INFO-H516 - Visual Media Compression

Exercises: Image and Video Compression

Image Data: https://links.uwaterloo.ca/Repository.html or 1 frame of a video content in video data
Task 1: Simulate an image encoder and decoder: Apply block-based coding; Implement DCT and Inverse-DCT per block; Implement Quantization and inverse-Quantization per block; Implement zigzag and inverse zigzag scan per block (optional); Implement entropy encoding/decoding (optional).

> Control the compression rate by changing the quantization table and draw a rate-distortion curve (PSNR vs data size or quantization scale) for objective evaluation, and discuss the obtained results subjectively.

Video Data: https://media.xiph.org/video/derf/
Use one video content of your choice for all following tasks
Task 2: Simulate a video encoder and decoder using all I-picture: Consider a Group of Pictures (GOP) consists of several frames, i.e. I-I-…-I. For each I-picture, apply task 1.

> Control the compression rate by changing the quantization table and draw a rate-distortion curve (PSNR vs BitsPerSecond or quantization scale) for objective evaluation, and discuss the obtained results subjectively.

Task 3: Simulate a video encoder and decoder using D-picture: Consider a Group of Picture (GOP) consists of several frames, i.e. I-D-…-D. For each I-picture and D-picture, apply task 1.

> Discuss how the size of the Group of pictures impacts the compression quality. Discuss impact the compression quality when D-picture is calculated with respect to I frame or sequentially. For a fixed size of GOP, control the compression rate by changing the quantization scale and draw a rate-distortion curve for objective evaluation, and discuss the obtained results subjectively. Discuss how the quantization is different for I-picture and D-picture.

(optional) Task 4: Simulate a video encoder and decoder using P-picture: Consider a Group of Pictures (GOP) consists of several frames, i.e. I-P-…-P. For each I-picture and P-picture, apply task 1. Note that when calculating P-picture, you need to encode and decode the MV per block.

> Discuss how the size of the Group of pictures impacts the compression quality. Discuss impact the compression quality when P-picture is calculated with respect to I frame or sequentially. For a fixed size of GOP, control the compression rate by changing the quantization table and draw a rate-distortion curve for objective evaluation, and discuss the obtained results subjectively. Discuss how the quantization is different for I-picture and P-picture.

(optional) Task 5: Compare your codecs for image and video with existing codec, objectively and subjectively: Image compression by JPEG and/or JPEG2000; and Video compression by h.264 and/or h.265.