VC Seminar Project Group 3

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Image compression

Reducing the size of image without losing visual quality. Making it easier to store and transmit

Lapped transform

Mathematical technique used in signal and image processing to achieve overlapping of blocks of data, reducing artifacts typically associated with block-based transforms

DCT

Technique used in image and signal processing to represent an image as a sum of cosine functions oscillating at different frequencies. It is particularly known for its application in JPEG image compression.

Effective image compression

- Training convolutional filters that act as the lapped transform and its inverse
- Creating neural network, defining a loss function, and optimizing the filters based on training data.

Convolutional Layer

- Filter: matrix of weights
- Stride: The step size of filter to move
- Padding: Adding border to input image to control spatial size
- Activation function: Non-Linear functions to add non-linearity into the model

Transposed convolutional layer

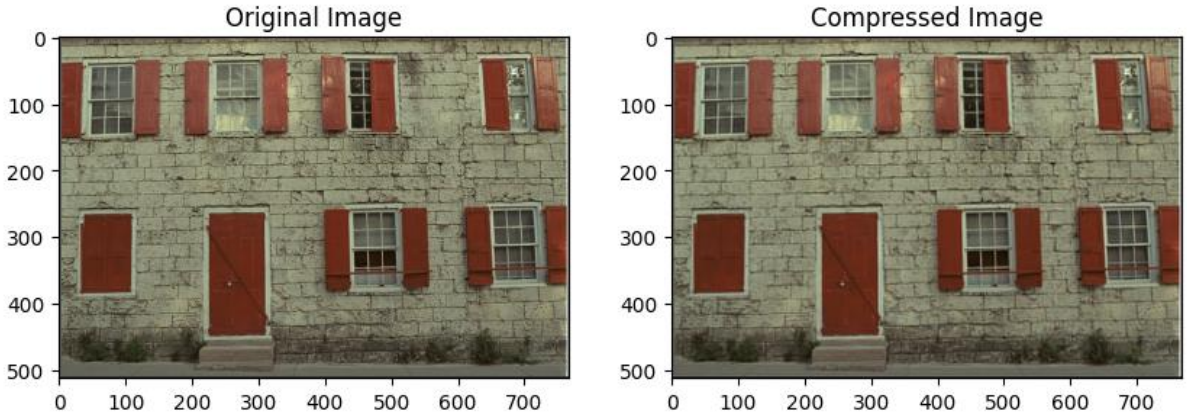
- Applies the inverse transform filters to reconstruct the image
- The input channels of this will be equal to the output channels of convolutional layer
- The output channels will be 3 (RGB) the desired output channels of out reconstructed image
- Kernal size, stride and padding will be same

Steps of Compression

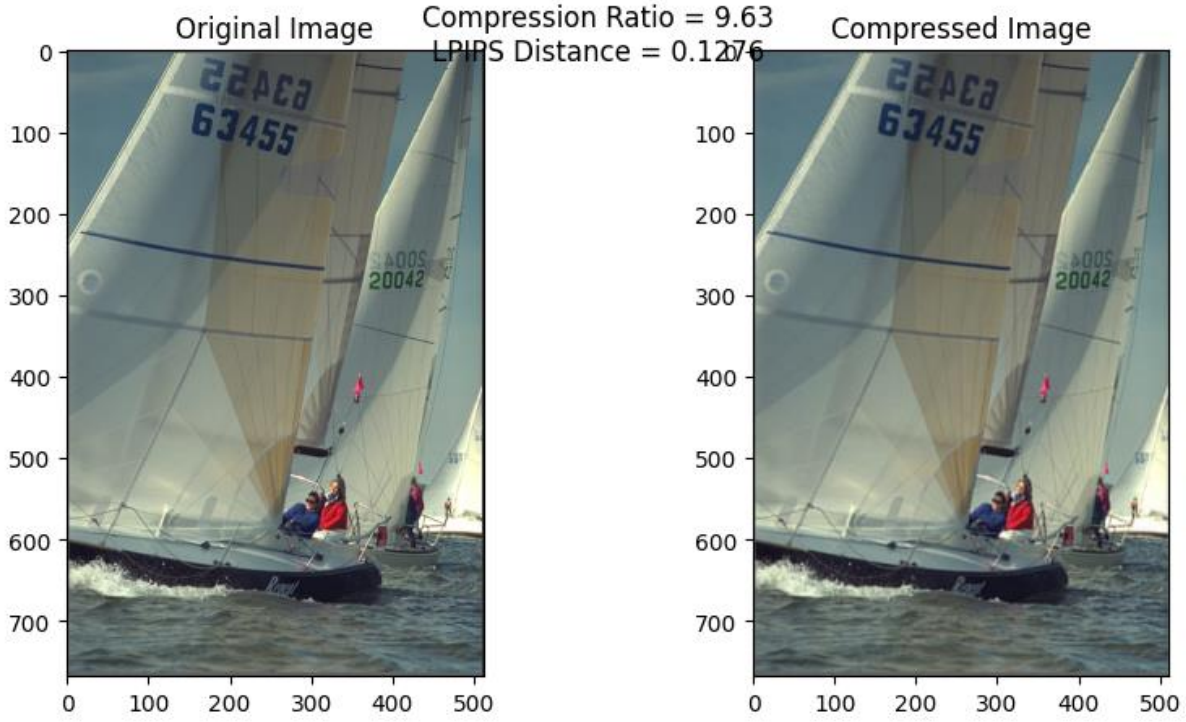
- Data preprocessing
- Convolutional layer
- Training the model
- Compression
    - Transformation with convolutional layer
    - Quantization
    - Conversion to Byte Stream
- Decompression
    - Byte Stream to quantized
    - Dequantization
    - Inverse transformation

