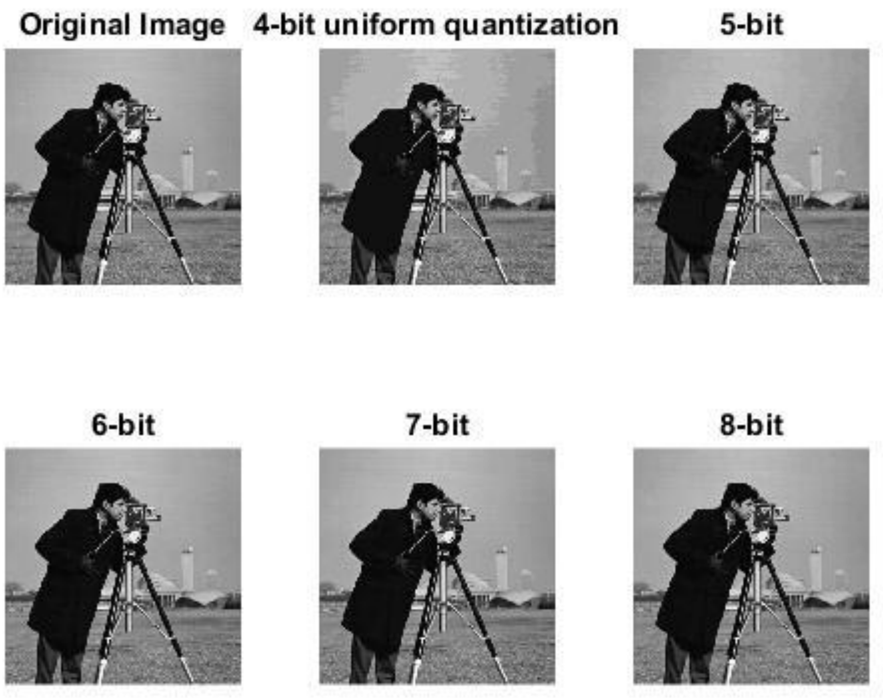
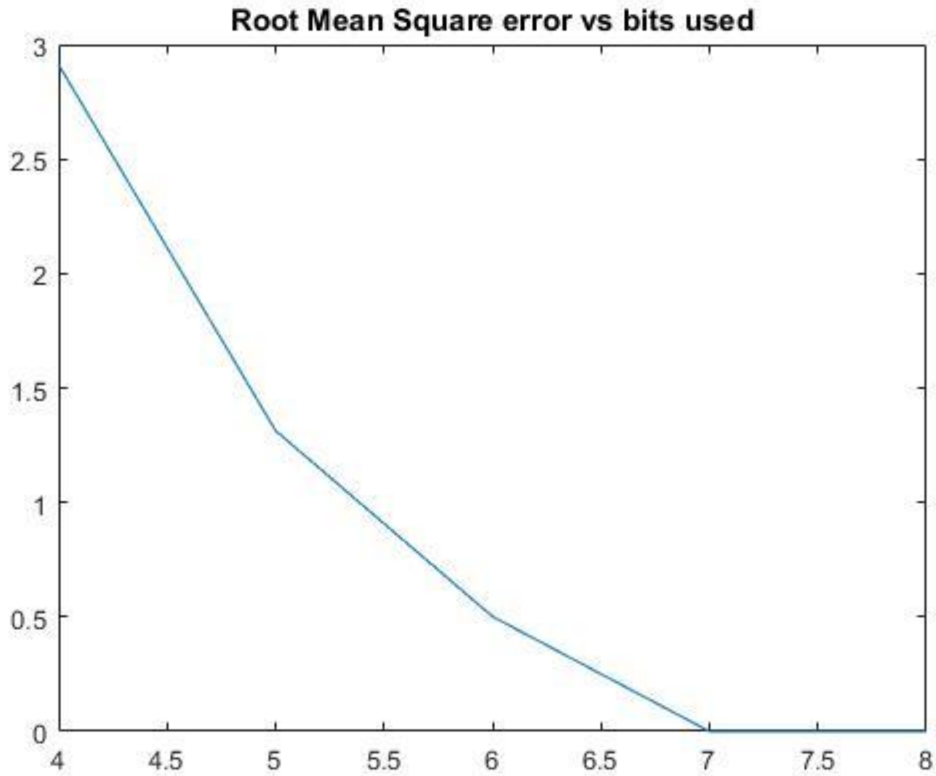
# ELL715

