Technische Universiteit
Eindhoven
University of Technology

Practical assignment 5LSE0

Supervisor:
Matthijs Zwemer

m.zwemer@tue.nl

Practical assignment

- 7 exercises
- Programming in MATLAB
- Motivate your answers **and** implementations
- Individual exercises, working together is **not** allowed!
- Also provide the MATLAB code to each exercise

Grading

- Grade between 0 – 10
- 30% of your final grade

- Assignments may be personalized!
  - Only use exercises provided by the supervisor via mail.
  - Do not use assignments or images given to other students.
- Plagiarism will result in an unsatisfactory grade.

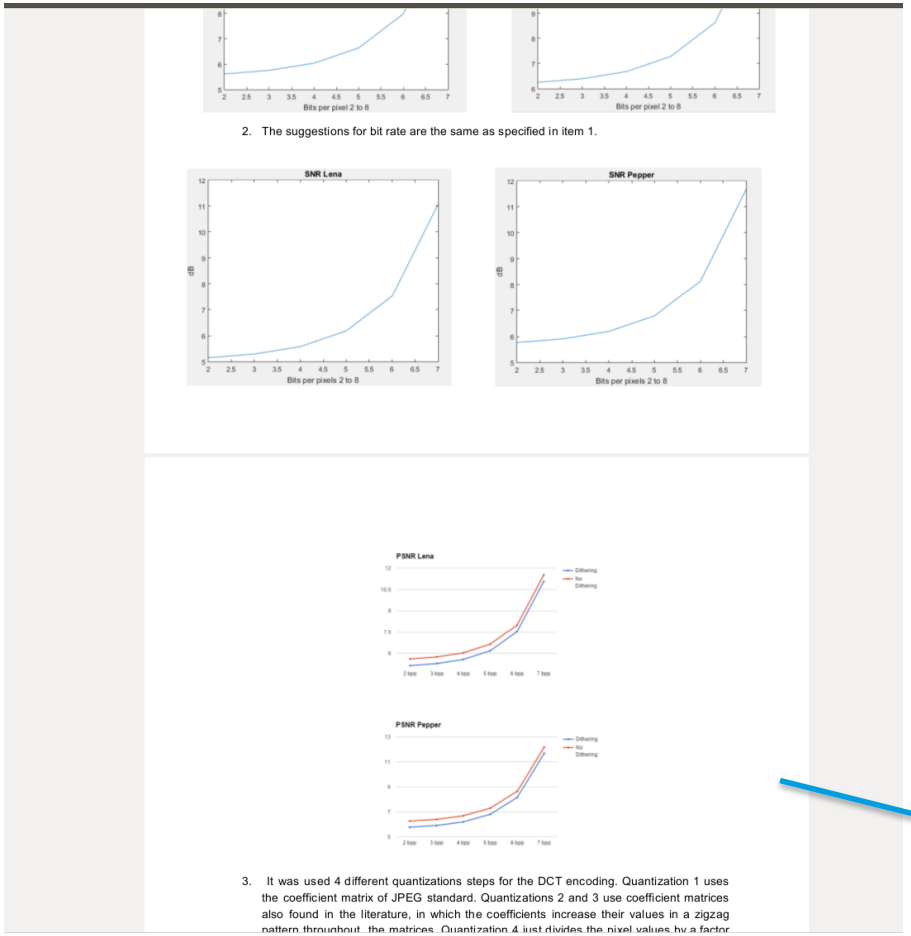
Starting

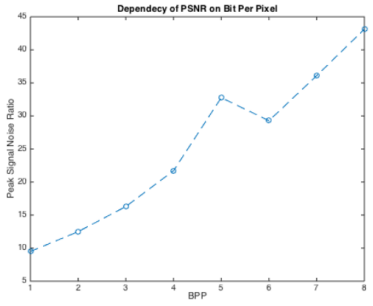
- Exercises can be obtained by responding to an email from the assignment supervisor. (will be send this afternoon)
- m.zwemer@tue.nl