DCT

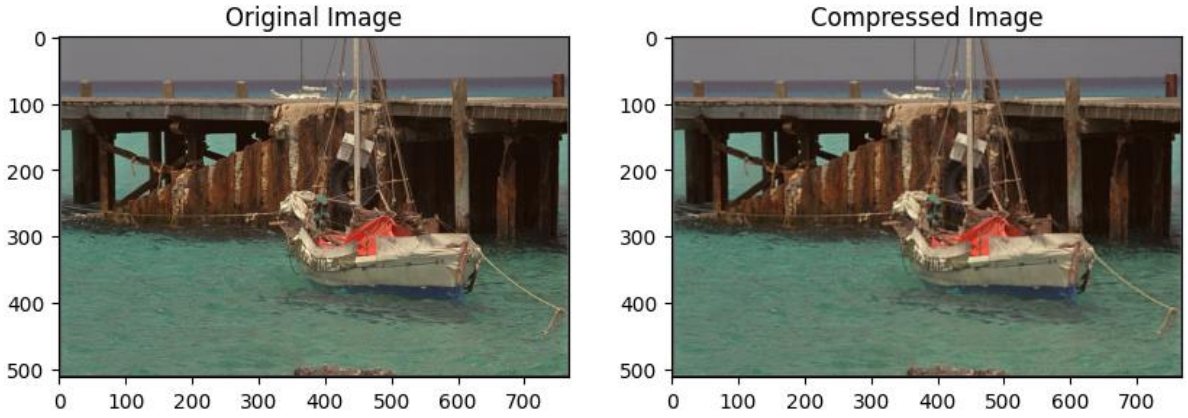
PSNR = 30.26
Compression Ratio = 7.03
LPIPS Distance = 0.2664



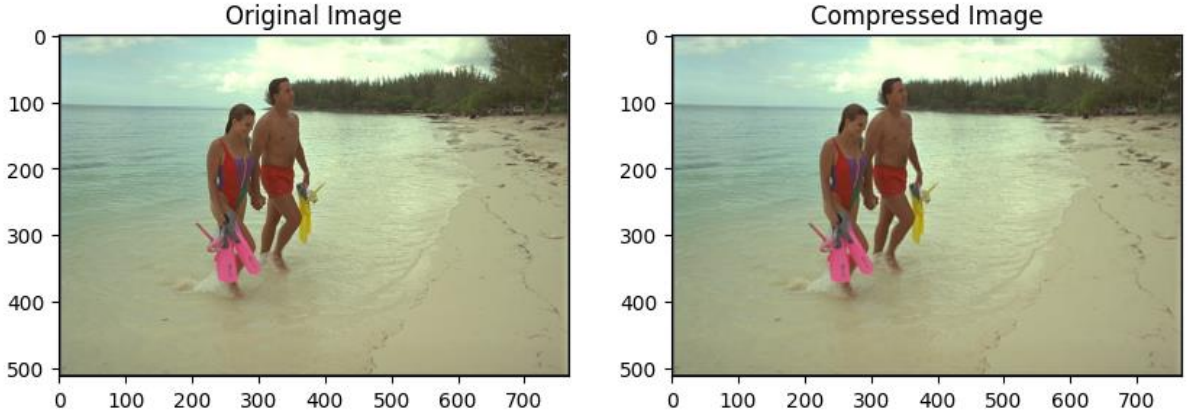
PSNR = 34.41
Compression Ratio = 9.63
LPIPS Distance = 0.1276



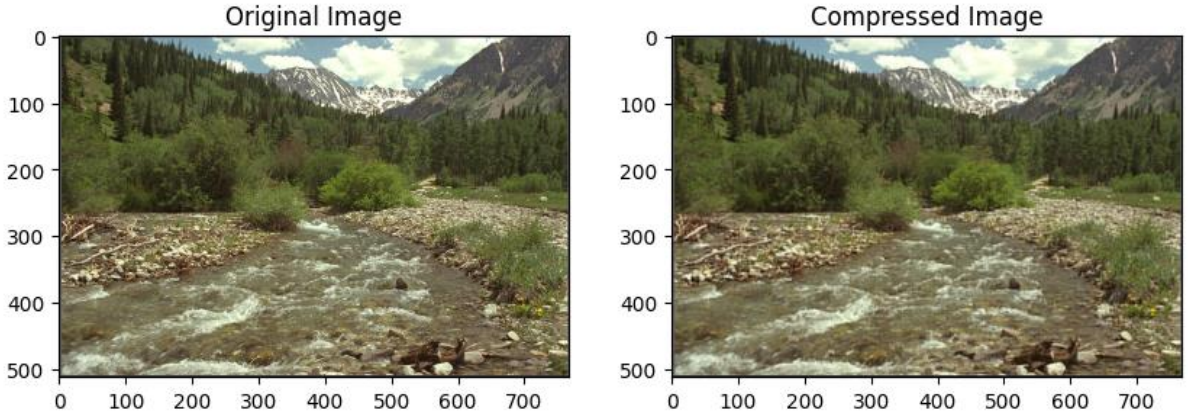
PSNR = 32.37
Compression Ratio = 7.97
LPIPS Distance = 0.2040



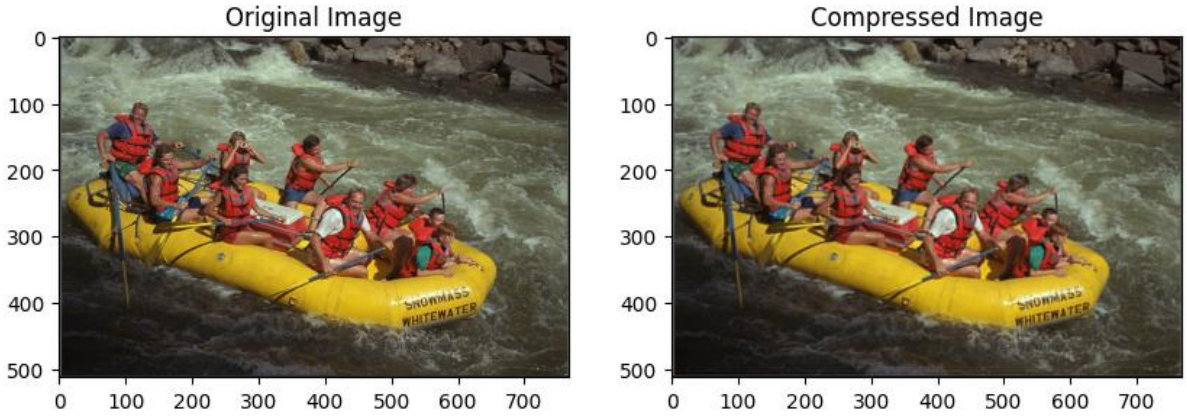
PSNR = 34.26
Compression Ratio = 9.26
LPIPS Distance = 0.1186



