EQ2330 – Image and Video Processing

Assignment 7

The following preparation assignment is to be solved before the next exercise session indicated by the due date of the assignment. You bring your solution to the exercise session and one of your peers will correct it during that session. After that you will discuss the correction with your peers and resolve any open questions. If necessary, the teaching assistant can help you. It is required to solve all the assignments and correct at least one peer solution of each assignment in order to pass the course.

Problem

The baboon image of Figure 1 has four (4) shades of gray. Its size is 512x512 pixels. The empirical probabilities of the gray levels are $p(0) = 0.0797$, $p(1) = 0.3786$, $p(2) = 0.4792$, $p(3) = 0.0625$.
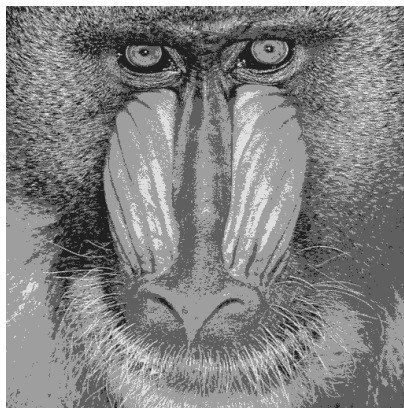

Figure 1: Baboon image.

1. How many bits are required to store or transmit the entire image with the same codeword length for all pixels?

2. What is the entropy of the image on a per pixel basis?

3. Forget the baboon for a minute. Describe the image type that is most difficult to encode if you require lossless decodability. Explain why. *Hint: Note that there are two aspects to this question.*

4. We now want to code the baboon again. Using only the information that you have, it is possible to design a code that has a lower average codeword length than the code used in 1. Design such a code and compare its average codeword length to the entropy of the image.

5. Does the Kraft inequality hold for your code?