JPEG Compressor Documentation

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CODE OVERVIEW

Software Used: MATLab

Function: Split images into series of 8-by-8 matrix, performs DCT, quantize & display

How To Run

Step 1: Import All function files into MATLab file path.
Step 2: Import Lena image object [imgObj = 'lena512color.tiff'].
Step 3: Run the runCompression.m function, stating the quantization table pair you would like to use [runCompression(imgObj, 4)]

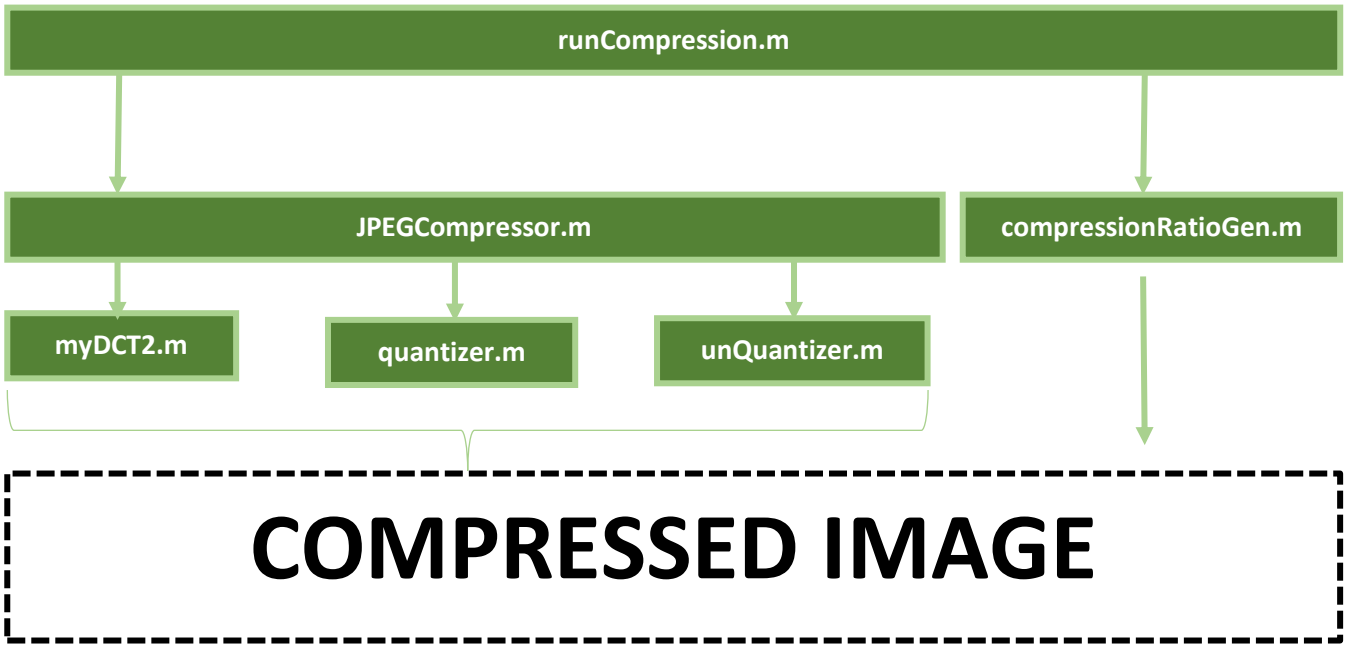

Fig. 1. Figure Showing my Different functions in MATLab and the How They Combine to Form The Code Flow

VALIDATING CODE ON BLACK AND WHITE IMAGE

Performing Transformation Coding on the **black and white** image with a quantization matrix of ones

```
Quantization Matrix  = [   1   1   1   1   1   1   1   1;
                           1   1   1   1   1   1   1   1;
                           1   1   1   1   1   1   1   1;
                           1   1   1   1   1   1   1   1;
                           1   1   1   1   1   1   1   1;
                           1   1   1   1   1   1   1   1;
                           1   1   1   1   1   1   1   1;
                           1   1   1   1   1   1   1   1   ];
```

