DPCM

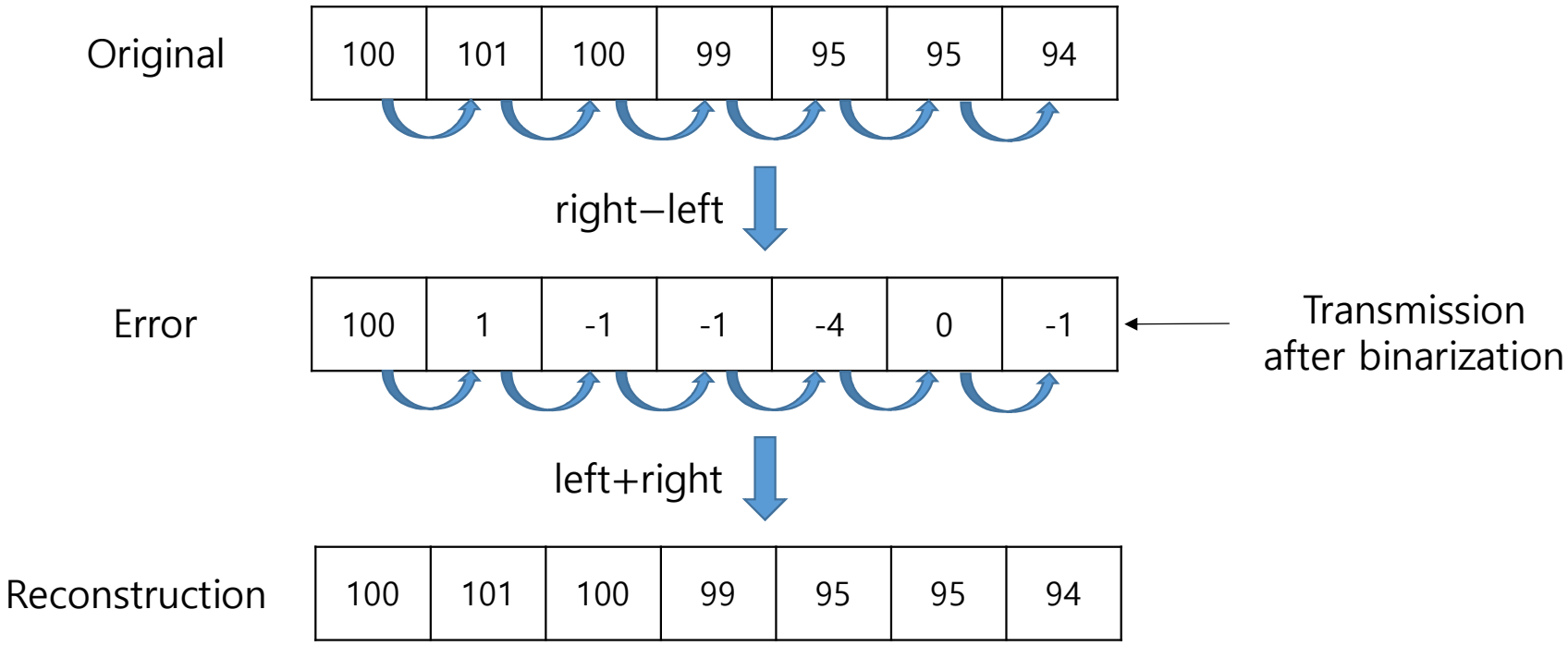
이진영

DPCM

- Differential pulse code modulation (DPCM) for reduction of data size
- Basically, signaling of difference between two consecutive samples
- Adaptive prediction from previously encoded or decoded samples
- Prediction error between original and predicted samples, and then signaling of the error