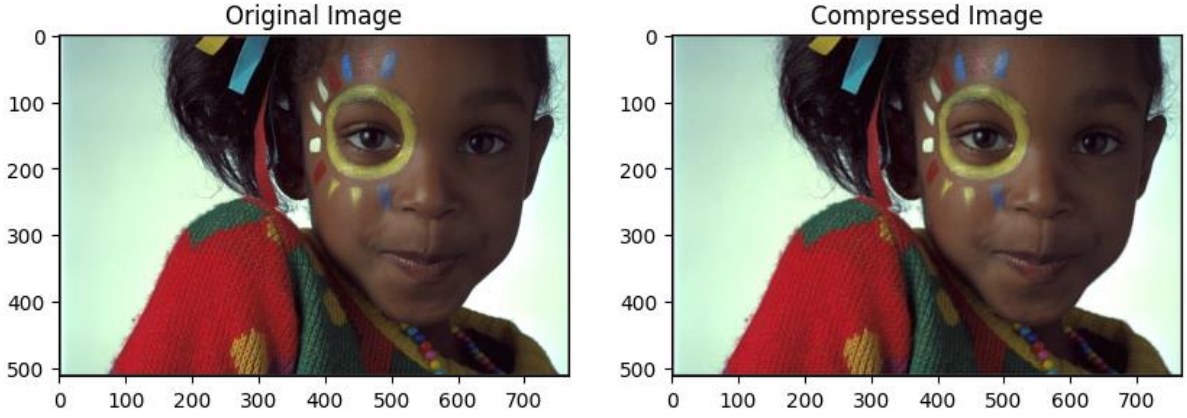
PSNR = 29.76
Compression Ratio = 6.68
LPIPS Distance = 0.3737



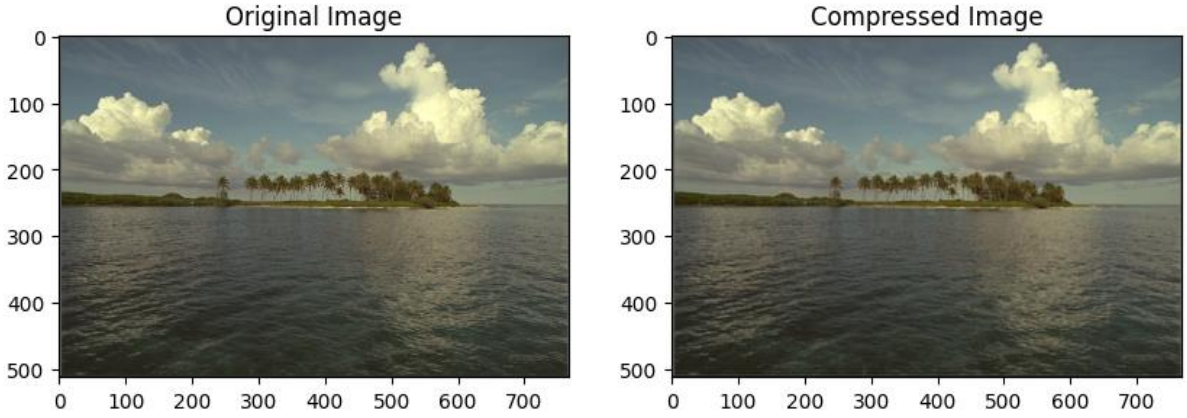
PSNR = 31.59
Compression Ratio = 6.93
LPIPS Distance = 0.2061