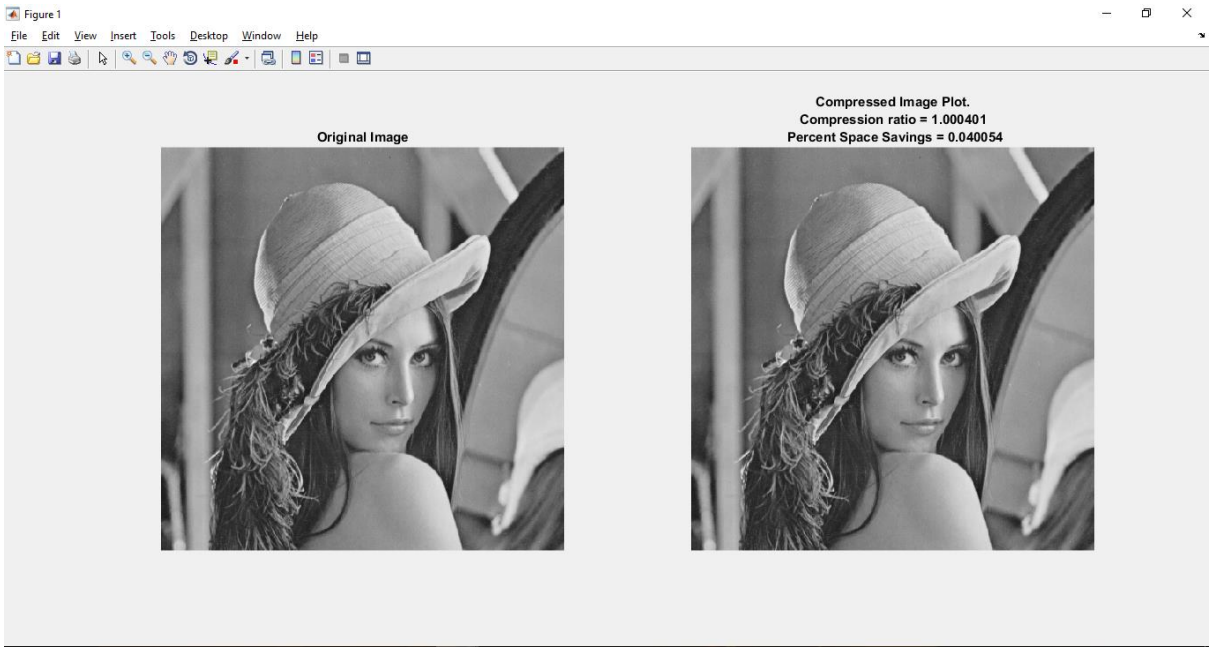

Fig. 2. Figure Showing Original vs Compressed Image Using Quantization Matrix of all 1s

