Report - Lab 1 Video Encoding

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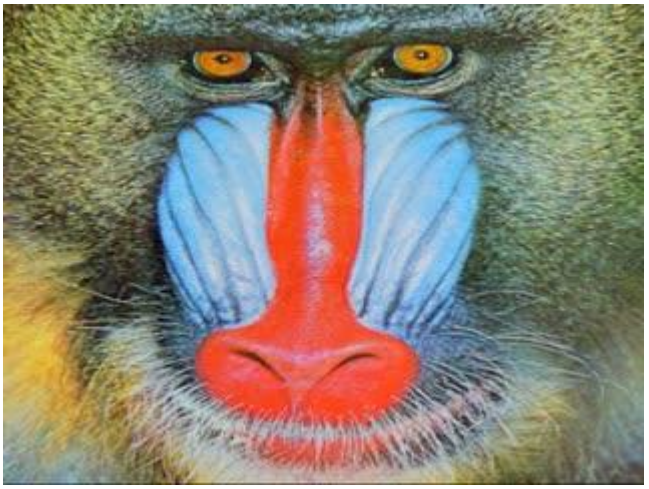
Exercise 2: resize

Command written on terminal:

```
poblenou-136-15:Lab1Video Dani$ ffmpeg -i mandril3.jpg -vf scale=320:240 mandril_320x240.jpg
ffmpeg version 4.4.1 Copyright (c) 2000-2021 the FFmpeg developers
  built with Apple clang version 12.0.0 (clang-1200.0.32.29)
  configuration: --prefix=/usr/local/Cellar/ffmpeg/4.4.1_2 --enable-shared --enable-pthreads --enable-version3 --cc=clang --host-cflags= --host-ldfl
ags= --enable-ffplay --enable-gnutls --enable-gpl --enable-libaom --enable-libbluray --enable-libdav1d --enable-libmp3lame --enable-libopus --enable
-librav1e --enable-librubberband --enable-libsnappy --enable-libsrt --enable-libtesseract --enable-libtheora --enable-libvidstab --enable-libvorbis
--enable-libvpx --enable-libwebp --enable-libx264 --enable-libx265 --enable-libxml2 --enable-libxvid --enable-lzma --enable-libfontconfig --enable-l
ibfreetype --enable-frei0r --enable-libass --enable-libopencore-amrnb --enable-libopencore-amrwb --enable-libopenjpeg --enable-libspeex --enable-lib
soxr --enable-libzmq --enable-libzimg --disable-libjack --disable-indev=jack --enable-avresample --enable-videotoolbox
  libavutil      56. 70.100 / 56. 70.100
  libavcodec     58.134.100 / 58.134.100
  libavformat    58. 76.100 / 58. 76.100
  libavdevice    58. 13.100 / 58. 13.100
  libavfilter     7.110.100 /  7.110.100
  libavresample   4.  0.  0 /  4.  0.  0
  libswscale      5.  9.100 /  5.  9.100
  libswresample   3.  9.100 /  3.  9.100
  libpostproc    55.  9.100 / 55.  9.100
Input #0, image2, from 'mandril3.jpg':
  Duration: 00:00:00.04, start: 0.000000, bitrate: 7133 kb/s
  Stream #0:0: Video: mjpeg (Baseline), yuvj420p(pc, bt470bg/unknown/unknown), 256x256, 25 fps, 25 tbr, 25 tbn, 25 tbc
Stream mapping:
  Stream #0:0 -> #0:0 (mjpeg (native) -> mjpeg (native))
Press [q] to stop, [?] for help
[swscaler @ 0x7ff31683a000] deprecated pixel format used, make sure you did set range correctly
Output #0, image2, to 'mandril_320x240.jpg':
  Metadata:
    encoder         : Lavf58.76.100
  Stream #0:0: Video: mjpeg, yuvj420p(pc, bt470bg/unknown/unknown, progressive), 320x240, q=2-31, 200 kb/s, 25 fps, 25 tbn
    Metadata:
      encoder         : Lavc58.134.100 mjpeg
    Side data:
      cpb: bitrate max/min/avg: 0/0/200000 buffer size: 0 vbv_delay: N/A
frame=    1 fps=0.0 q=4.0 Lsize=N/A time=00:00:00.04 bitrate=N/A speed=8.11x
video:22kB audio:0kB subtitle:0kB other streams:0kB global headers:0kB muxing overhead: unknown
poblenou-136-15:Lab1Video Dani$
```

Original image (mandril3.jpg)

Result, scaled at 320x240 (imageScaled.jpg)