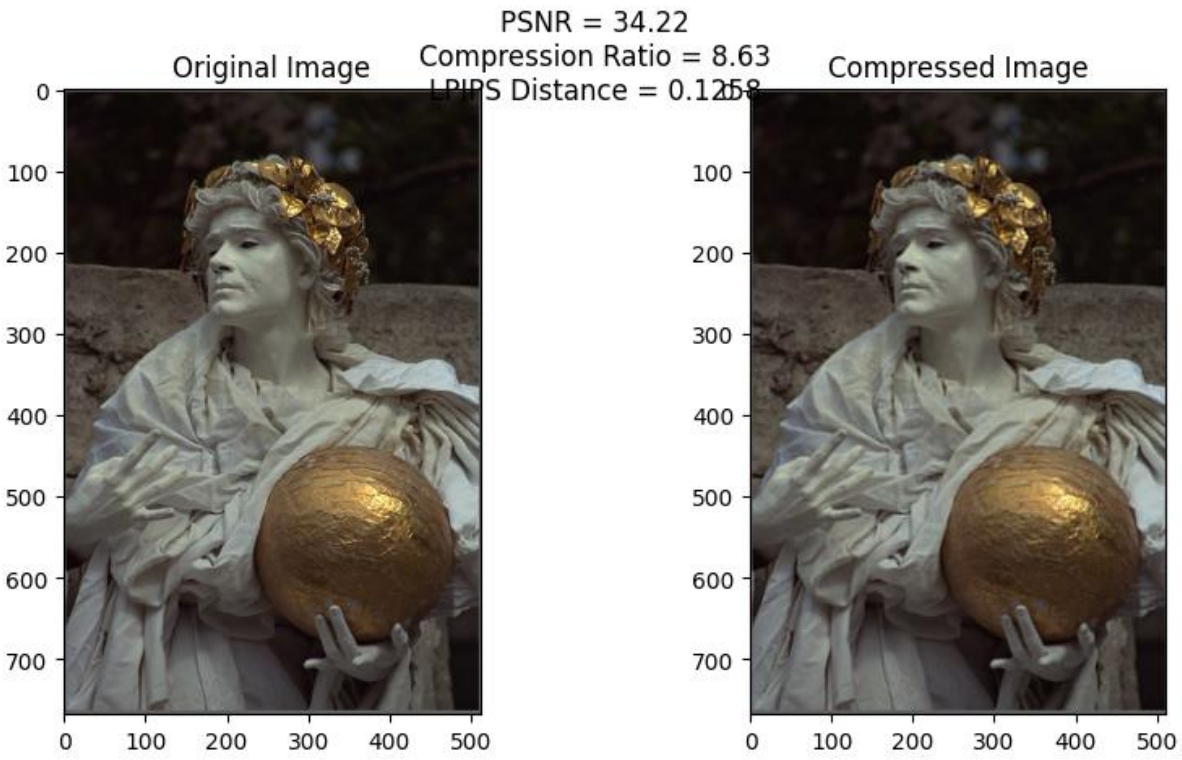


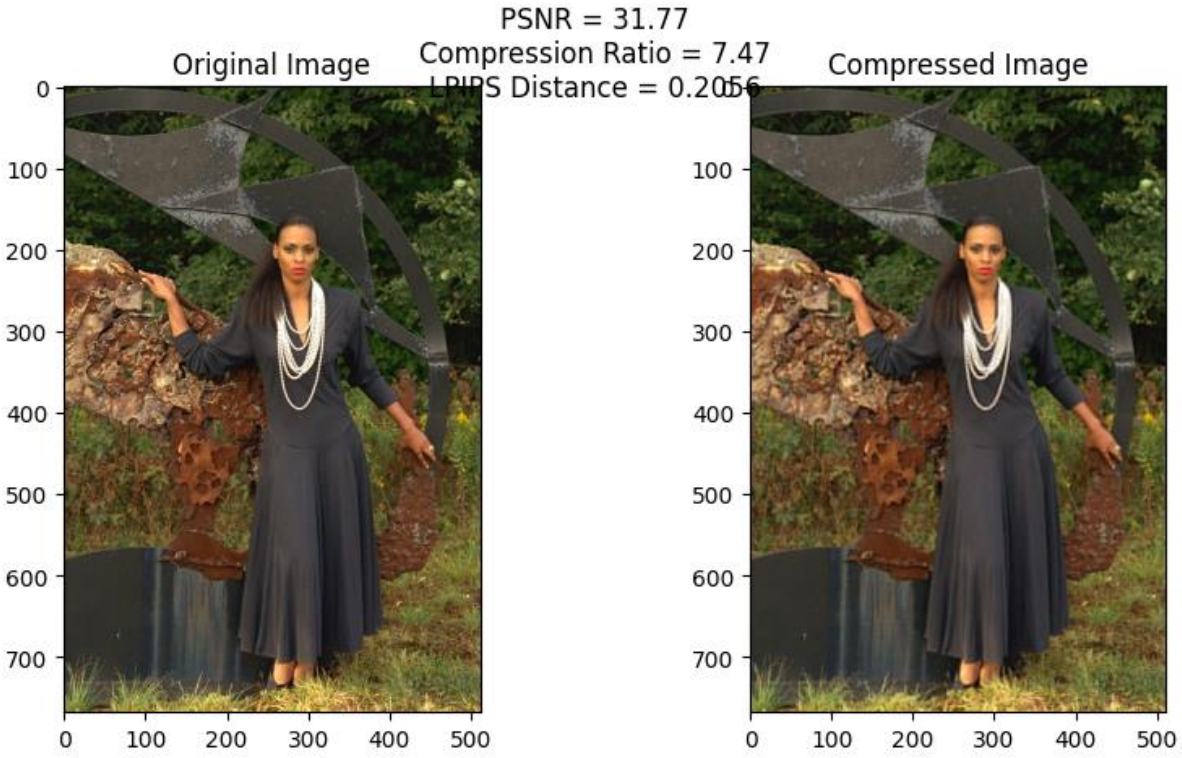
PSNR = 34.09
Compression Ratio = 10.66
LPIPS Distance = 0.1211



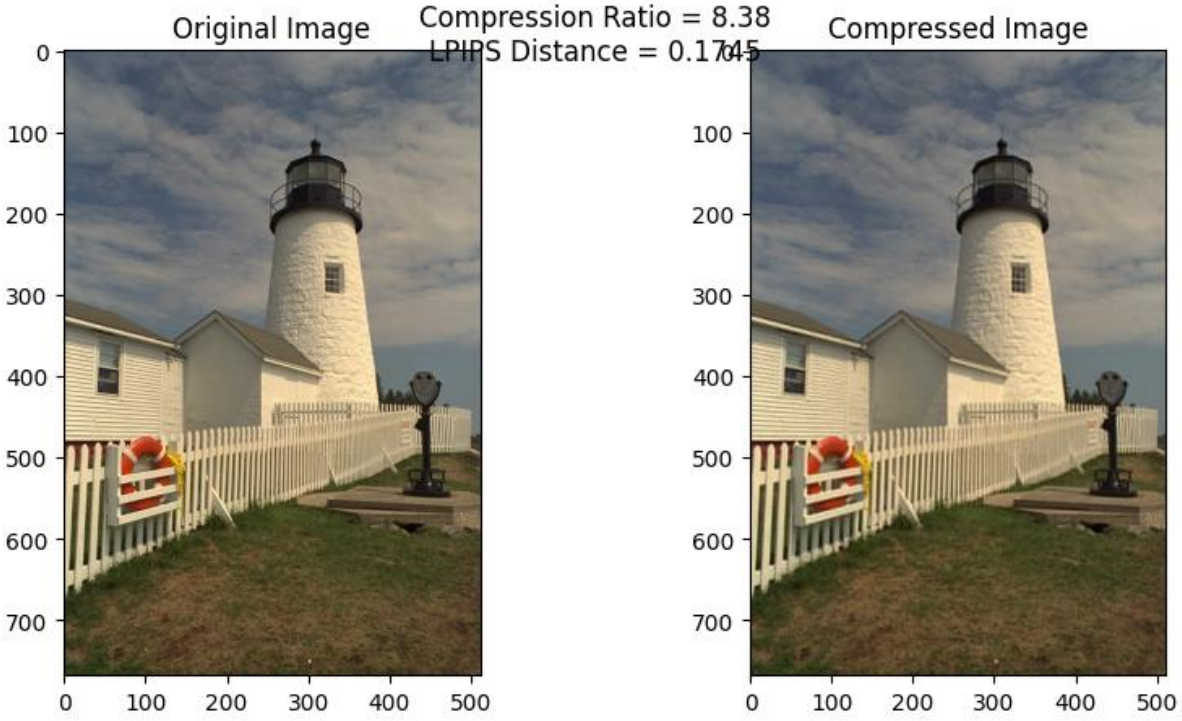
PSNR = 33.07
Compression Ratio = 8.46
LPIPS Distance = 0.1731




PSNR = 34.22
Compression Ratio = 8.63
LPIPS Distance = 0.1258
Original Image
Compressed Image
0
100
200
300
400
500
600
700
0
100
200
300
400
500

