Report for Question 2 **Date: February 27, 2019**
Assignment 2 [MM802] **Submitted by: 1591212**

Problem Overview

Analyzing the results demonstrated by the images after decompression on applying different values of quantization factor 'L' and comparing them to the original images before compression. Using a client-server setup compression techniques (DCT, quantization, RLC) are performed at the client side, then a compressed image is sent to server through TCP-IP and finally decompression is performed on the server side.

Objectives

- Finding Mean Square Error between the original image before compression and the image obtained after decompression for all values of 'L'
- Number of received bytes at the server side for all values of 'L'
- Displaying the images at the server side for all values of 'L'

Why is compression done?

Compression of image implies reducing the number of bytes being transferred via the network. By doing this we ensure that we do not consume more network resources (that is required for transferring more bytes); we try to overcome this drawback by sending a good enough image with errors that are not perceived by human visual system. Although, here we are compressing for all values of 'L' from 1 to 8; in practical real life scenarios, we only compress it so much that it is not as evident to human eye. Therefore we do workaround for finding the solution without compromising on image quality received by the receiver(not evident to human eye).

Explanation of the code

Note: The comments in both server_code.m and cliemt_code.m are written to help you understand my code.

Client Side

1. Compression techniques
    a. Discrete Cosine Transform(DCT)
    b. Quantization: There is a global variable 'L' which should be changed every time (L= 1 to 8).
    c. Run Length Coding: As this takes a vector, it needs a zig zag scan technique which acts as prerequisite for Run Length Coding.
2. Establishing connection with the server using TCP-IP

Server Side

1. Establishing connection with the client using TCP-IP and receiving the client's image vector
2. Decompression techniques
   a. Inverse RLC followed by inverse zigzag
   b. Inverse DCT
3. Computing Mean Square Error
4. Displaying the decompressed image

Result Evaluation

The following table shows the relation between the 'L factor', 'Mean Square Error' and 'Received Bytes at the server's side'

L Factor	Mean Square Error	Bytes Received
1	17846.9152	32768
2	17844.1246	114176
3	17842.9153	228352
4	17842.2571	375296
5	17841.81	555008
6	17841.5277	767488
7	17841.3241	1012736
8	17841.1758	1048576

The following graph shows the 'Mean Square Error' vs 'L factor'

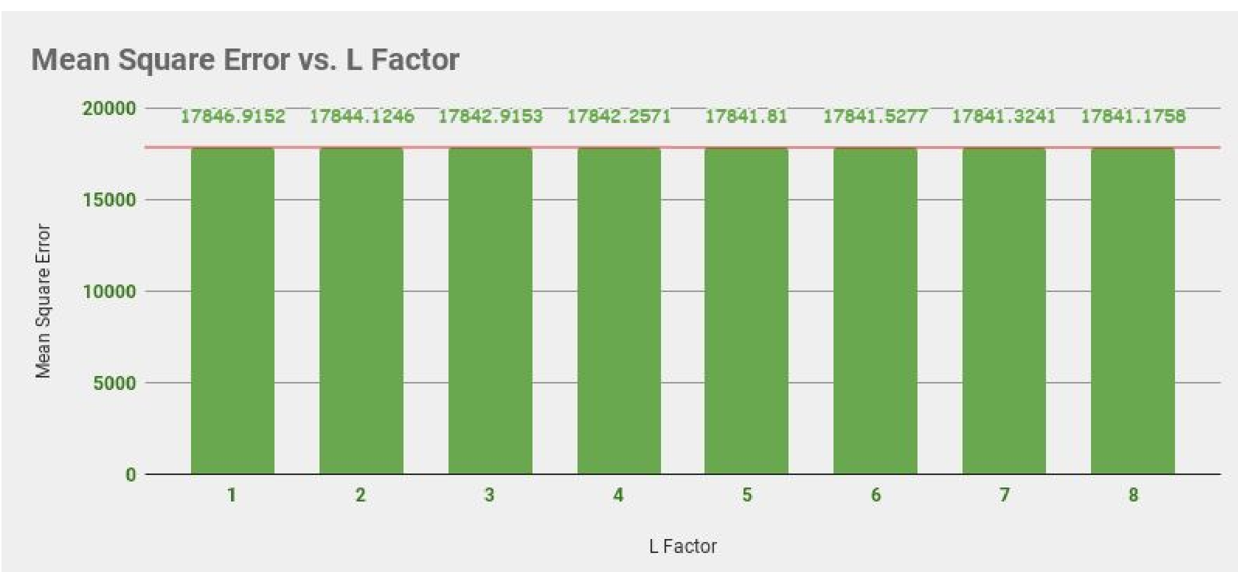

Fig a

The following graph shows the relation between ‘Received Bytes’ vs ‘L factor’

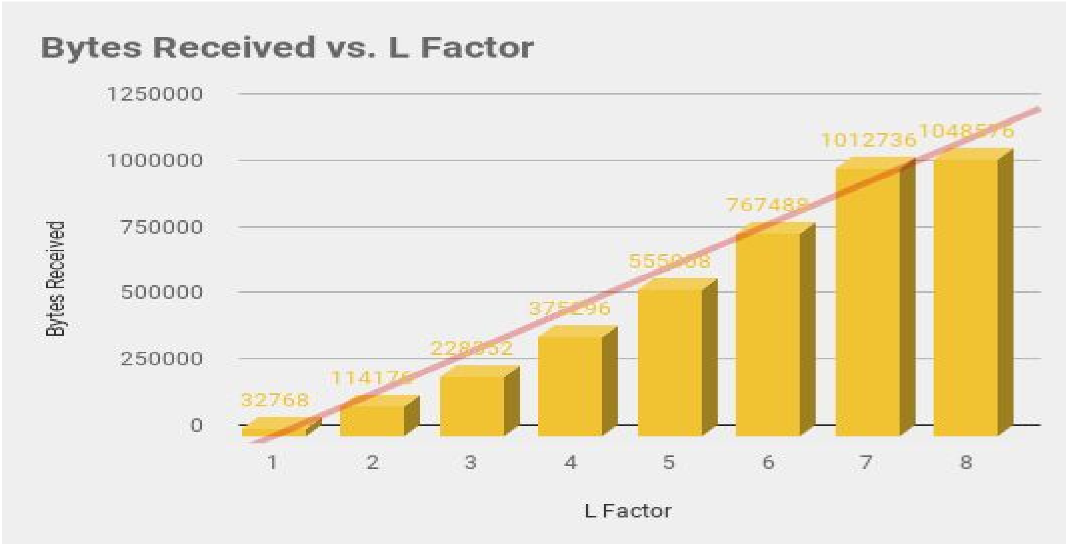

Fig b

Inference

We can conclude that:

- L is inversely proportional to Mean Square Error (Fig a); however as the decrease is very less the graph appears to be linear. On the contrary, it is decreasing graph which means ‘with increasing value of L the Mean Square Error will decrease’.
- L is directly proportional to Bytes Received (Fig b); which means ‘with every increasing value of L even the received bytes increases. We can conclude that more the compression, lesser the bytes will be received at the server side(L=1) and lesser the compression, more bytes will be received at the server side(L=8).
- Approximately until L=4, the human eye may not notice the difference caused due to compression in this case.

Important Note: The Outputs of decompressed image for all values of L received at the server side has been saved in the ‘Received_Images_for_all_L_Values’ folder in the qs2 of the submitted assignment folder.

Acknowledgement

[1] MATLAB Documentation: https://www.mathworks.com/help/

I have taken clues from mathworks documentation and have reconstructed the code to suit the requirements of the question.