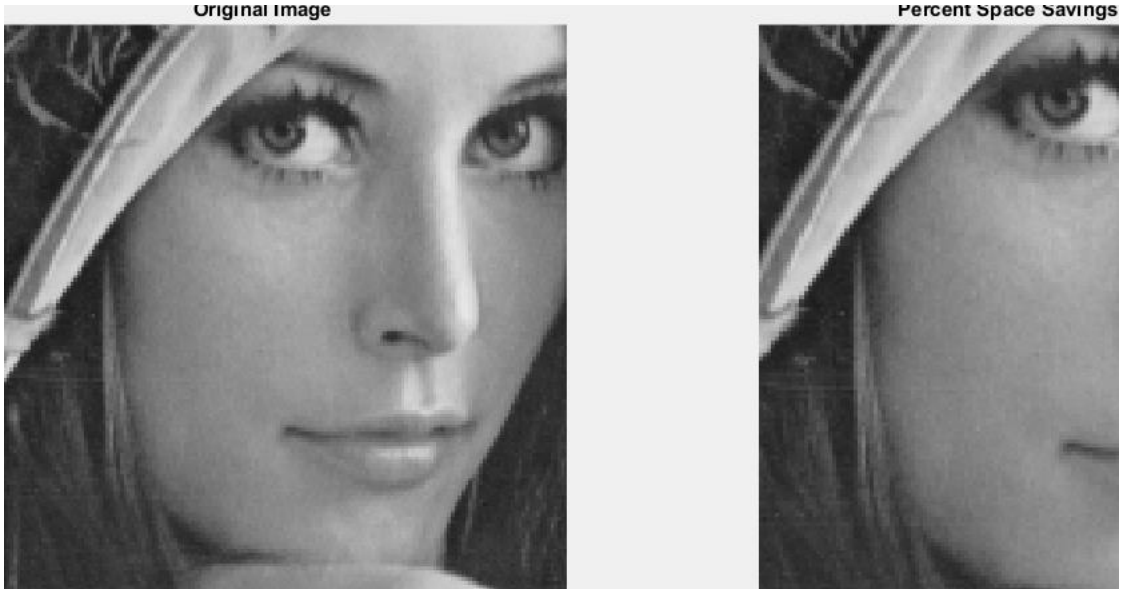

Fig. 3. Zoomed in Figure Showing Original vs Compressed Image Using Quantization Matrix of all 1s

Compression Ratio: 1

Comment: No compression happens when a quantization matrix of all ones is used

Performing Transformation Coding on the **black and white** image using the quantization matrix declared below

```
Quantization Matrix  = [   32 33 51 81 66 39 34 17;
                           33 36 48 47 28 23 12 12;
                           51 48 47 28 23 12 12 12;
                           81 47 28 23 12 12 12 12;
                           66 28 23 12 12 12 12 12;
                           39 23 12 12 12 12 12 12;
                           34 12 12 12 12 12 12 12;
                           17 12 12 12 12 12 12 12    ];
```

Fig. 2. Figure Showing Original vs Compressed Image Using the Above Quantization Matrix

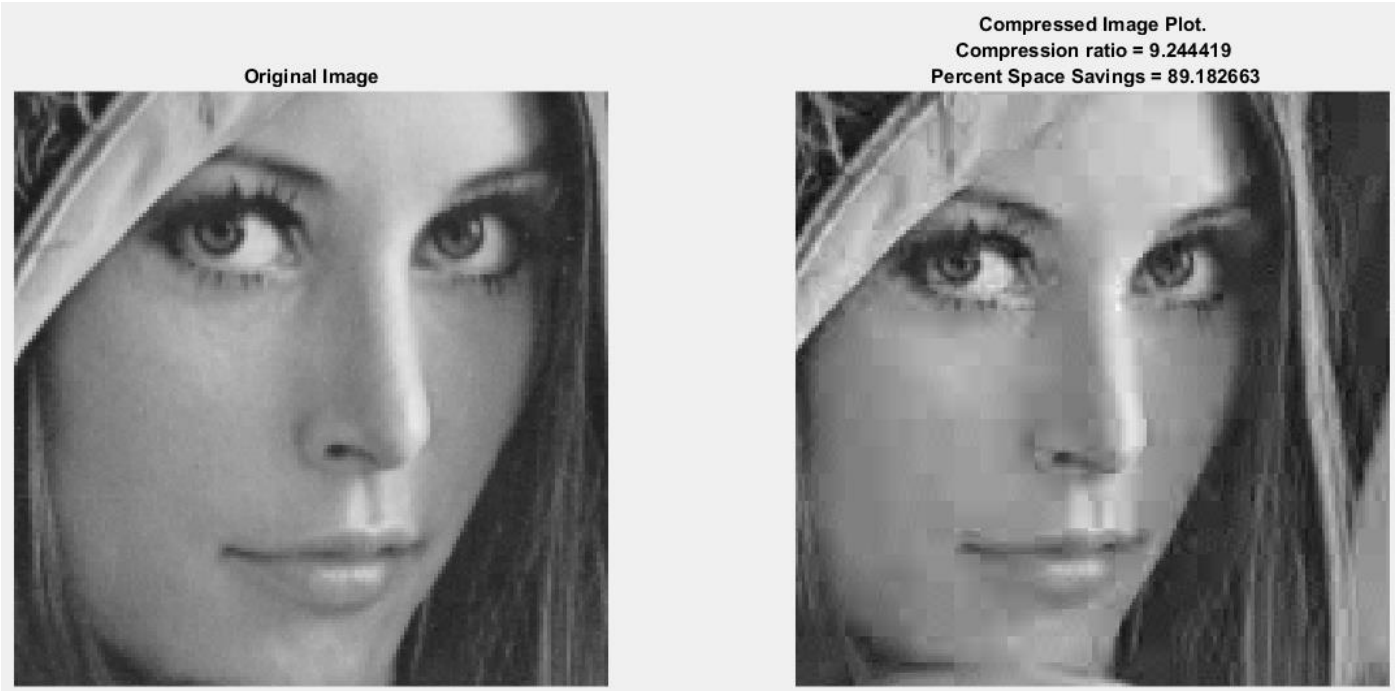

Fig. 3. Zoomed in Figure Showing Original vs Compressed Image Using the Above Quantization Matrix