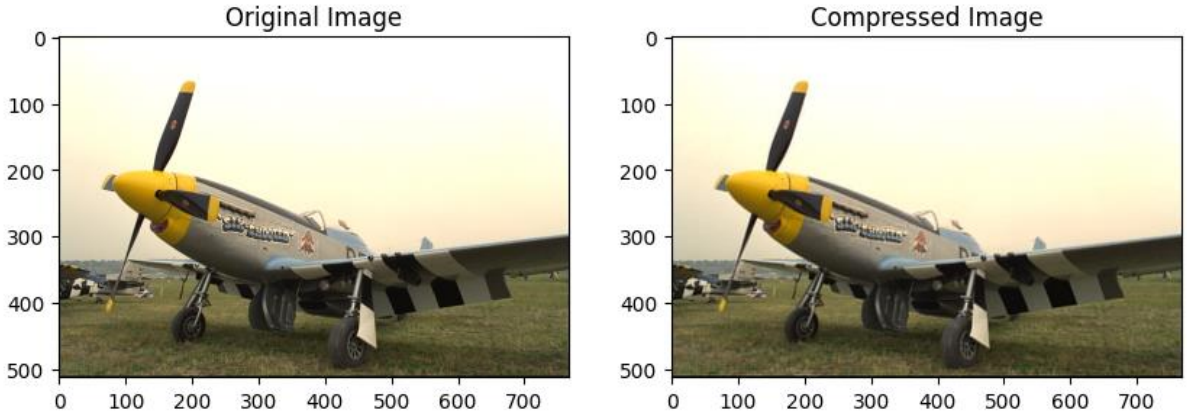

PSNR = 31.77
Compression Ratio = 7.47
LPIPS Distance = 0.2056
Original Image
Compressed Image
0
100
200
300
400
500
600
700
0
100
200
300
400
500

PSNR = 32.37
Compression Ratio = 8.38
LPIPS Distance = 0.1745

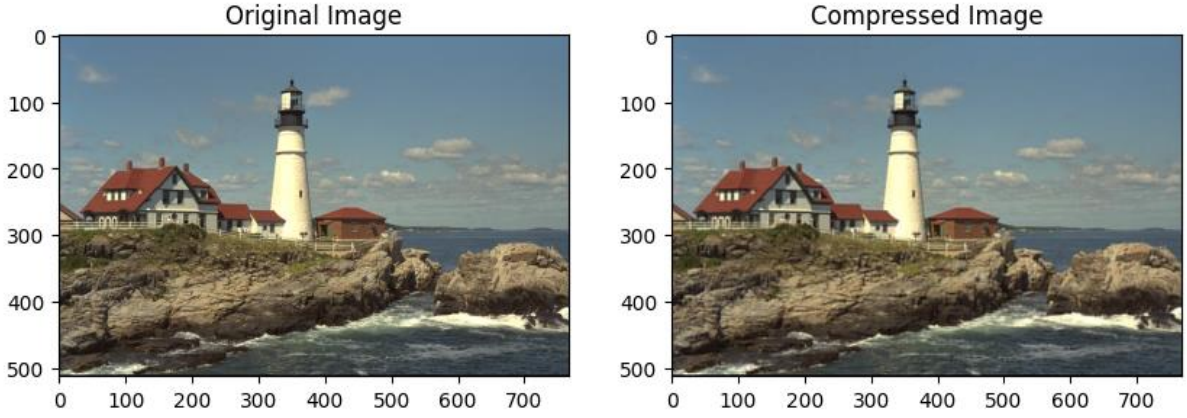


PSNR = 34.23
Compression Ratio = 8.78
LPIPS Distance = 0.1757

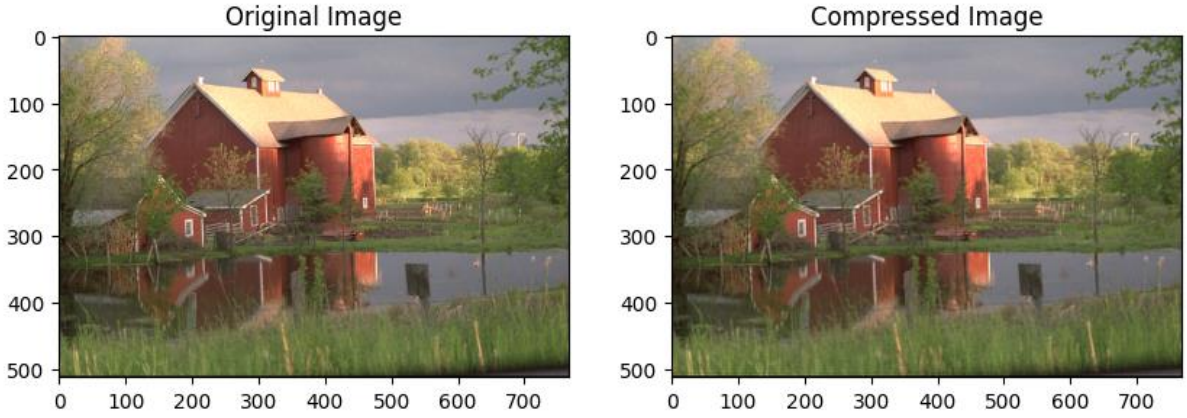
PSNR = 34.42
Compression Ratio = 11.84
LPIPS Distance = 0.1173



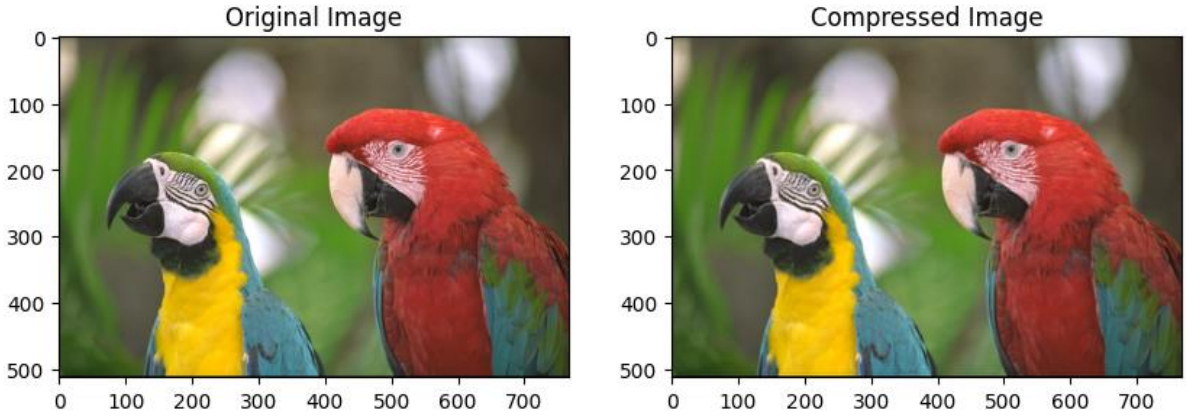
PSNR = 32.54
Compression Ratio = 9.34
LPIPS Distance = 0.1775