## Assignment 4 – Report

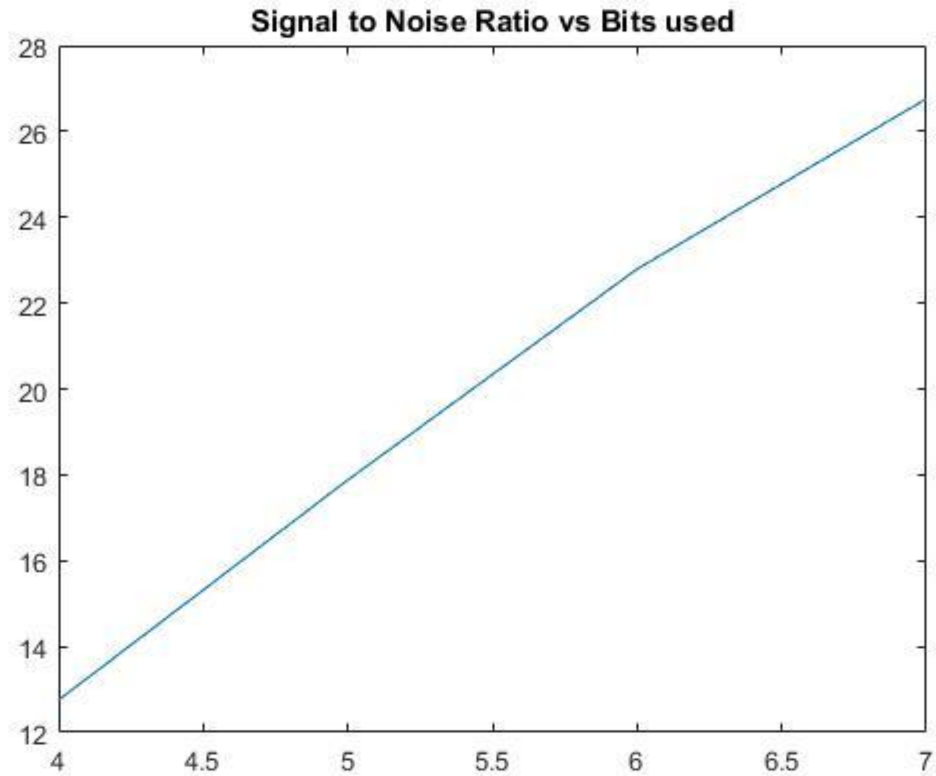
Deepali Gupta
2013MT60079

1. Object Fidelity Criteria
   (Code in q1.m)

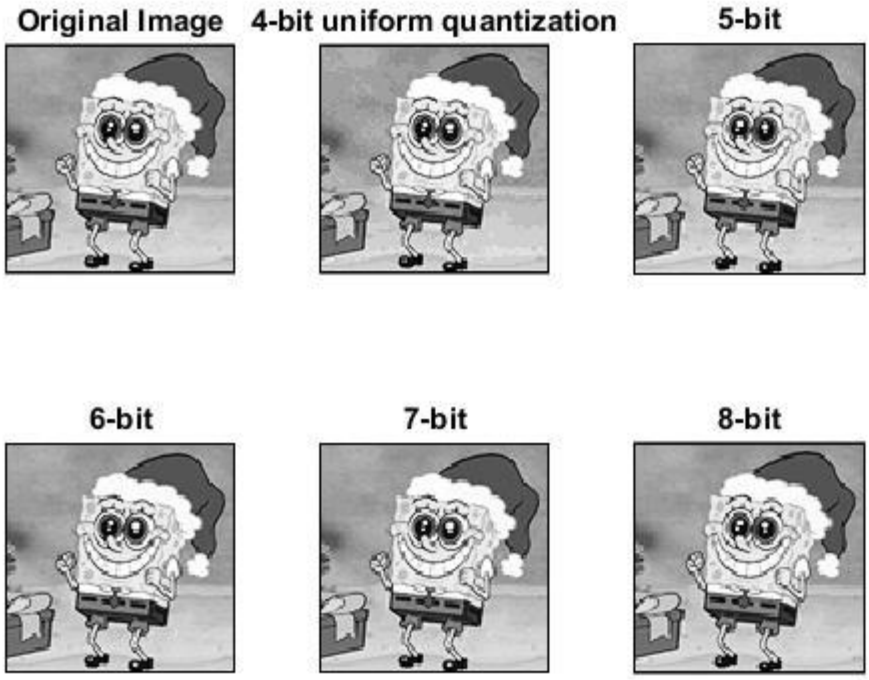


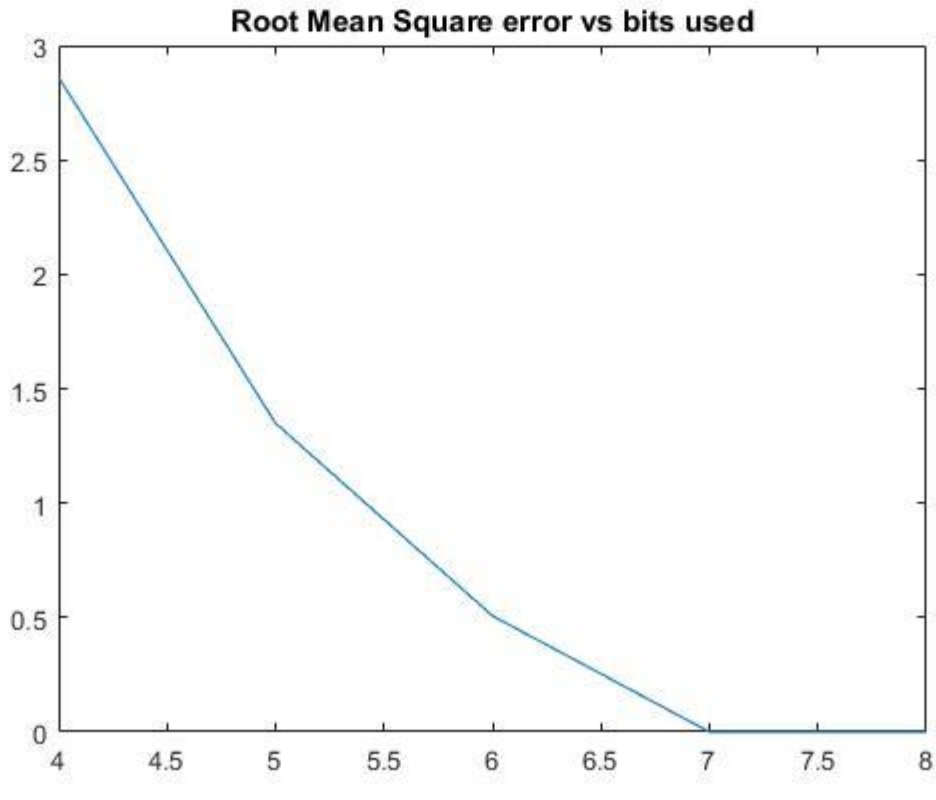


