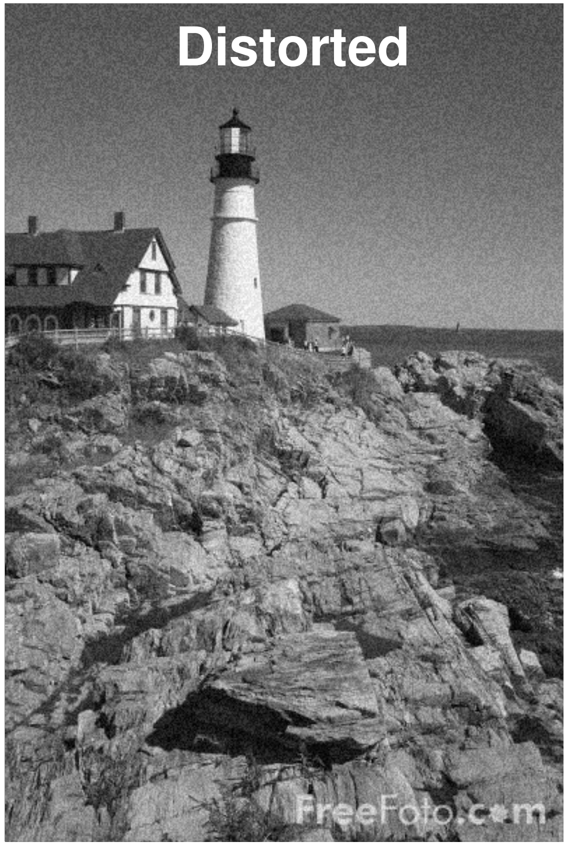
- Typically smooth areas are easier to compress than textured areas
  - Example: A picture consist of 50% smooth and 50% textured blocks
  - A QP delta of -5 on a smooth area could possibly be compensated by a +1 on textured areas

- RDO can result in the opposite effect, e.g. skip mode
  - The distortion for the SKIP mode has to be significant to choose any other mode