Compression Ratio: 9

Comment: With JPEG, for a compression ratio of about 9:1, the image quality still looks good **from afar**, but however, when we zoom in closely, we can see the effect of the compression (loss of details), especially in high frequency areas.

APPLY TRANSFORMATION CODING TO THE COLOURED IMAGE

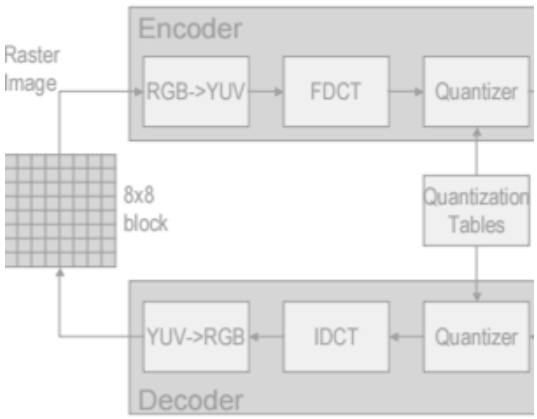

Fig. 4. Block Diagram of The Colour Image Compression Process

JPEG Standard Quantization Table pairs used where gotten from [2].

1. Performing Transformation Coding on the **coloured** image with a quantization matrix of ones

Quantization Matrix = [1 1 1 1 1 1 1 1;
1 1 1 1 1 1 1 1;
1 1 1 1 1 1 1 1;
1 1 1 1 1 1 1 1;
1 1 1 1 1 1 1 1;
1 1 1 1 1 1 1 1;
1 1 1 1 1 1 1 1;
1 1 1 1 1 1 1 1];