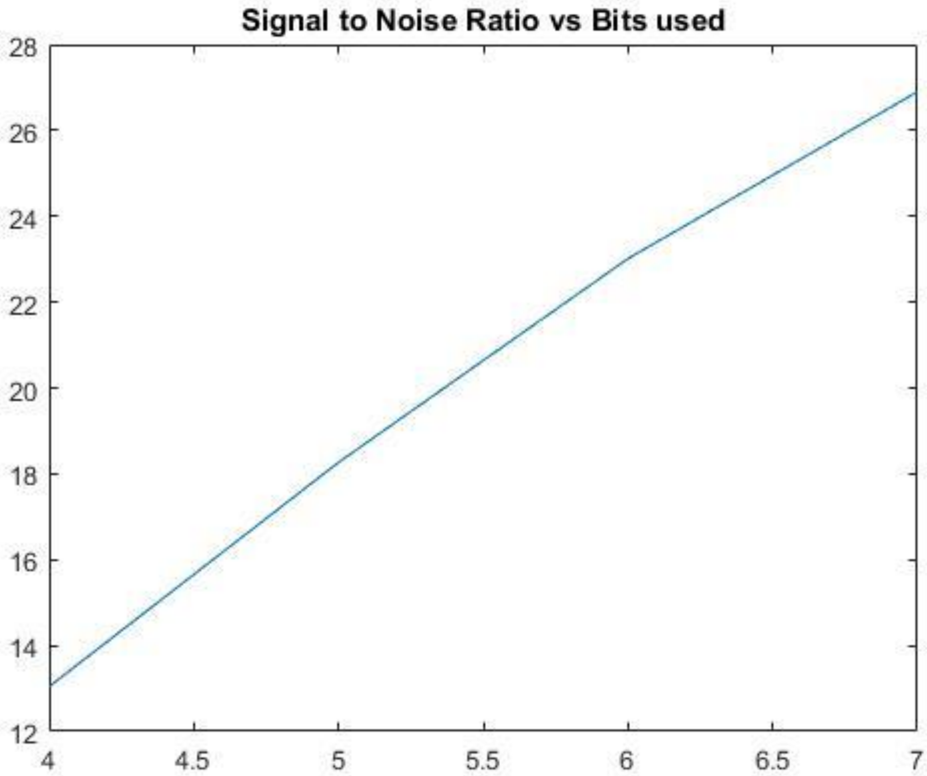

the Root Mean square Error term reduces as we increase the number of bits in the quantization, eventually dying out to zero at 8 bits as the original image is of 8 Bits.