SUBJECTIVE DISTORTION PERCEPTION

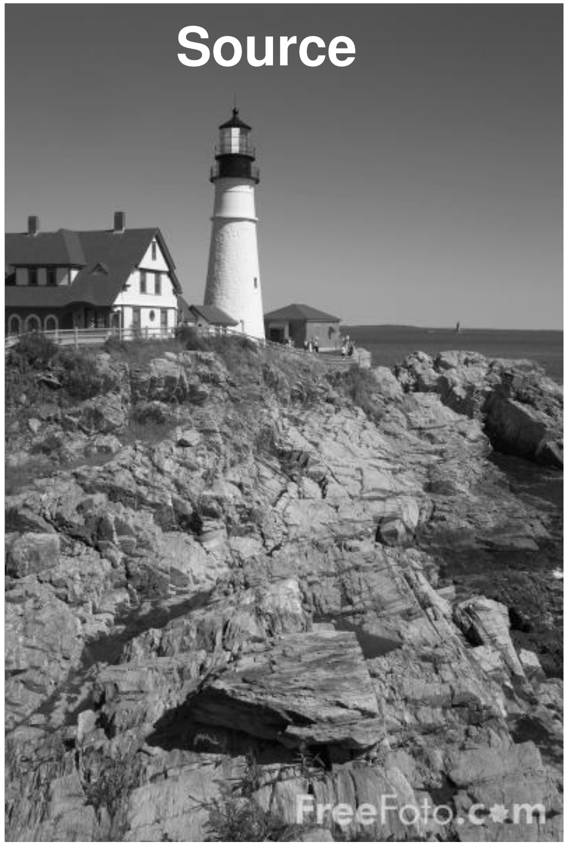


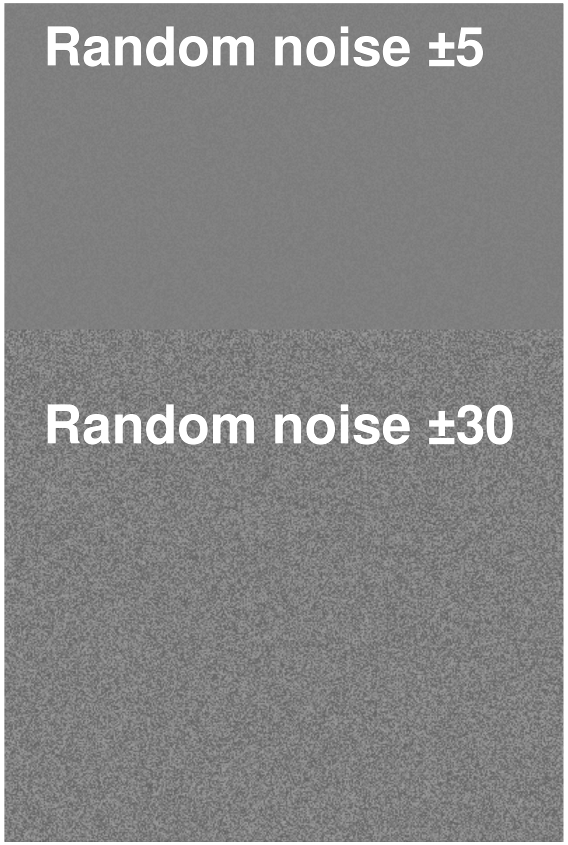


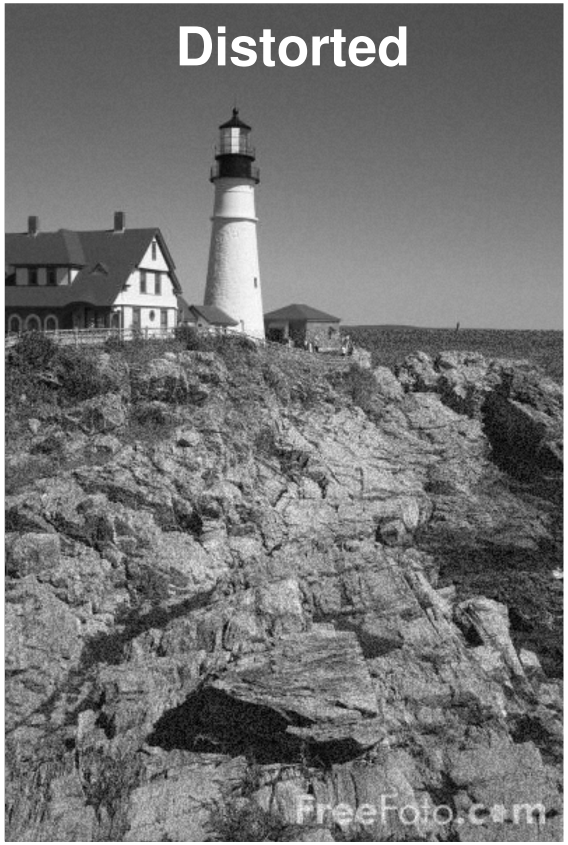


MSE = 140
Average error = 10.25

SUBJECTIVE DISTORTION PERCEPTION

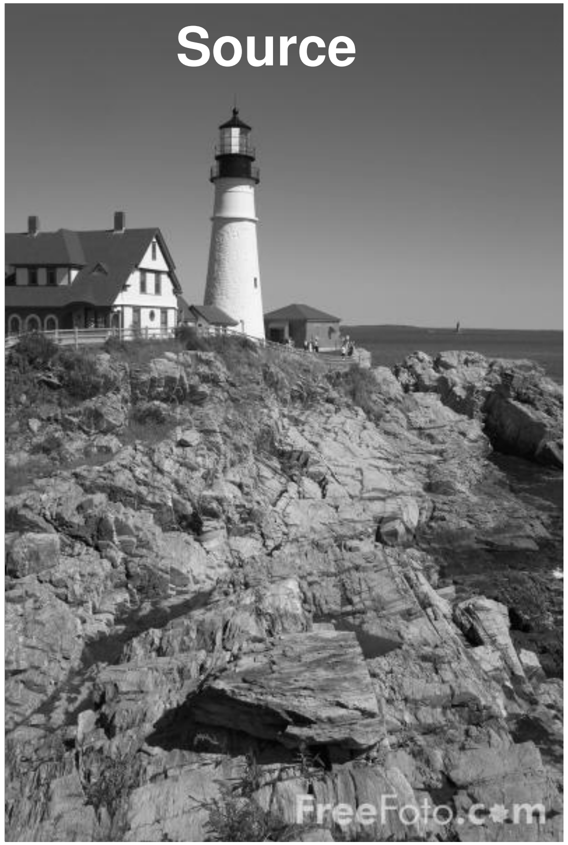


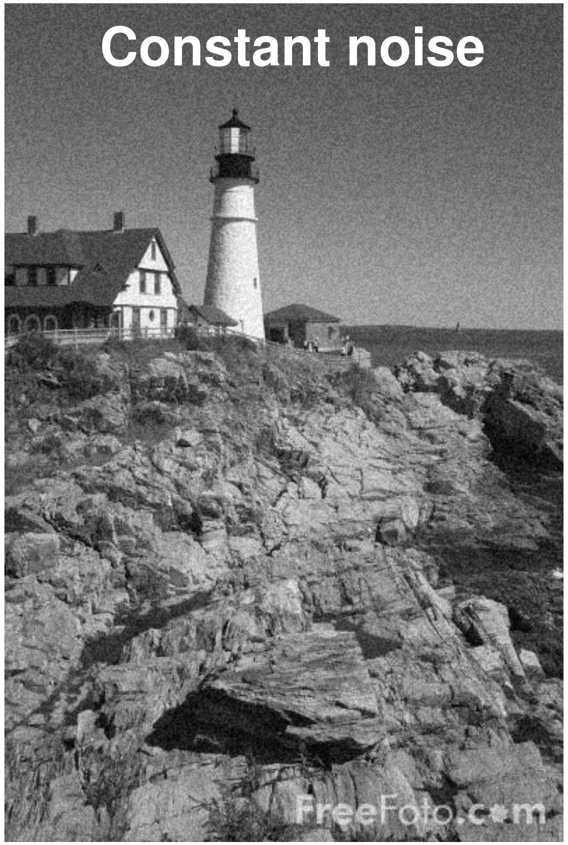


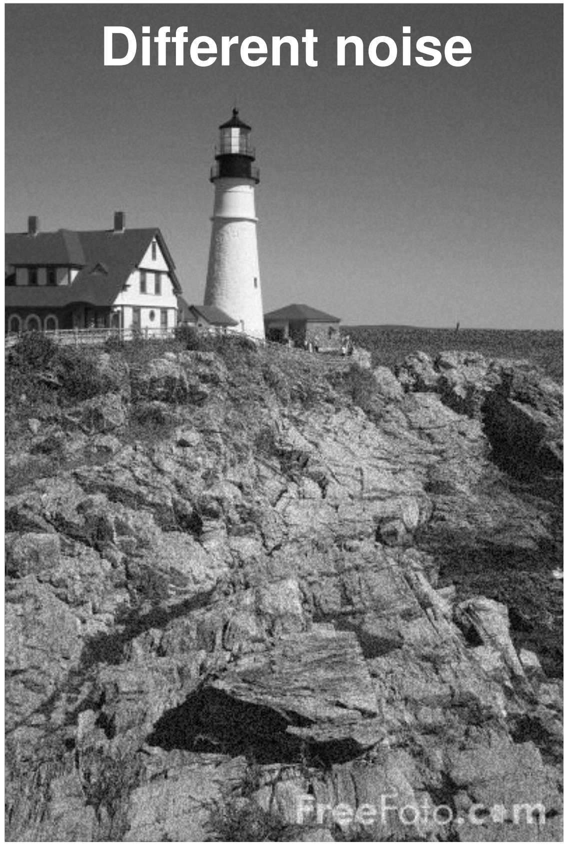


MSE = 193
Average error = 10.39

SUBJECTIVE DISTORTION PERCEPTION







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EXPERIMENT 1 – AVC BITSTREAMS

- We captured six AVC bitstreams
  - Captured from different live TV channels

Bitstream	dQP bit cost (%)	A=Average QP span per slice	B=Average number of different QP values used per slice	A / B (QP distribution indicator)
1	2.56%	6.67	3.0	2.22
2	2.48%	10.22	11.1	0.92
3	4.19%	11.88	12.9	0.92
4	3.93%	12.56	13.1	0.96
5	2.48%	5.56	3.0	1.85
6	2.27%	7.20	3.8	1.89

- Average dQP bit cost 2.99%: not negligible
- Some AVC encoders using Adaptive QP have sparse QP distribution
- Current dQP coding may not model sparse QP distribution very well

EXPERIMENT 2 – QP CODING ALGORITHM

- Introduce a QP-table containing all possible QP values
  - Present in both encoder and decoder
- Encoder
  - Instead of sending a delta QP we send a QP-table index
  - The QP table is updated for each QP
- Decoder
  - The QP table indices are decoded to get the QP values.
  - QP table is updated using same method as encoder.
- A PPS flag could possibly be used to switch between the proposed and current dQP signaling schemes.