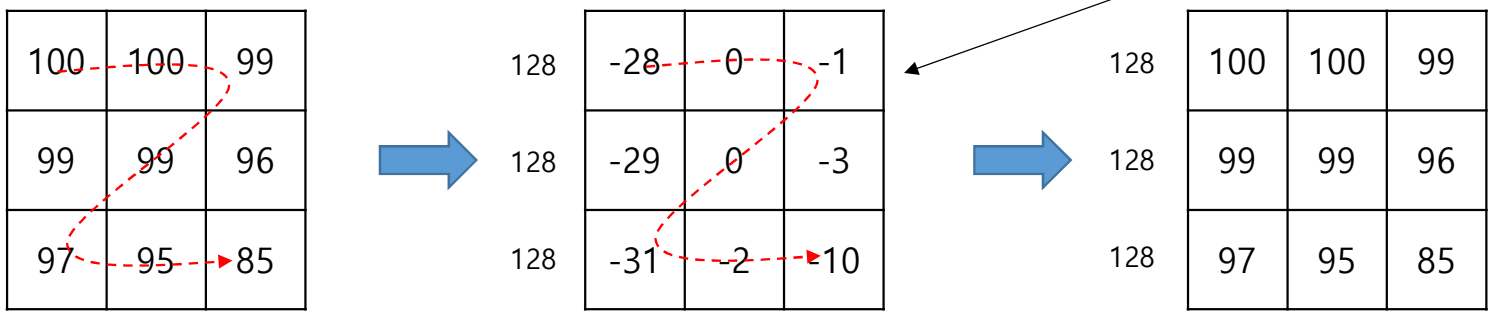
Principle

- Signaling of difference between two consecutive pixels



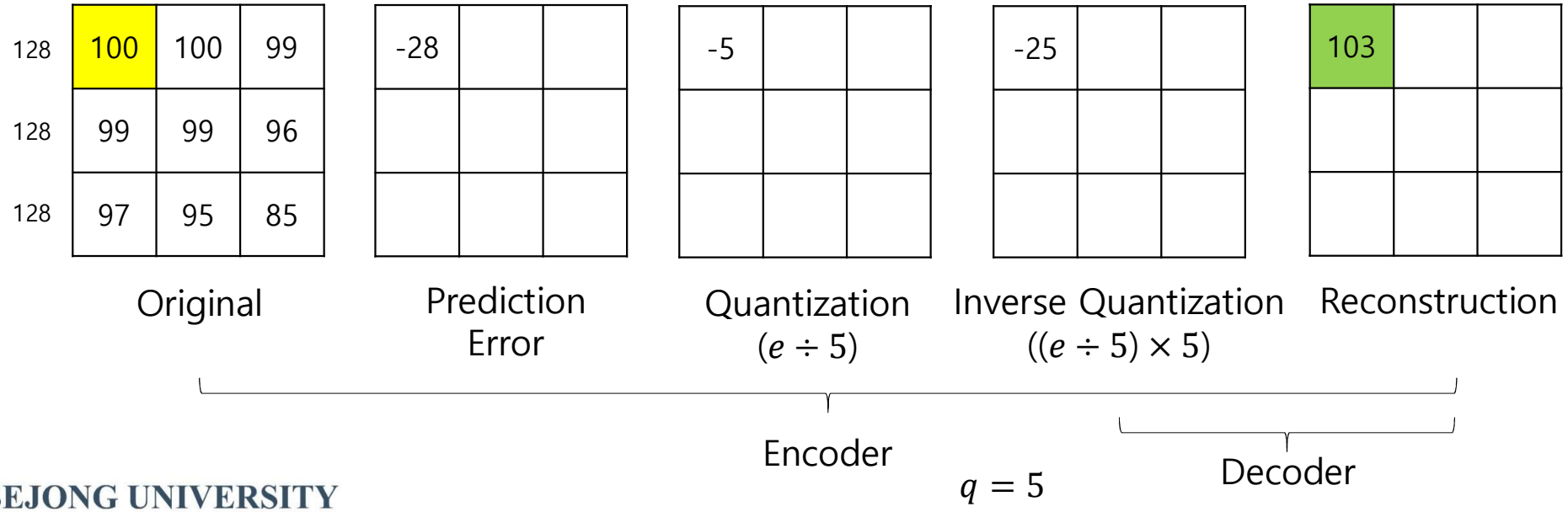
DPCM in Image

- In general, scanning from top-left to bottom-right
- Prediction with a predefined value for the first pixel of each row, or no prediction
- Signaling of prediction error (e) between original (o) and predicted (p) pixels
- Reconstruction (r) from the predicted pixel and prediction error