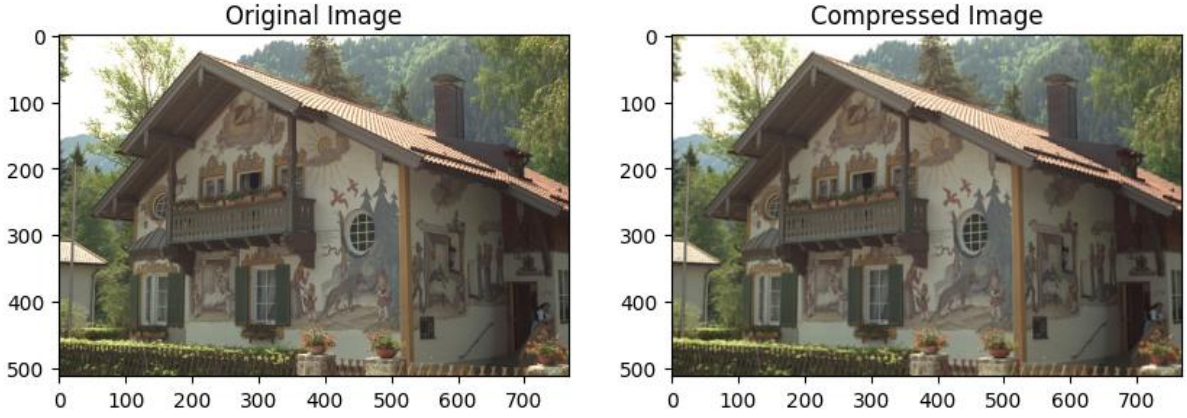
PSNR = 32.81
Compression Ratio = 7.91
LPIPS Distance = 0.1889



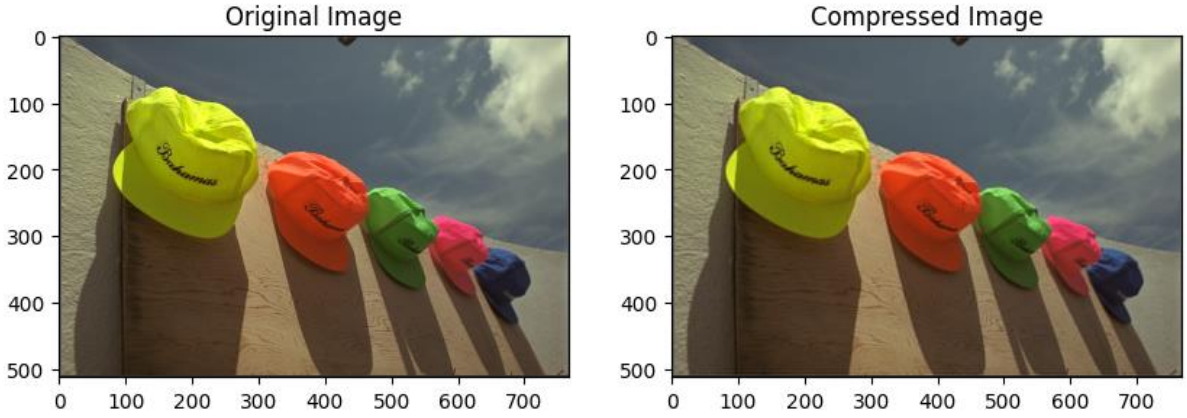
PSNR = 36.65
Compression Ratio = 11.78
LPIPS Distance = 0.0650