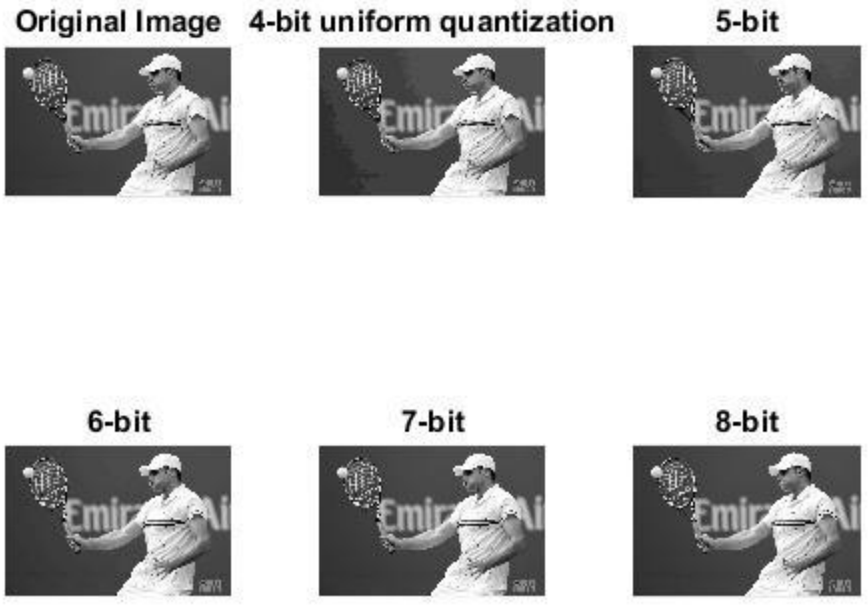


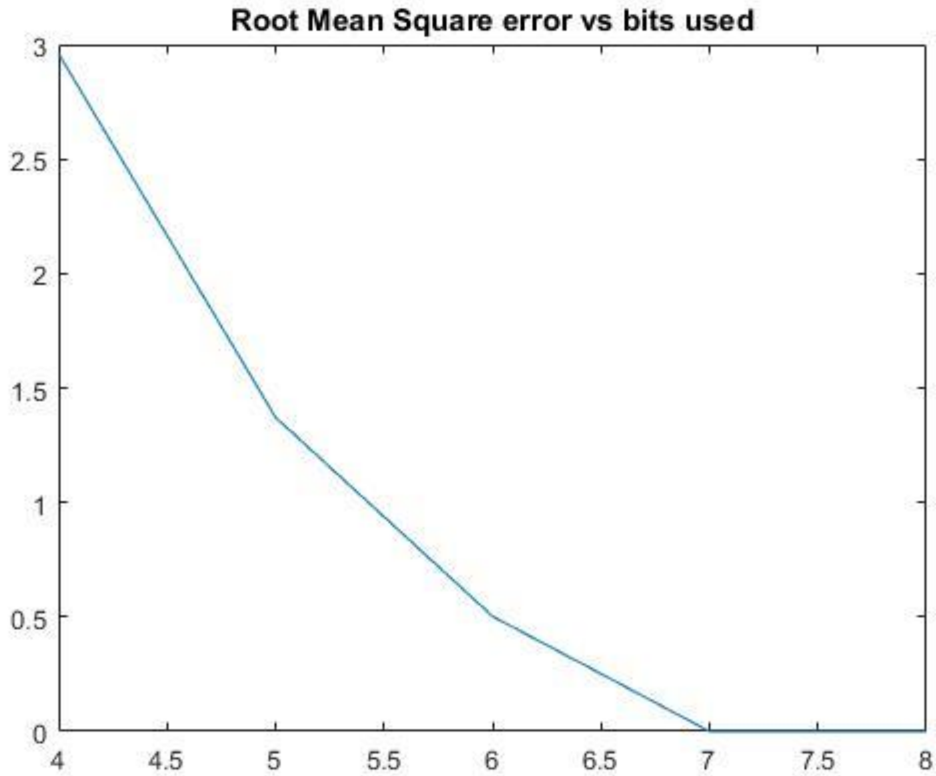
Mean Square Signal to noise ratio keeps on increasing with increase in number of bits as the signal strength remains the same and noise reduces