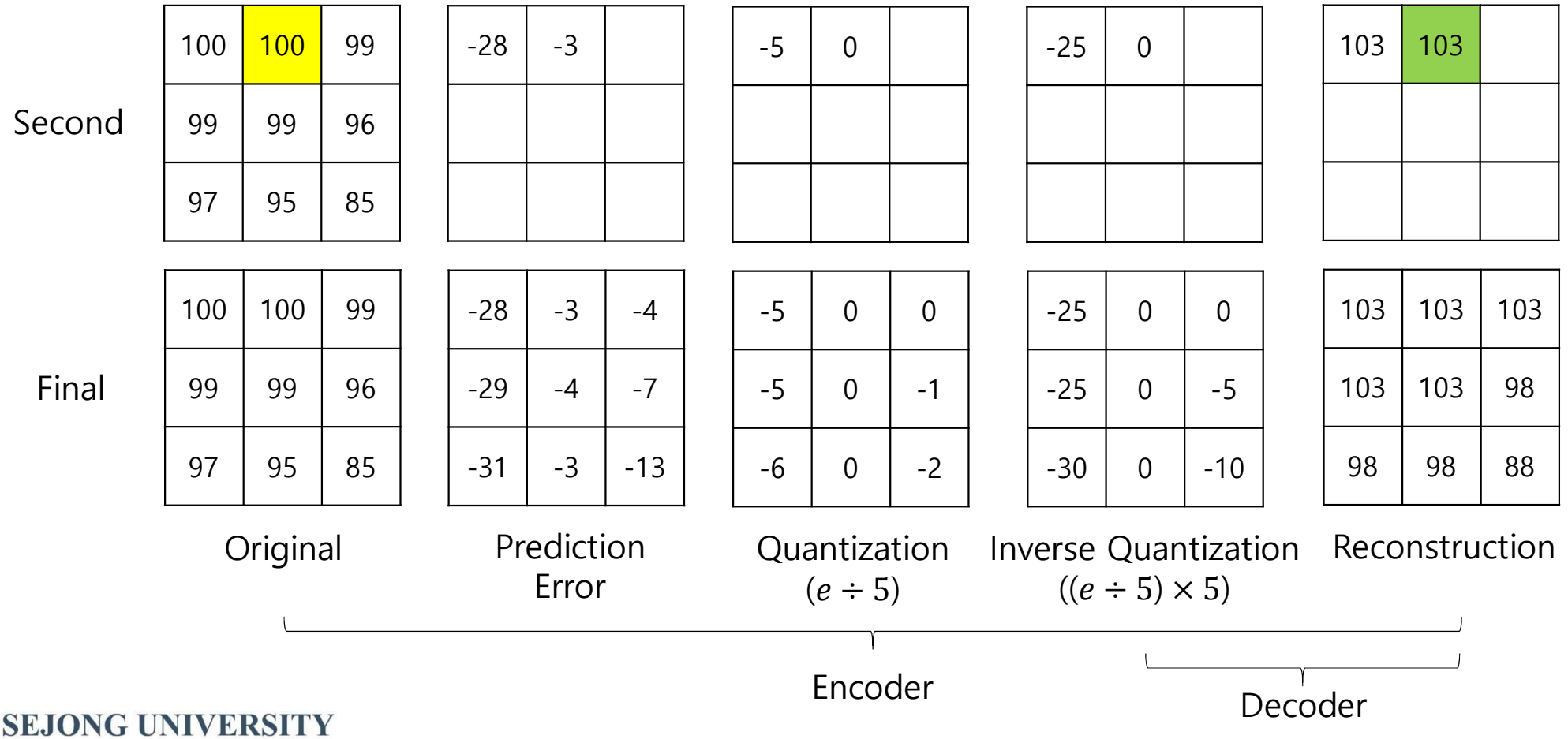


Quantization

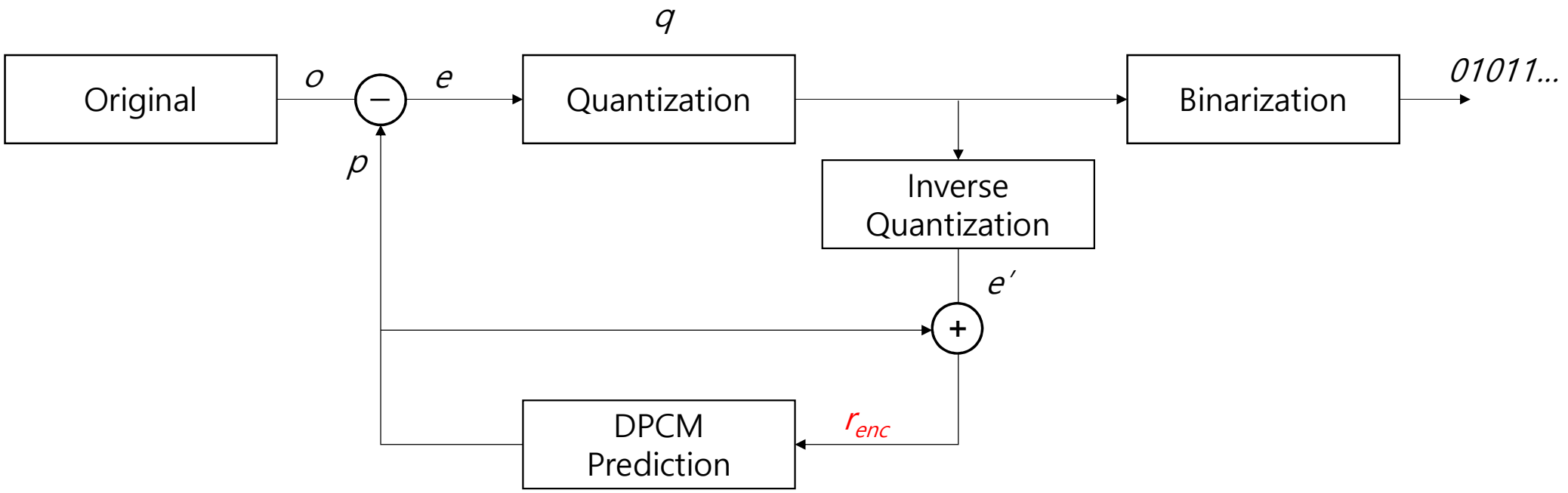
- Reduction of data size by compressing a range of values
- Lossless compression without quantization, or lossy compression with quantization
- Quantization parameter (q) depending on applications