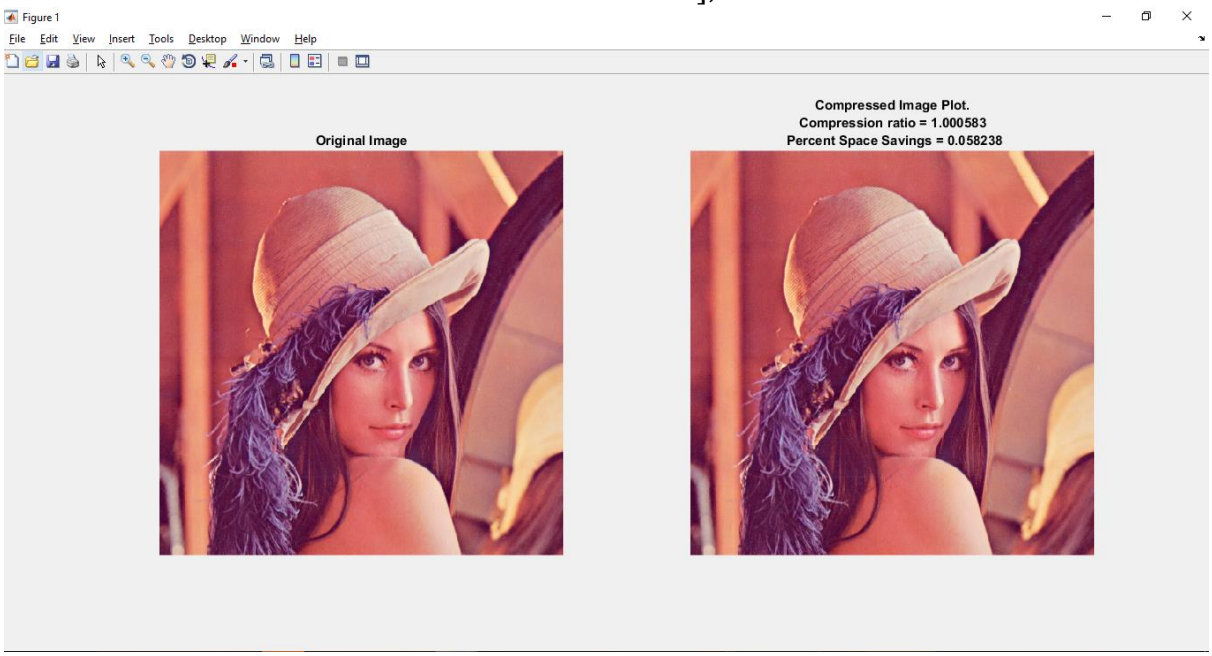

Fig. 5. Figure Showing Original vs Compressed Image Using the Above Quantization Matrix

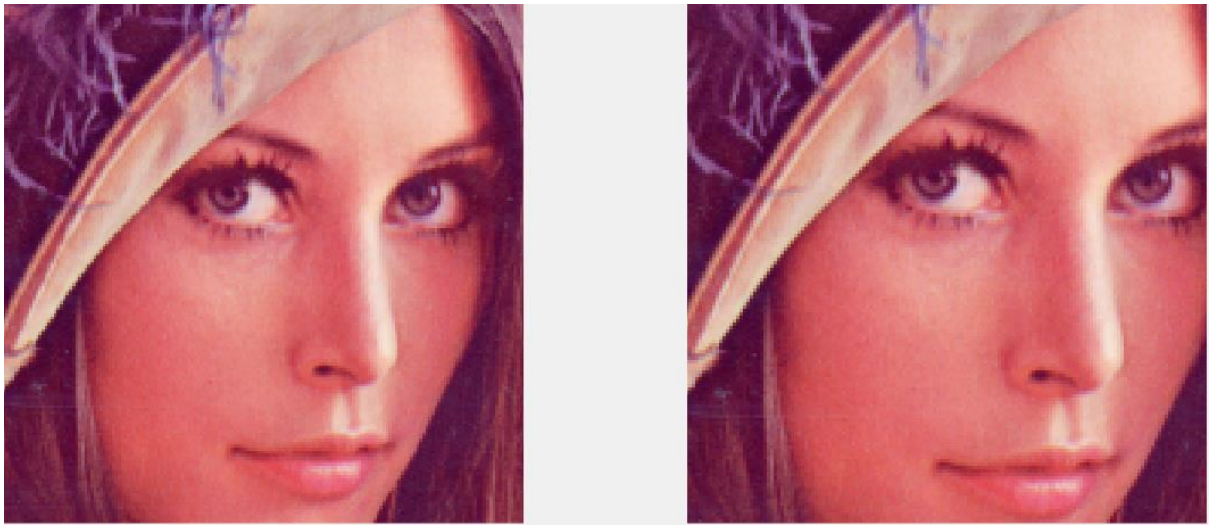

Fig. 6. Zoomed in Figure Showing Original vs Compressed Image Using the Above Quantization Matrix

Compression Ratio: 1

Comment: No compression happens when a quantization matrix of all ones is used

2. Performing Transformation Coding on the **coloured** image using transformation coding with a quantization matrix of ones

Luminance Quantization Table =

```
[   32 33 51 81 66 39 34 17;
    33 36 48 47 28 23 12 12;
    51 48 47 28 23 12 12 12;
    81 47 28 23 12 12 12 12;
    66 28 23 12 12 12 12 12;
    39 23 12 12 12 12 12 12;
    34 12 12 12 12 12 12 12;
    17 12 12 12 12 12 12 12   ];
```

Chrominance Quantization Table =

```
[
    34 51 52 34 20 20 17 17;
    51 38 24 14 14 12 12 12;
    52 24 14 14 12 12 12 12;
    34 14 14 12 12 12 12 12;
    20 14 12 12 12 12 12 12;
    20 12 12 12 12 12 12 12;
    17 12 12 12 12 12 12 12;
    17 12 12 12 12 12 12 12   ];
```

