# Multimedia and Video Communications (SSY150)
# Lab 2

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## Task 1

### 1

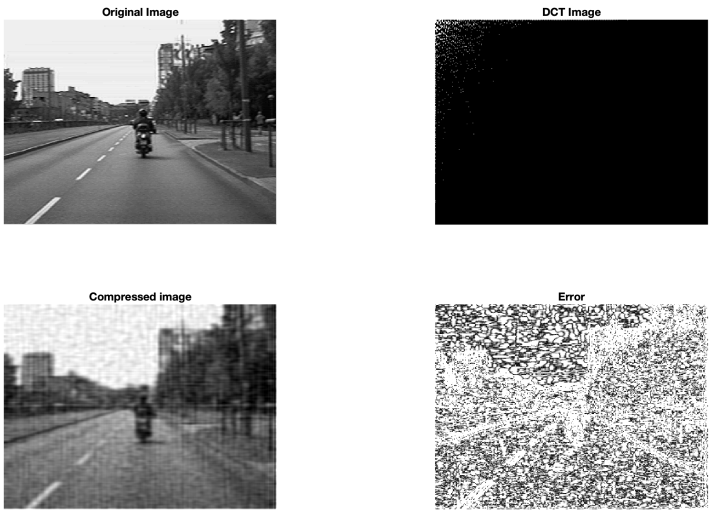


Figure 1:

Th = (0:98×$N1 \times N2$)
$Thfrom.avi = 75814$
$MSSIM = 0.587144221602508$
$PSNR = 23.929004331856653dB$

## lena.bmp Image

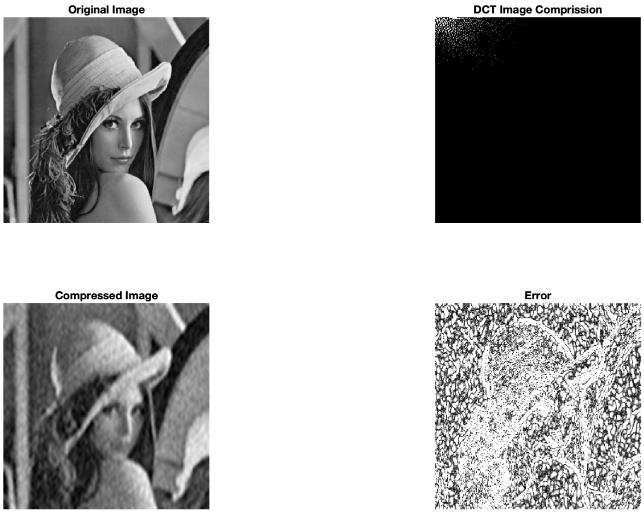


Figure 2:

$Th_{lena} = 64226$
$MSSIM_{lena}$=0.657896315974687
$PSNR_{lena}$= 24.233716419505060 dB

It was observed in both cases that, if the PSNR value is 30db or above, it is possible to reconstruct the exact image and there will be no much different between the original image and the compressed image. Hence, when the threshold value goes up, the of PSNR and MSSIM values will decrease and the compressed image quality will also decrease.

## Task 2

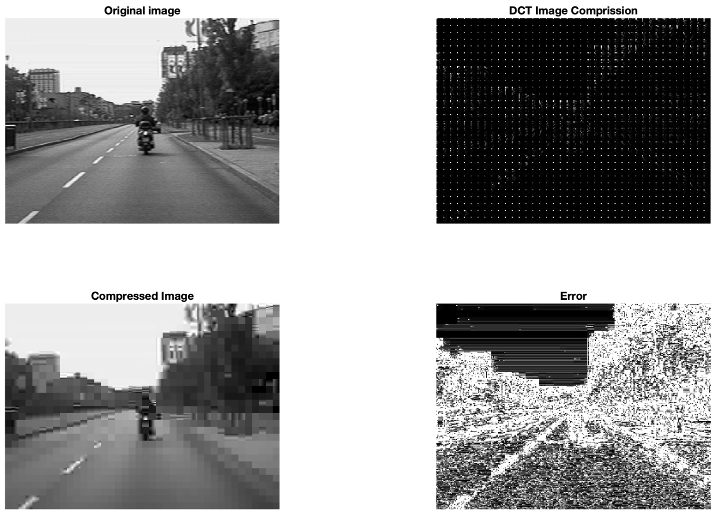


Figure 3:

th = 0.555150205713476
$MSSIM_2 = 0.660025365190771$
$PSNR_2 = 24.505583048376650$ dB