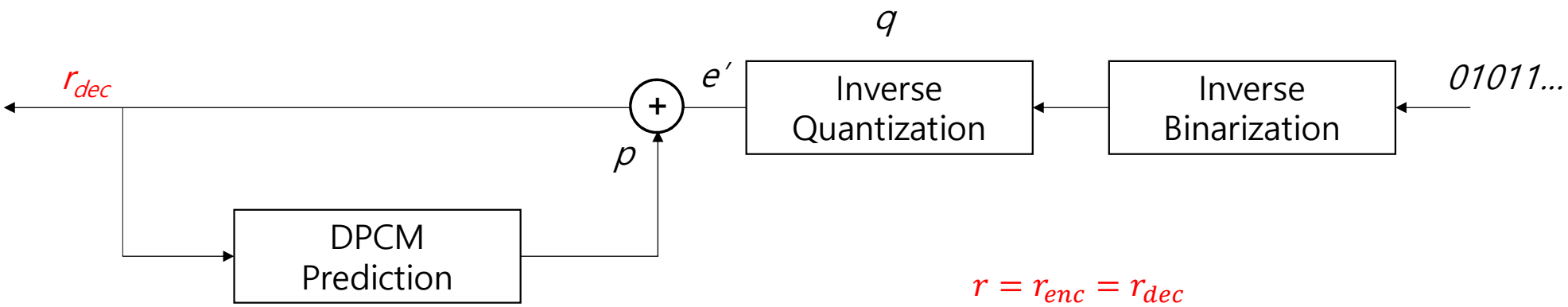
Example


Second
Final
100 100 99
99 99 96
97 95 85
-28 -3
-5 0
-25 0
103 103
100 100 99
99 99 96
97 95 85
-28 -3 -4
-29 -4 -7
-31 -3 -13
-5 0 0
-5 0 -1
-6 0 -2
-25 0 0
-25 0 -5
-30 0 -10
103 103 103
103 103 98
98 98 88
Original
Prediction Error
Quantization ($e \div 5$)
Inverse Quantization ($(e \div 5) \times 5$)
Reconstruction
Encoder
Decoder

DPCM Based Encoder



DPCM Based Decoder



$r = r_{enc} = r_{dec}$

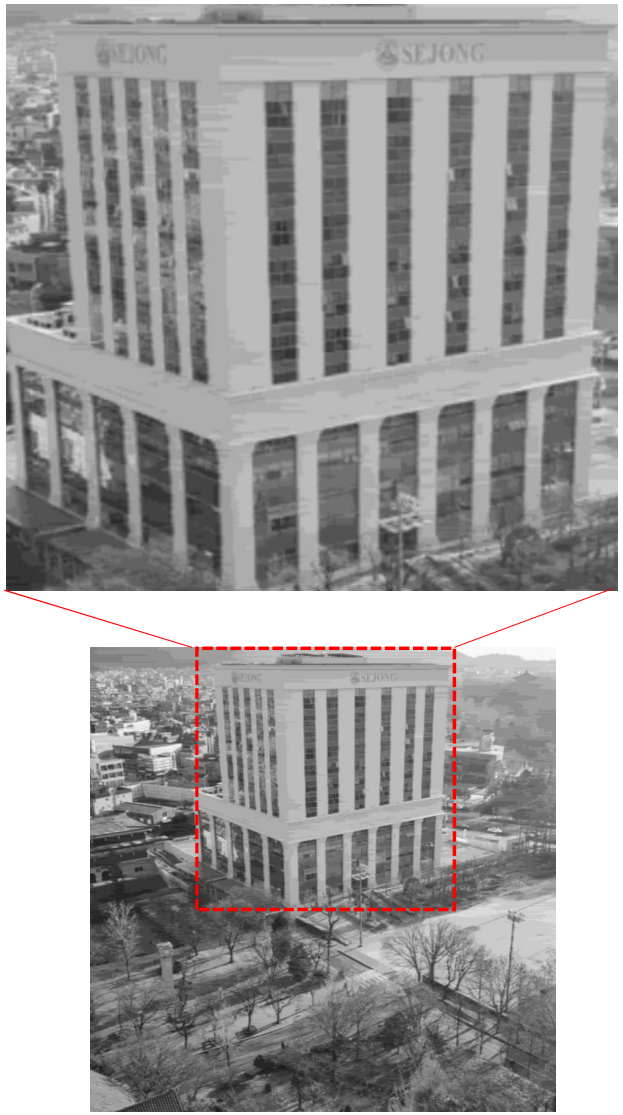
$$MSE = \frac{(o-r)^2}{\#Pixels}$$

$$PSNR = 10 \cdot \log(\frac{MAX^2}{MSE})$$

Experiment

- DPCM-based compression on AICenterY.bmp
- $e \div q$ for quantization in an encoder (q=5)
- Generation of reconEncY.bmp (r_{enc}) and bitstream.txt (e)
- Decompression, based on bistream.txt
- $e \times \alpha$ for inverse quantization in a decoder (q=5)
- Generation of reconDecY.bmp(r_{dec})
- reconEncY.bmp = reconDecY.bmp

In general, $\alpha \uparrow \rightarrow PSNR \downarrow$



reconDecY.bmp