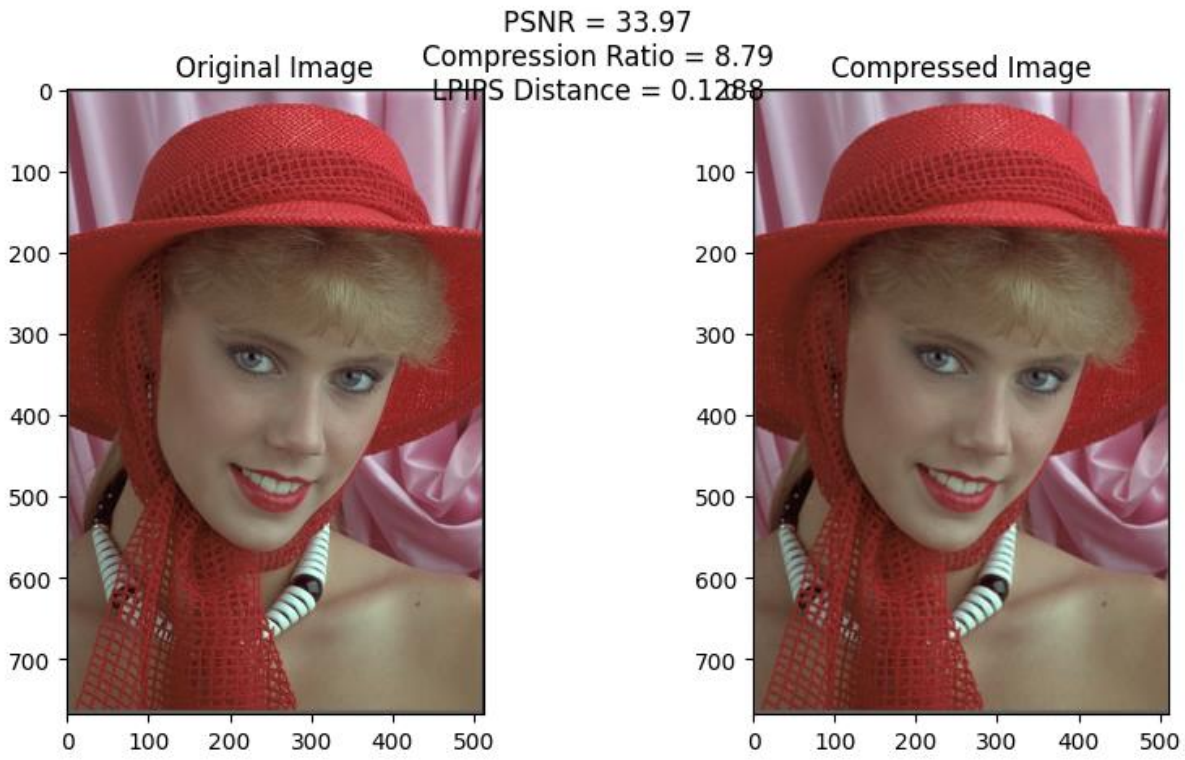


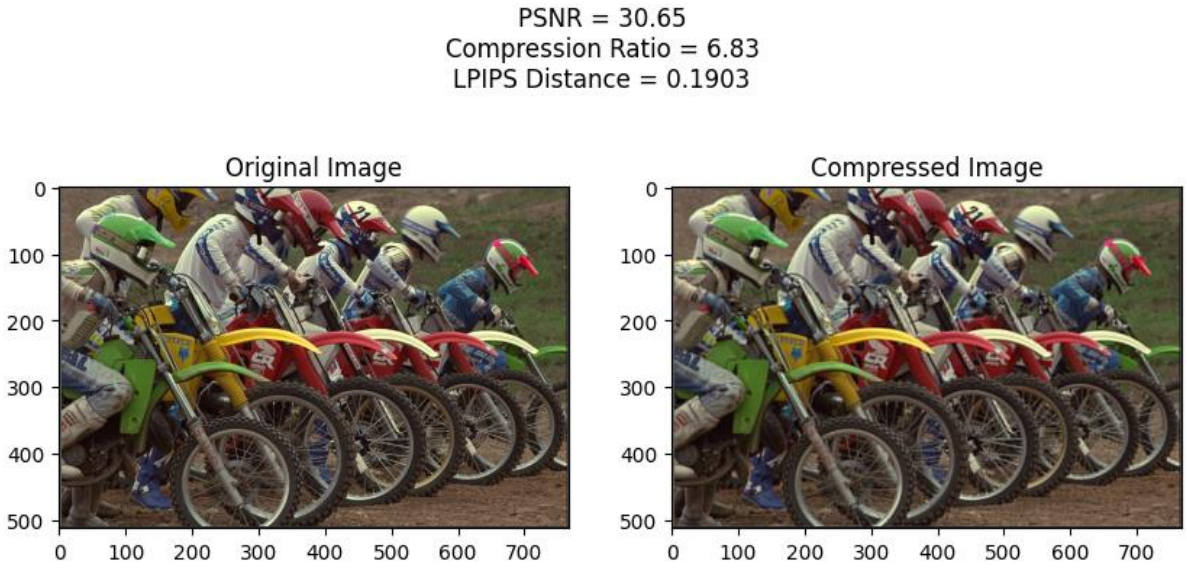
PSNR = 31.92
Compression Ratio = 7.79
LPIPS Distance = 0.2056



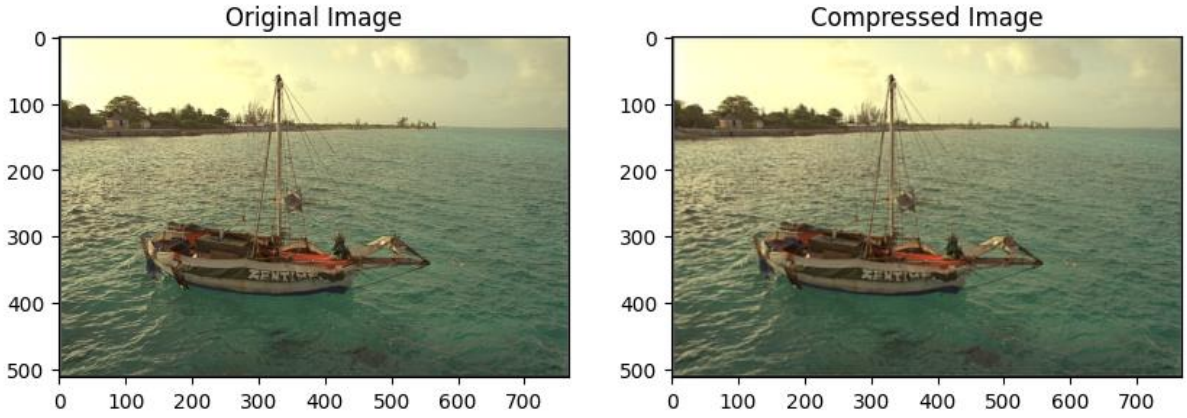
PSNR = 35.10
Compression Ratio = 10.94
LPIPS Distance = 0.0773



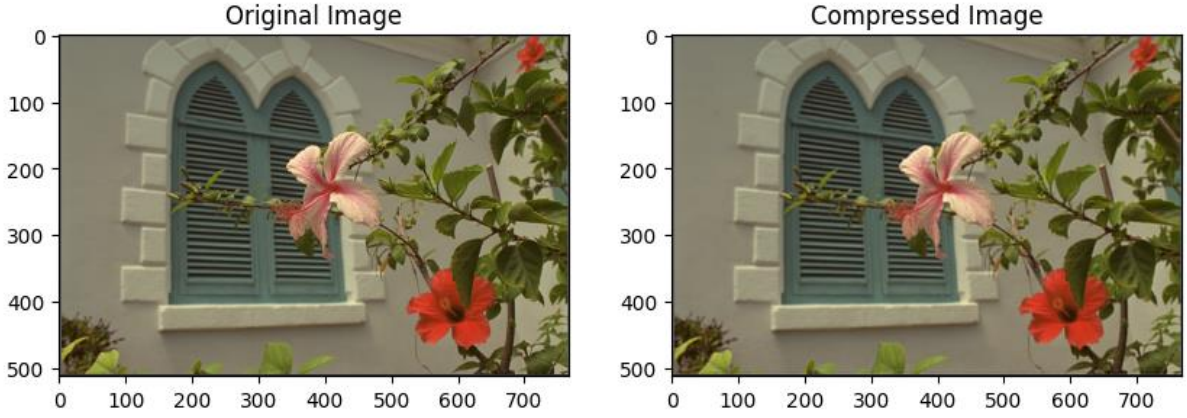

PSNR = 33.97
Compression Ratio = 8.79
LPIPS Distance = 0.1288
Original Image
Compressed Image