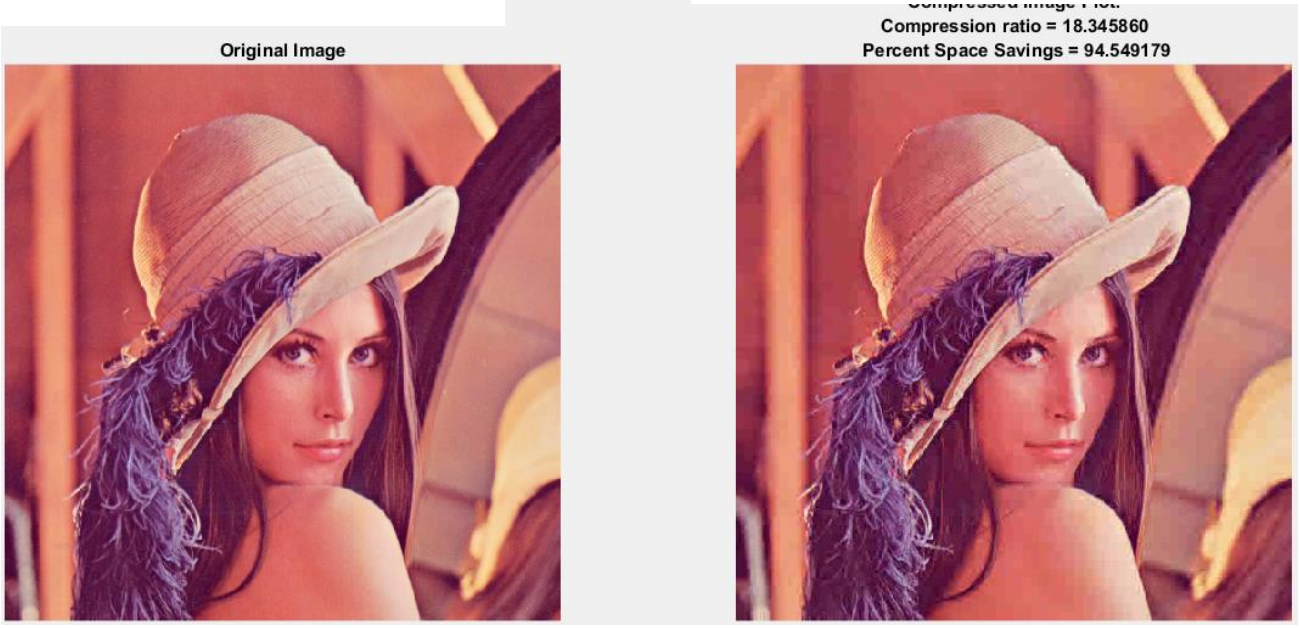

Fig. 7. Zoomed in Figure Showing Original vs Compressed Image Using the Above Quantization Matrix