## lena.bmp Image

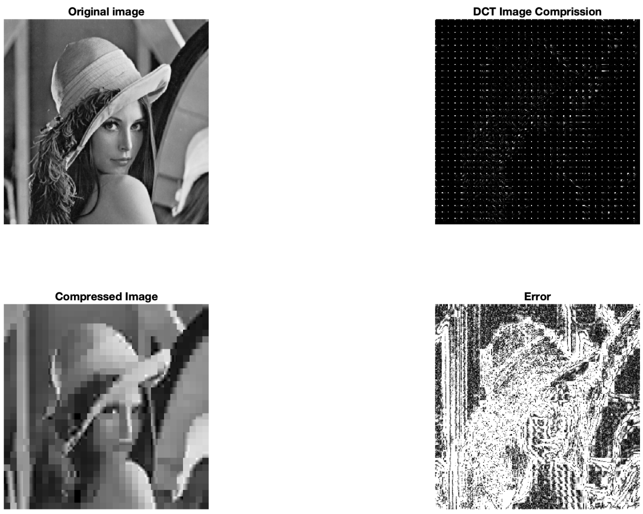


Figure 4:

TH lena = 0.695378151260504
$MSSIM_2$ lena = 0.608332343010488
$PSNR_2$ lena =22.66268963975991 dB

Based on the outputs, the quality in the block-base method as compared with Intra-mode is better, but there are some drops, or artifacts, in the image where the blur effect can be seen on the image as square blocks. This blurring seems to be increasing, as we increase the compression ratio.

## Task 3

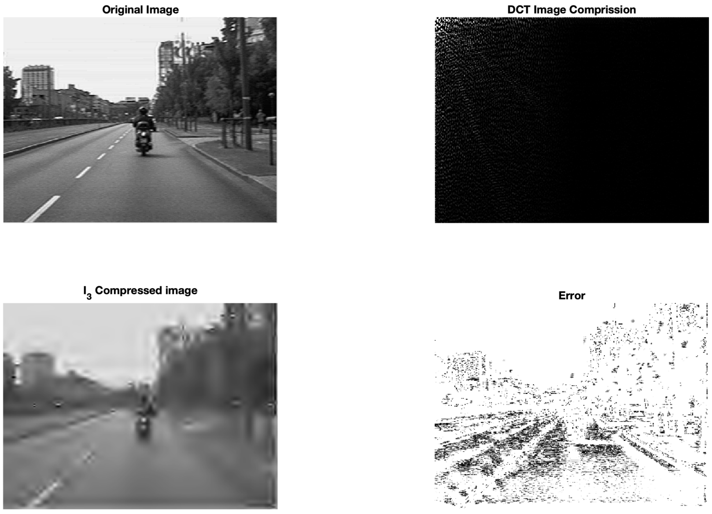


Figure 5:

The compression ratio 98%
Th= 210.5
$MSSIM_{wavelets} = 0.569298674063608$
$PSNR_{wavelets} = 19.210535136318500$ dB

$MSSIM_2 = 0.660025365190771$
$PSNR_2 = 24.505583048376650$ dB

## lena

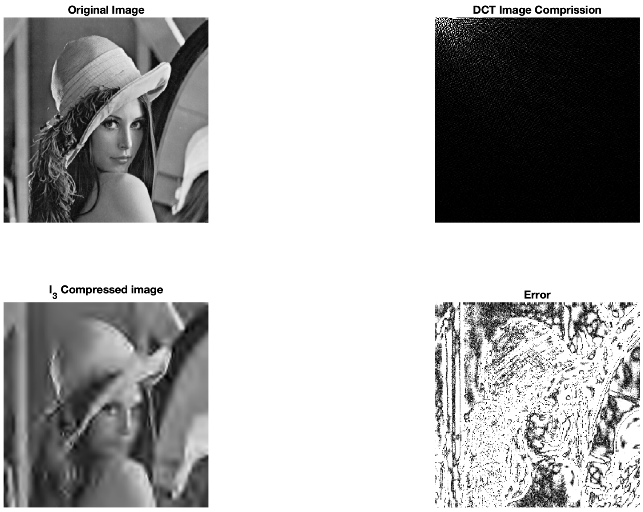


Figure 6:

The compression ratio 98%
Th = 171.3
$MSSIM_{wavelets} = 0.629436142937835$
$PSNR_{wavelets} = 22.144219723244795$ dB

$MSSIM_2$ lena = 0.608332343010488
$PSNR_2$ lena =22.66268963975991 dB

The quality in Wavelet is better because there are no pronounced block artifacts in the picture. There is a smooth region in back ground of the image. While in the block-based,the quality is lower and seems rather unpleasant, with visible artifacts.