Deadline: April 20th, 2018

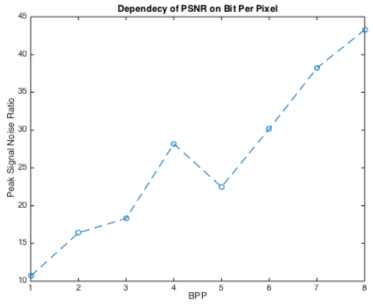
- All results should be summarized in a (digital) report.
- Code should be provided as an attachment.
- **Once handed in, no changes are allowed**

What you should prevent





(a) lena with 2^n



(b) peppers with 2^n

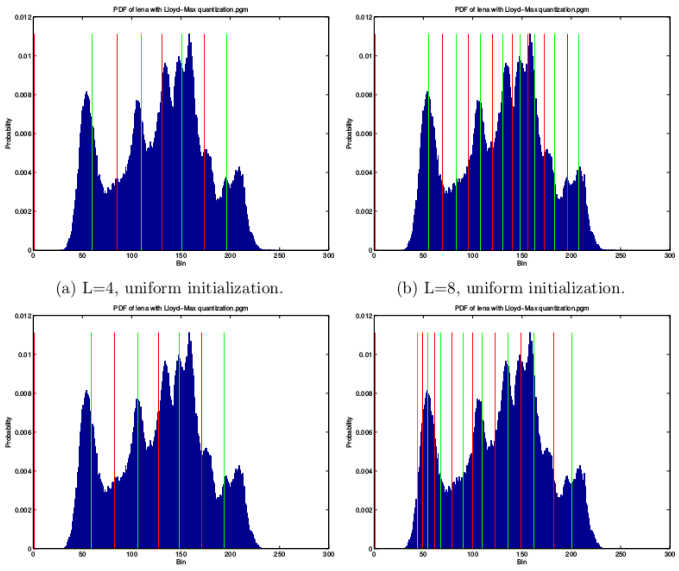
Results that are theoretically impossible, yet presented as if logical

Results without any explanation … will get 0 points …

Examples of good reports

5.1 Probability Density and Initial Conditions

Figure 16 shows four different solutions of the LMQ on top of the PDF of lena, where the red lines are the decision levels t_k and the green lines are the representation levels r_k. First, we analyze the difference between $L = 4$ and $L = 8$. It is clear that using eight levels approximates the PDF a lot better than if only four levels are used; the representation levels are all on high peaks of the PDF for L=8.



(a) L=4, uniform initialization. (b) L=8, uniform initialization.

(c) L=4, 1:L initialization. (d) L=8, 1:L initialization.

Figure 16: PDF of lena at both L=4 and L=8 with different initializations.

Next, we analyze the influence of different initial conditions of the LMQ algorithm. We used two types of initialization of t_k: (1) uniform quantization, as if we would quantize the image without using the PDF; and (2) $1 : L$ initialization, the initial decision levels are placed at 1

(a) Lena 2 bpp. (b) Lena 3 bpp. (c) Lena 4 bpp. (d) Lena 5 bpp.

Figure 1: PCM encoding with different number of bpp on 'lena.pgm'.

(a) Peppers 2 bpp. (b) Peppers 3 bpp. (c) Peppers 4 bpp. (d) Peppers 5 bpp.

Figure 2: PCM encoding with different number of bpp on 'peppers.pgm'.

To have a metric for the image quality (both mathematical and quantitatively), the Signal-to-Noise Ratio (SNR) can be used. Equation 1 is used to calculate the SNR of each encoded image, where $s(n)$ represent the pixels values of the original image and $\hat{s}(n)$ represent the pixel values of the encoded image. The SNR has been calculated (figure 3) for both the lena as the peppers image and from 2 bpp to 7 bpp. These lines are almost linear on a logarithmic scale, which translates to exponential growth of the SNR on a linear scale.

$$SNR = \frac{E\{(s(n))^2\}}{E\{(s(n) - \hat{s}(n))^2\}} \quad (1)$$

Motivation

Clear visualization of results

Well structured

To summarize

- Respond to the supervisors' email to get your assignment
- Assignments are personal and may have slight variations
- Make sure your report and code are well structured and readable

Questions can be directed to the supervisor, who's contact details will be listed on the assignment.

Good luck!