QP TABLE INITIALIZATION

- Initialization of the QP table
  - Carried out at the beginning of each slice
  - Put the Slice QP first in the table
  - QP values are then added to the table with the QP value closest to the SliceQP first, then the second closest QP and so on.

- Example for Slice QP 25

Index	QP
0	25
1	26
2	24
3	27
4	23
...	...

QP CODING AND TABLE UPDATE

- Example sending QP=23

Index	QP
0	25
1	24
2	26
3	23
4	27
…	…

Index (sent to the decoder)

Current QP

Before update

Index	QP
0	23
1	25
2	24
3	26
4	27
…	…

After update

  – Same binarization, contexts and coding as delta QP for the index

Index	0	1	2	3	4	...
dQP	0	+1	-1	+2	-2	...

RESULTS

- 6 AVC bitstreams were used
- The delta QP parts of the bitstreams were transcoded using proposed algorithm.

Captured bitstream	dQP bit cost (%), AVC dQP method	dQP bit cost (%), proposed dQP method	Bitrate reductions
1	2.56%	1.34%	-1.22%
2	2.48%	2.53%	0.05%
3	4.19%	4.35%	0.16%
4	3.93%	3.82%	-0.11%
5	2.48%	1.39%	-1.09%
6	2.27%	1.47%	-0.80%

SUMMARY

- There may be some dQP coding gains for sparse adaptive QP algorithms
  - Possibly around 1%
- The adaptive QP algorithm used in CE4 is not sparse
  - We do not anticipate any gains for the CE4 adaptive QP algorithm
- We propose to study this further, possibly in a CE
  - Study how common sparse adaptive QP algorithms are
  - Study how the proposed Table algorithm performs in HEVC

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