## Task 5 and 6

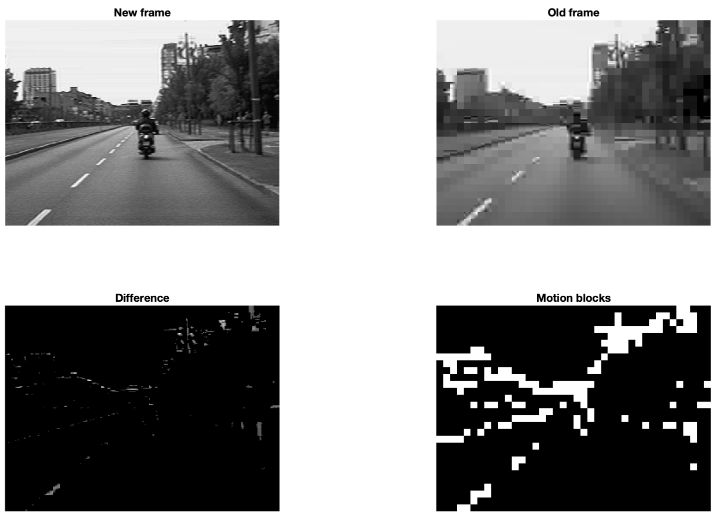


Figure 7:

Th = 0.250980392156863

# Task 7 and 8

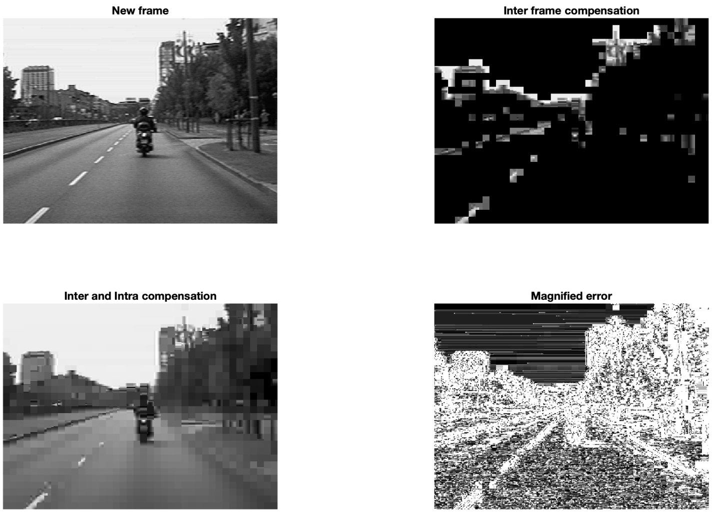


Figure 8:

PSNR= 23.063882093188862 dB
MSSIM= 0.640810198919975

# Task 9

REPORT

## 9.1

2D image compression is achieved by source coding. This is made up of the Transform, Quantization and Entropy coding. Transform removes redundancy in the data values. Video Compression is achieved by exploiting motion compensation using the I-frames, P-frames and B-frames. The steps are reduction of the resolution, motion estimation,Transform (DCT), quantization and entropy encoding.

## 9.2

The main criterion is high energy compaction in the transform domain. Low frequencies carry most of the energy, so reducing the energy of the high frequencies, will result in image compression.

## 9.3

- (a.) Yes, it is expected that Wavelet will be better than DCT.
- (b.) No. It was observed from our experiment that the reconstructed image quality from the DCT method is better than that from the wavelet method. It was assumed initially to be the other way round. Possible reason is that a lossy compression was performed with a very high compression ratio, of 98% . This will impact negative the quality of the reconstructed image.Basically,the lower the compression ratio, the better the quality of the reconstructed image, for a lossy compression.
- (c.) Yes. It was observed that if the threshold value is moved up, the quality of the compressed image becomes better, and increasing of the compression ratio value, the quality of the image goes down.
- (d.) DCT is used for lossy compression while Wavelet is used for both lossy and lossless compression. Here, Wavelet is used for lossy compression. The image retained its quality and the compression ratio of the image is the ratio of the non-zero elements considered in the original form to the non-zero elements in the compressed image. Wavelet image compression mostly relies on averaging as well as the differences in the values present in the image matrix that would be nearly sparse, and thus avoid block artifacts. Hence, the wavelet would generate better quality images. In general, wavelet is much better than DCT in 2D image compression.

## 9.4

In INTER mode, the P and B frames helps to achieve compression. The main information exploited for high compression is the similarity between frames in terms of pixels, or macro-blocks.

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## 9.5

Block Matching technique predicts the motion of a block of pixels between two frames in an image sequence. The prediction generates a pixel displacement or motion vector whose size is constrained by the search area.The complexity of the algorithm is determined by the search area. The best match can be chosen at the minimum mean square error (MSE), which for a full search is computed for each block in the search area.Motion compensation takes advantage of the significant information redundancy in the temporal domain by creating current frame predictions based upon block matching motion estimates between the current and previous image frames. Assuming 85% of the motion vectors should be best, or optimally compensated, then this is to find the best displacement vector block. The local search will not have to search through the whole area. This will be the displacement vector (d˙x,d˙y) that minimizes mean square error (MSE). Computational cost is efficient and quality is very good, since it is based on minimum MSE.

## 9.6

Local search method does not give the optimal solution at all times. It gives a partial solution, with less computational cost and reduced quality.Global search will always find the optimal solution, if there is one, with better quality but will be computationally expensive.