

Exercise 1: Typical Compression Factors for Media Files

Determine typical compression factors for media files you use every day. Choose one or more examples for the following categories:

- **Images:** Pictures (JPEG) taken with your smartphone
- **Audio:** Songs (MP3 or AAC) you listen
- **Video:** Videos (AVC or ...) you captured or downloaded

Determine the compression factors by

- Measuring the file size
- Calculating the raw data rate, based on
 - for images: image size, color format, and bits per sample
 - for audio: duration, sampling rate, and bit depth
 - for video: duration, frame rate, picture size, color format, bits per sample

Exercise 2: Compare Lossy and Lossless Image Compression

- 1 Choose one or more of the raw image files (PPM format) provided at the course web site:
<http://iphome.hhi.de/schwarz/DC.htm>
- 2 Compress the file(s) with a general lossless compression tool (such as zip, rar, ...) and measure the compression factor
- 3 Convert the file(s) into the PNG format and measure the compression factor
- 4 Convert the file(s) into the JPEG format and measure the compression factor
- 5 Can you see a difference between lossy and lossless compression?

The conversion into PNG and JPEG can be done with any suitable software. One example is ImageMagick (available for Window, Linux, MacOS):

- Available at <https://www.imagemagick.org>
- Conversion from PPM to PNG: `convert test.ppm test.png`
- Conversion from PPM to JPEG: `convert test.ppm test.jpg`

Exercise 3: Analysis of JPEG Compression

- Choose one or more of the raw image files (PPM format) provided at the course web site:
<http://iphome.hhi.de/schwarz/DC.htm>
- Compress the image using JPEG with varying quality parameter ($Q = 1..100$)
with image magick, you can use the following command line
`convert -quality (Q) test.ppm test.jpg`
- What effect has the quality parameter on
 - compression factor / file size
 - reconstruction quality
- Up to which compression factor
 - you cannot distinguish the compressed and the original image
 - does the compressed image looks acceptable
- What kind of compression artefacts do you observe in highly compressed JPEG images?

Exercise 4: Calculus of Probabilities

Repeat the basics of the calculus of probabilities:

- Axiomatic Definition of Probability
- Conditional Probability
- Independence of Events
- Random Variables
- Expectation Values