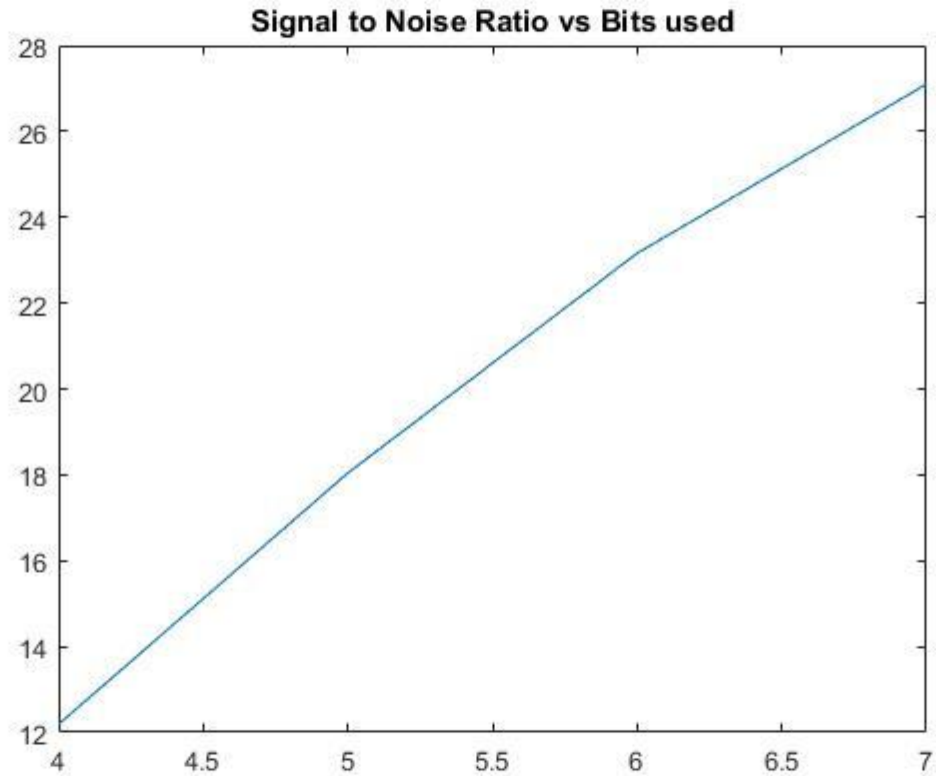



Signal to Noise Ratio vs Bits used
28
26
24
22
20
18
16
14
12
4
4.5
5
5.5
6
6.5
7


Original Image
4-bit uniform quantization
5-bit
6-bit
7-bit
8-bit




2. Image Entropy
   (Code in q2.m)

Entropy = 7.4949

Entropy = 7.0911

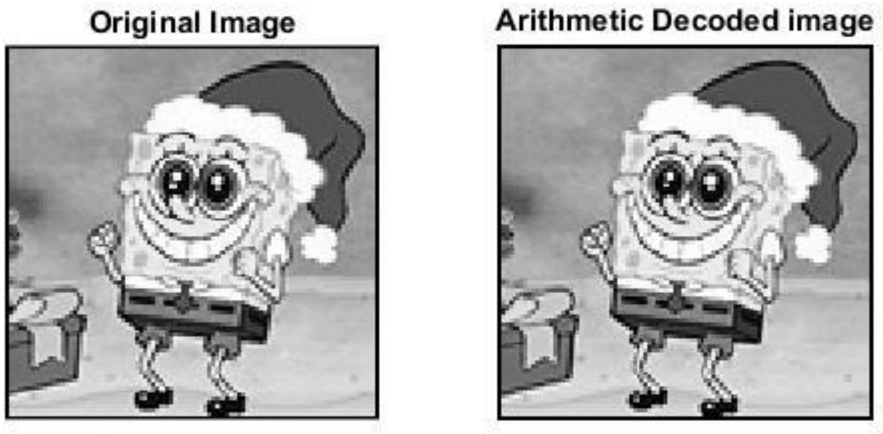
The minimum length required to code the image, i.e., minimum average bits per pixel is equal to the entropy itself.
Entropy = 7.4949, thus around 0.5 bits per pixel, i.e., 6.25% reduction in size possible
Entropy = 7.0911, thus around 1 bits per pixel, i.e., 12.5% reduction in size possible

