

Second Watermark Competition for Image

Notation

$JPEG(F, r)$ stands for JPEG compression of image F with ratio r .

$BER(\hat{m}; m)$ is bit error rate, where \hat{m} is a decoded message vector.

$PSNR(\hat{F}; F)$ is image quality of test image \hat{F} vs standard image F .

Uncompressed

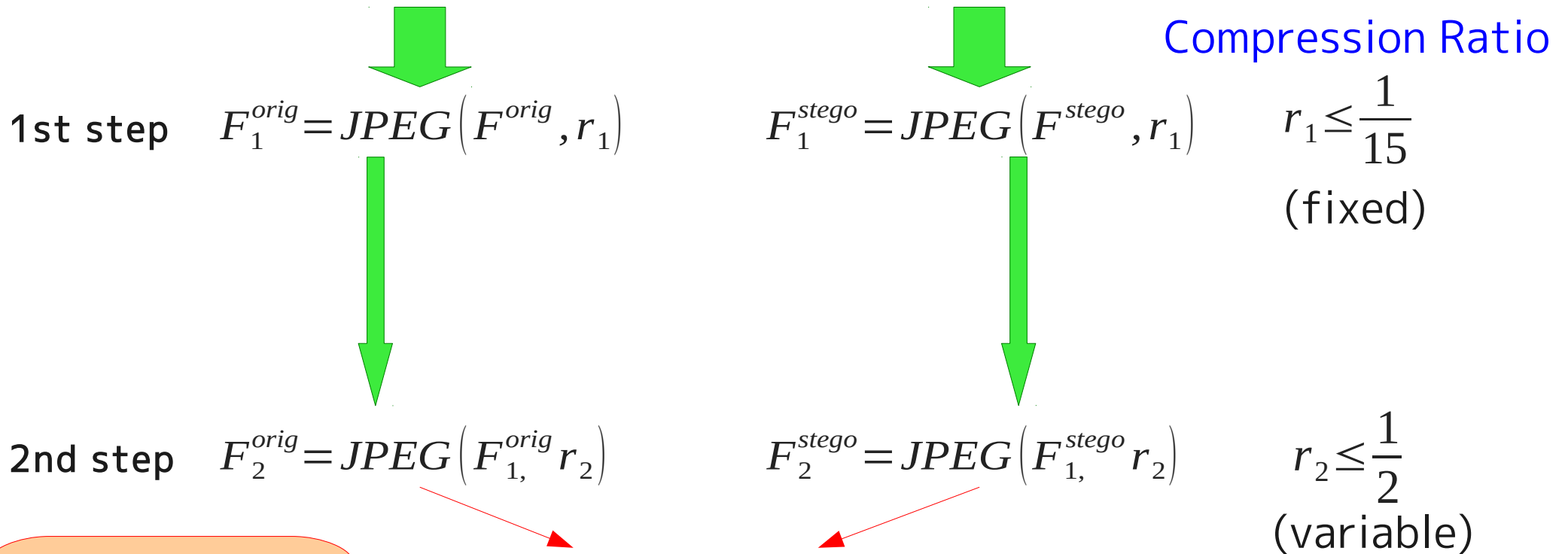
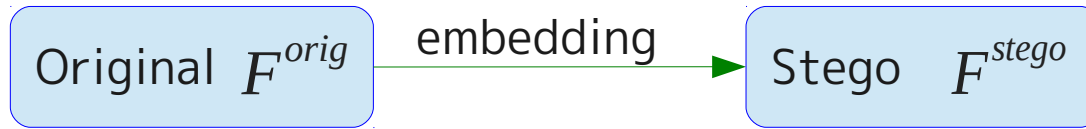
Original Image : F^{orig} Stego-Image: F^{stego} Message : $\mathbf{m} = (m_1, m_2, \dots, m_{200})$

1st compression $F_1^{stego} = JPEG(F^{stego}, r_1), r_1 \leq \frac{1}{15}$, where decoded message is $\hat{\mathbf{m}}^1$
(images on the market)

2nd compression $F_2^{stego} = JPEG(F_1^{stego}, r_2), r_2 \leq \frac{1}{2}$, where decoded message is $\hat{\mathbf{m}}^2$
(attacked images)

Necessary condition : $PSNR(F_2^{stego}, JPEG(F^{orig}, r_2)) \geq 30 \text{ dB}$

Flow



Measure qualities by same compression ratio.

$$PSNR(F_2^{stego}; F_2^{orig}) \geq 30 \text{ dB}$$

compete for $BER(\hat{m}^2; m)$

Necessary condition: Quality is more than or equal to 30 dB.

Evaluation Criteria

[The highest tolerance award]

The bit error rate must be zero for all ten rectangle regions in 6 images

$$BER(\hat{\mathbf{m}}^2; \mathbf{m}) = 0.$$

This award is bestowed to achieve the highest compression ratio for 6 images,

$$r = r_1 \times r_2 \quad \text{The 1st ratio is fixed to 1/15. Vary the 2nd ratio.}$$

[The highest image quality award]

The average of bit error rate in each test image must be less than or equal

$$\text{to 1.0\%; } BER(\hat{\mathbf{m}}^2; \mathbf{m}) \leq 0.01.$$

This award is bestowed to achieve the highest image quality

$$\text{PSNR; } PSNR(F_2^{stego}; F_2^{orig}), \text{ where the ratio is } r = r_1 \times r_2 \leq \frac{1}{30}.$$

Note that subjective assessments may be conducted if need arises, and their results will be taken into account.