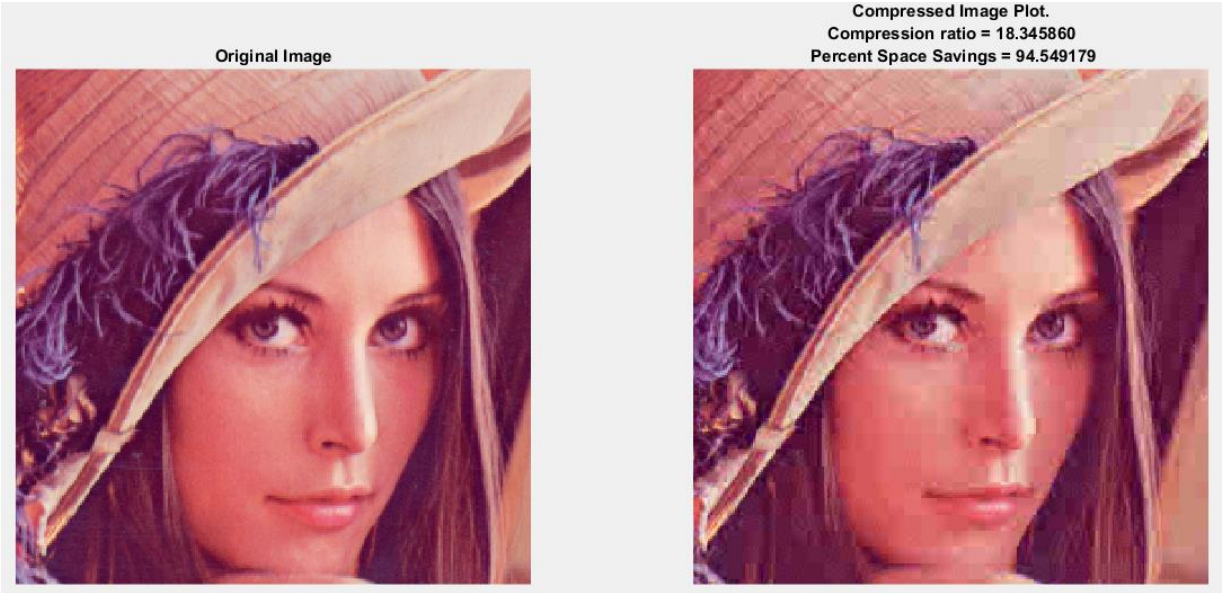

Fig. 8. Zoomed in Figure Showing Original vs Compressed Image Using the Above Quantization Matrix

Compression Ratio: 18

Comment: It is evident that for JPEG, a compression ratio of 18 affects the image, causing losses of high frequency components in the image.

3. Performing Transformation Coding on the **coloured** image using transformation coding with the quantization matrix pairs below

```
luminanceQuantizationTablePair =
[       1 1 1 1 1 1 1 2;
        1 1 1 1 1 1 1 2;
        1 11 1 1 1 2 2;
        1 1 1 1 1 2 2 3;
        1 1 1 1 2 2 3 3;
        1 1 1 2 2 3 3 3;
        1 1 2 2 3 3 3 3;
        2 2 2 3 3 3 3 3         ];
```

```
chrominanceQuantizationTable =
[       1 1 1 2 3 3 3 3;
        1 1 1 2 3 3 3 3;
        1 1 2 3 3 3 3 3;
        2 2 3 3 3 3 3 3;
        3 3 3 3 3 3 3 3;
        3 3 3 3 3 3 3 3;
        3 3 3 3 3 3 3 3;
        3 3 3 3 3 3 3 3         ];
```

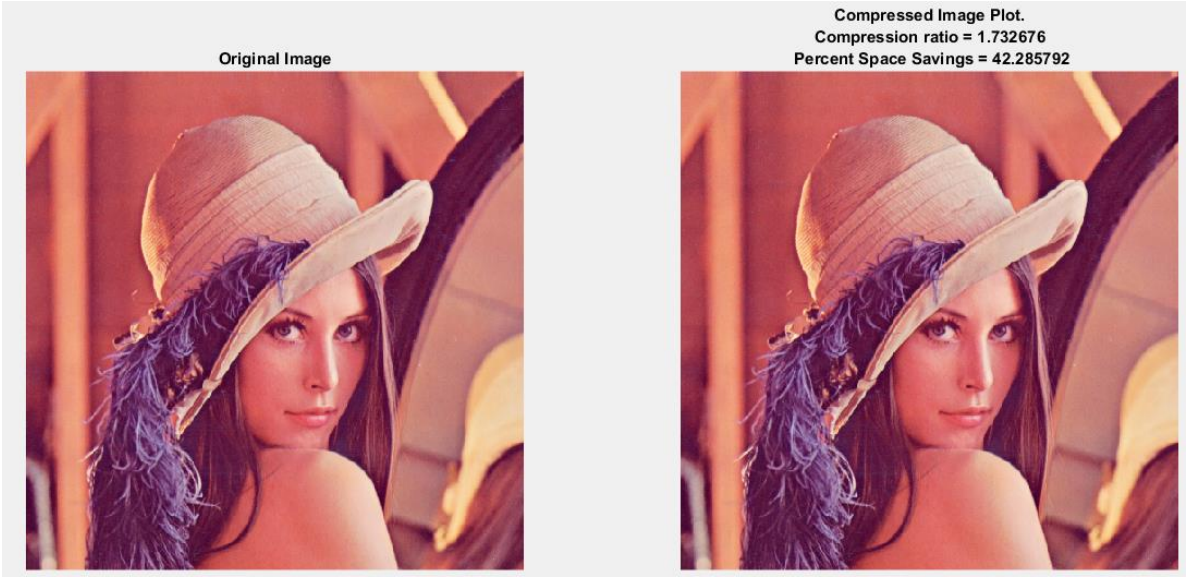

Fig. 9. Zoomed in Figure Showing Original vs Compressed Image Using the Above Quantization Matrix