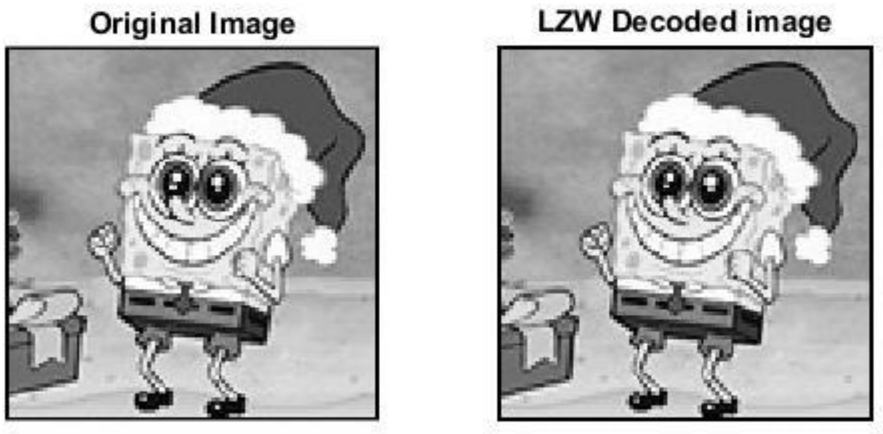
Original Image

Huffman Decoded image

Original Image

Golomb Decoded image



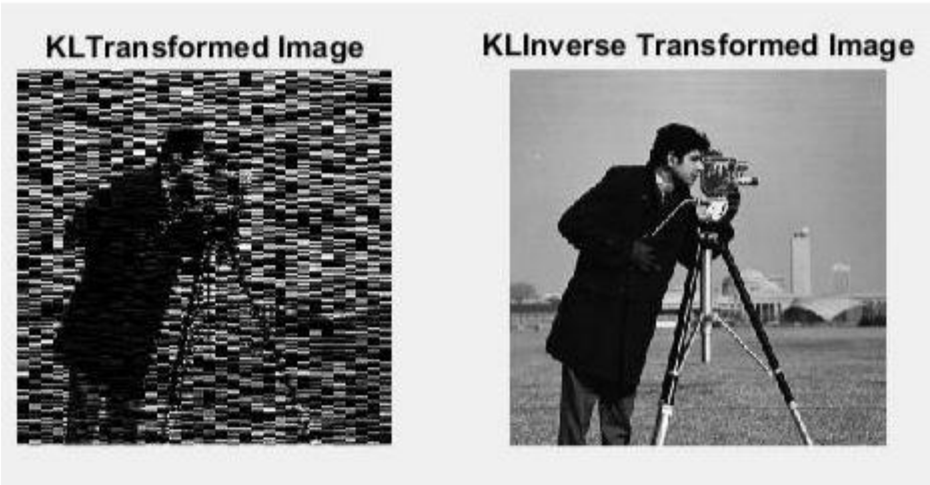




All these are lossless coding techniques and so we obtain the original image back
.

3. Transform Coding

(Code in q3.m)


Entropy=7.097




Entropy: 7.0097
Root Mean Square Error: 3.8647e-16
Signal to Noise Ratio : 302.6753

Entropy:7.0198
Root Mean Square Error : 0.0452
Signal to Noise Ratio: 21.3164

Entropy:7.1068
Root Mean Square error: 0.0536
Signal to Noise Ratio: 19.8354

KL transform is better at compression in terms of Mean square error as well as Signal to noise ratio but it is not preffered due to complication in implementation. The Fourier does not give good decompressed images. Discrete Cosine Transform is brother of Discrete Fourier transform which neglects the complex part of DFT assuming it exists in Conjugate pairs.

The DFT is widely used for general spectral analysis applications that find their way into a range of fields. It is also used as a building block for techniques that take advantage of properties of signals' frequency-domain representation, such as the overlap-save and overlap-add fast convolution algorithms.

The DCT is frequently used in lossy data compression applications, such as the JPEG image format. The property of the DCT that makes it quite suitable for compression is its high degree of "spectral compaction;" at a qualitative level, a signal's DCT representation tends to have more of its energy concentrated in a small number of coefficients when compared to other transforms like the DFT. This is desirable for a compression algorithm; if you can approximately represent the original (time- or spatial-domain) signal using a relatively small set of DCT coefficients, then you can reduce your data storage requirement by only storing the DCT outputs that contain significant amounts of energy.