

Question I [6 pts]

Consider the transmission of digital images with a resolution of 720×576 . If we use a 2 Mbit/s transmission channel, answer the following:

1. Considering that the transmission channel is available during 10 s, how many complete black and white images can be transmitted without any compression?
2. How many complete grey scale images can be transmitted, in the same 10 s, if images with 256 grey levels are used?
3. Consider now 24-bit colored images with a 4:2:0 subsampling schema., how many complete images can be transmitted still in the same 10 s?

Question II [12 pts]

Given the following piece of a grayscale image that we want to compress, answer the following:

99	99	99	99	99	99	99	99
20	20	20	20	20	20	20	20
0	0	0	0	0	0	0	0
0	0	50	50	50	50	0	0
0	0	50	50	50	50	0	0
0	0	50	50	50	50	0	0
0	0	50	50	50	50	0	0
0	0	0	0	0	0	0	0

1. What is the entropy of the image?
2. If no compression is used, how many bits is needed to encode each pixel? and what is the efficiency of this coding?
3. Apply the RLE compression method and calculate the size of the compressed image.
4. Construct the Huffman tree to encode the above image.
5. Calculate the average bits per pixel and the efficiency of your codes.
6. Suppose now that we want to quantize the image in which each pixel will be coded on 2 bits instead of 8.
 - a. What is the resultant image? and its entropy?
 - b. Construct new Huffman codes, calculate the average bits per pixel and the efficiency of the codes.

Question III [6 pts]

1. Suppose we have the following alphabet of symbols {a, b, c}. Using the ASCII code of each symbol (a is 97, b is 98, c is 99), compress the message "a b b a c c c a b c" using the LZW algorithm.
2. Decode the following message 97 98 256 97 99 259 97.

Question IV [6 pts]

Given the below piece of image, apply the Floyd-Steinberg algorithm for dithering (error-diffusion method) in order to transform the piece of image into a black and white image.

128	64	46	128
128	32	64	160
32	16	12	32
4	31	40	32

Piece of image for dithering



Error distribution schema