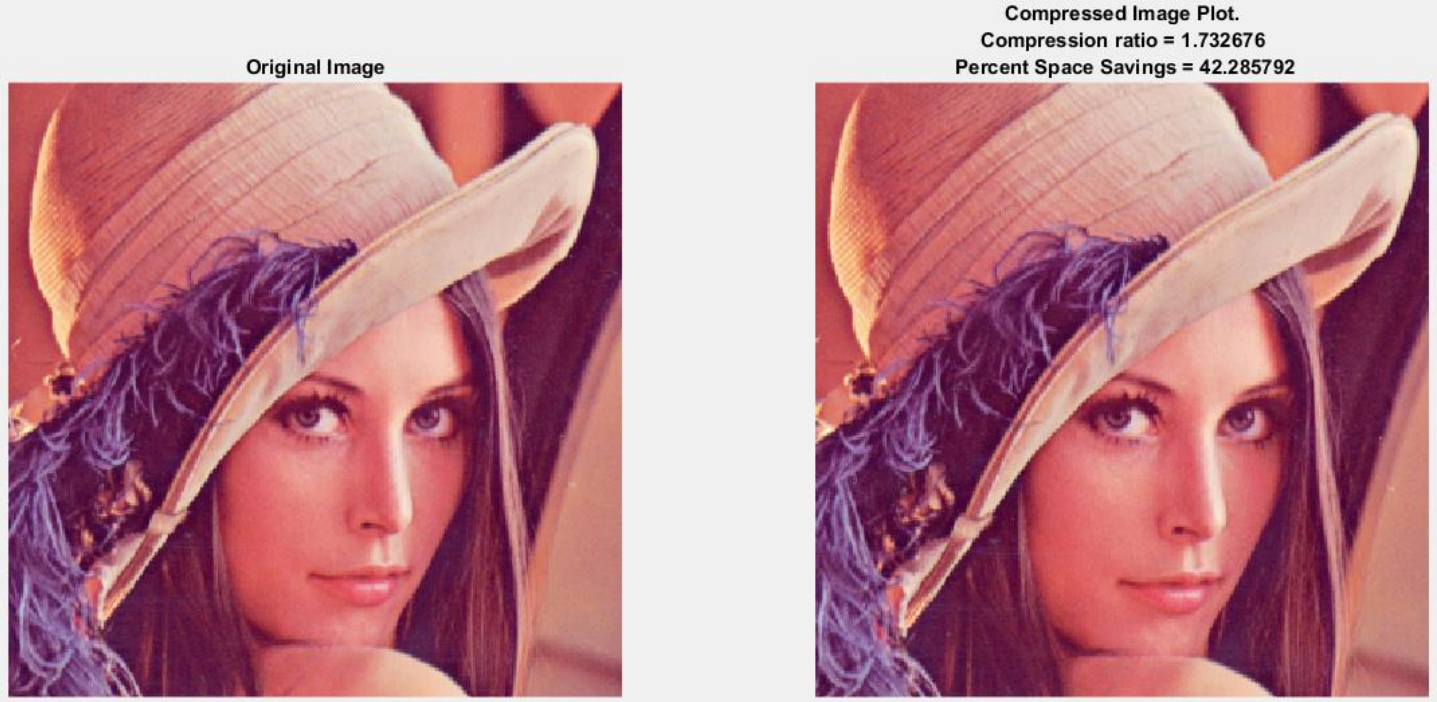

Fig. 10. Zoomed in Figure Showing Original vs Compressed Image Using the Above Quantization Matrix

Compression Ratio: 2

Comment: The image still retains most of its high frequency components/ This is especially since the values in the quantization table used are closed to one

Final Comments:

It is difficult for the human eye to detect missing high frequency components. JPEG compression applies Discrete Cosine Transforms (DCT) which help sift out high frequency components from the image. Except the compression levels very high, the image still appears proper to the eye. JPEG can withstand a compression ratio of close to about 16 before very evident loss in detail can begin to be seen. It is a very good and recommendable compression standard.