PSNR = 30.65
Compression Ratio = 6.83
LPIPS Distance = 0.1903
Original Image
Compressed Image

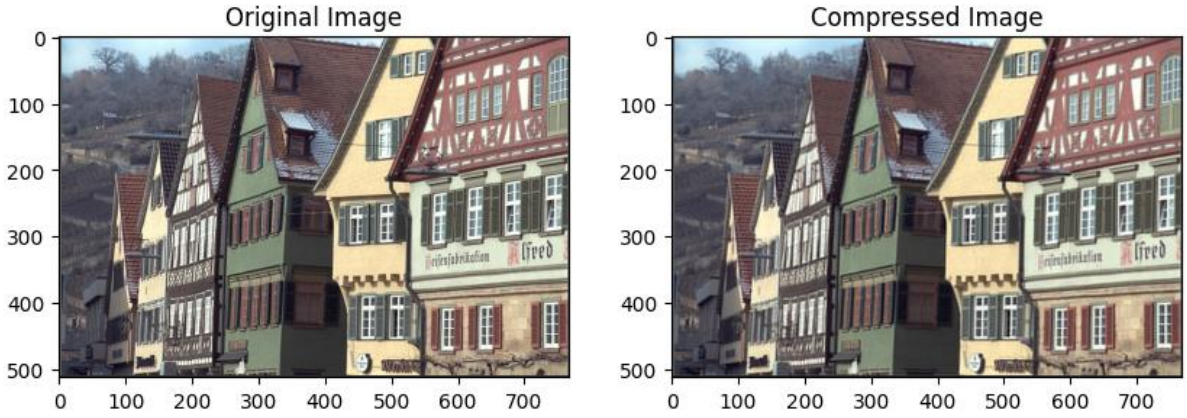
PSNR = 31.45
Compression Ratio = 7.88
LPIPS Distance = 0.2181



PSNR = 34.77
Compression Ratio = 9.48
LPIPS Distance = 0.0766



PSNR = 30.04
Compression Ratio = 7.02
LPIPS Distance = 0.2149



PSNR = 34.42
Compression Ratio = 11.63
LPIPS Distance = 0.1019

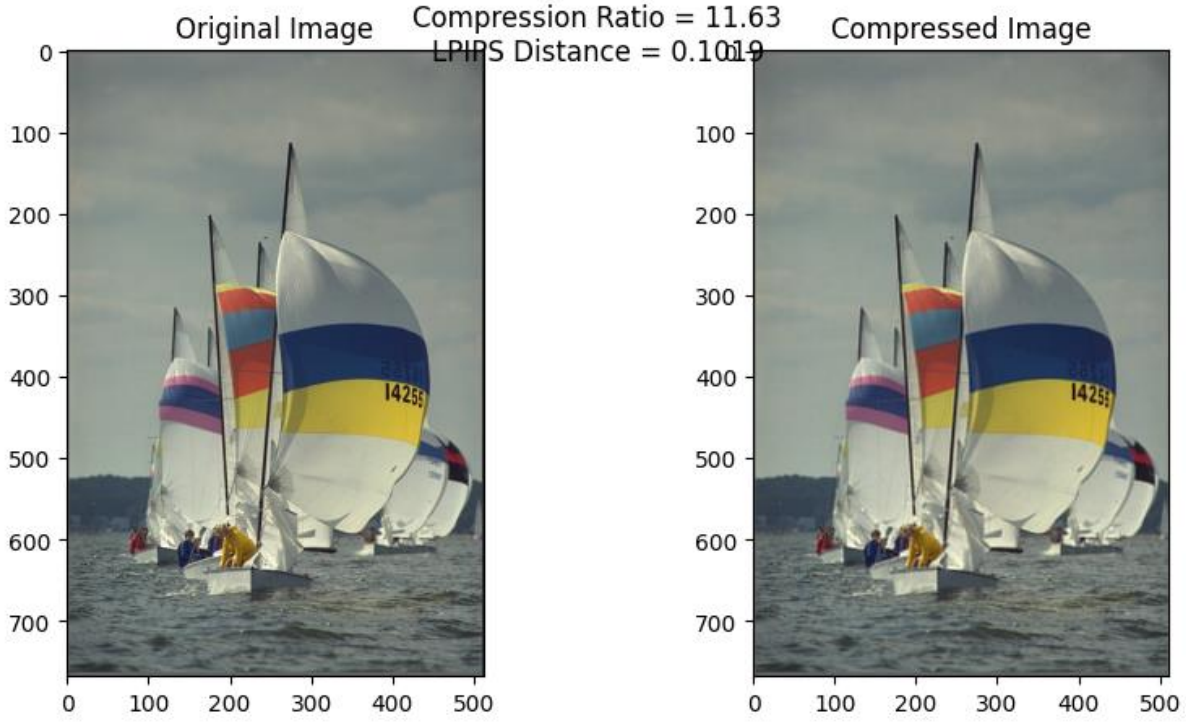


Image Compression using Lapped transform

Compression Ratio = 11.63
LPIPS Distance = 0.3374

Original Image

Reconstructed Image

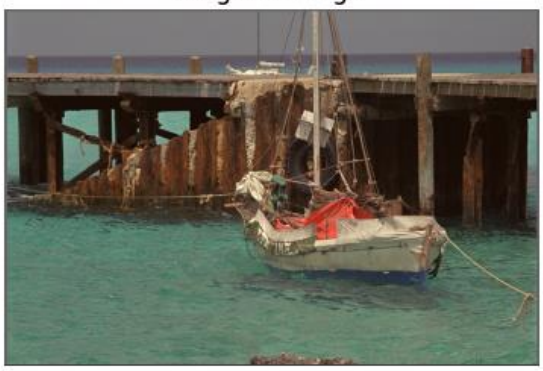
Compression Ratio = 12.32
LPIPS Distance = 0.4980

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.3123

Original Image



Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4289

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.3393

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.6764

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.5073

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.3413

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4303

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.3464

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4510

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4196

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4081

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.3799

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4323

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4392

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.2773

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4602

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.2824

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.3216

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4083

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.5008

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.2616

Original Image

Reconstructed Image

Compression Ratio = 12.32
LPIPS Distance = 0.4171

Original Image

Reconstructed Image