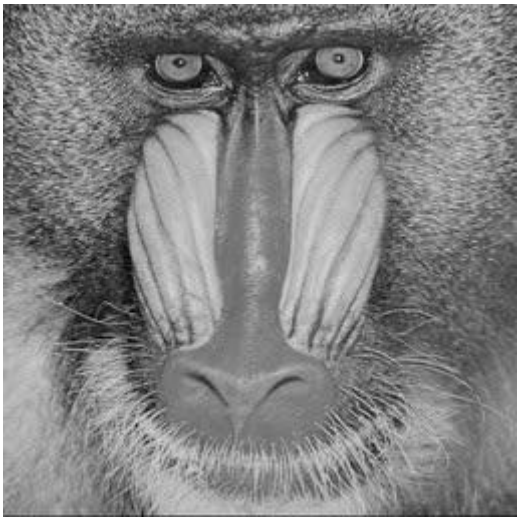


Exercise 3: b/w and compression

Black and white command:

```
poblenou-136-15:Lab1Video Dani$ ffmpeg -i mandril3.jpg -vf format=gray mandril3_bw.jpg
ffmpeg version 4.4.1 Copyright (c) 2000-2021 the FFmpeg developers
  built with Apple clang version 12.0.0 (clang-1200.0.32.29)
  configuration: --prefix=/usr/local/Cellar/ffmpeg/4.4.1_2 --enable-shared --enable-pthreads --enable-version3 --cc=clang --host-cflags= --host-ldflags= --enable-ffplay --enable-gnutls
--enable-gpl --enable-libaom --enable-libbluray --enable-libdav1d --enable-libmp3lame --enable-libopus --enable-librav1e --enable-librubberband --enable-libsnappy --enable-libsrt --enab
le-libtesseract --enable-libtheora --enable-libvidstab --enable-libvorbis --enable-libvpx --enable-libwebp --enable-libx264 --enable-libx265 --enable-libxml2 --enable-libxvid --enable-l
zma --enable-libfontconfig --enable-libfreetype --enable-frei0r --enable-libass --enable-libopencore-amrnb --enable-libopencore-amrwb --enable-libopenjpeg --enable-libspeex --enable-lib
soxr --enable-libzmq --enable-libzimg --disable-libjack --disable-indev=jack --enable-avresample --enable-videotoolbox
  libavutil      56. 70.100 / 56. 70.100
  libavcodec     58.134.100 / 58.134.100
  libavformat    58. 76.100 / 58. 76.100
  libavdevice    58. 13.100 / 58. 13.100
  libavfilter     7.110.100 /  7.110.100
  libavresample   4.  0.  0 /  4.  0.  0
  libswscale      5.  9.100 /  5.  9.100
  libswresample   3.  9.100 /  3.  9.100
  libpostproc    55.  9.100 / 55.  9.100
Input #0, image2, from 'mandril3.jpg':
  Duration: 00:00:00.04, start: 0.000000, bitrate: 7133 kb/s
  Stream #0:0: Video: mjpeg (Baseline), yuvj420p(pc, bt470bg/unknown/unknown), 256x256, 25 fps, 25 tbr, 25 tbn, 25 tbc
Stream mapping:
  Stream #0:0 -> #0:0 (mjpeg (native) -> mjpeg (native))
Press [q] to stop, [?] for help
[swscaler @ 0x7fc980f3a000] deprecated pixel format used, make sure you did set range correctly
[swscaler @ 0x7fc980f47000] deprecated pixel format used, make sure you did set range correctly
Output #0, image2, to 'mandril3_bw.jpg':
  Metadata:
    encoder         : Lavf58.76.100
  Stream #0:0: Video: mjpeg, yuvj444p(pc, bt470bg/unknown/unknown, progressive), 256x256, q=2-31, 200 kb/s, 25 fps, 25 tbn
    Metadata:
      encoder         : Lavc58.134.100 mjpeg
    Side data:
      cpb: bitrate max/min/avg: 0/0/200000 buffer size: 0 vbv_delay: N/A
frame=    1 fps=0.0 q=4.0 Lsize=N/A time=00:00:00.04 bitrate=N/A speed=7.96x
video:20kB audio:0kB subtitle:0kB other streams:0kB global headers:0kB muxing overhead: unknown
```

Result (mandril3_bw.jpg):

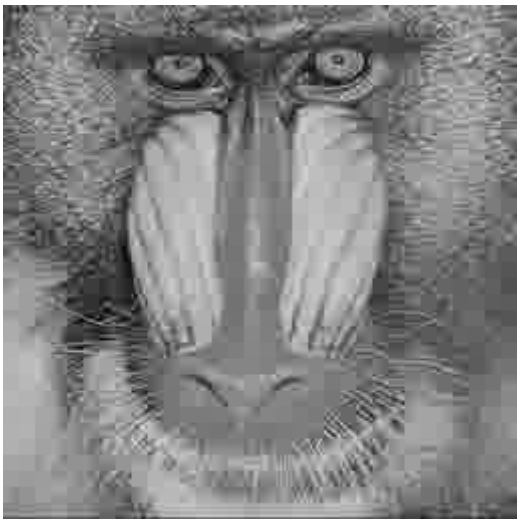


Compression command:

```
poblenou-136-15:Lab1Video Dani$ ffmpeg -i mandril3_bw.jpg -qscale:v 31 mandril3_bw_comp.jpg
ffmpeg version 4.4.1 Copyright (c) 2000-2021 the FFmpeg developers
  built with Apple clang version 12.0.0 (clang-1200.0.32.29)
  configuration: --prefix=/usr/local/Cellar/ffmpeg/4.4.1_2 --enable-shared --enable-pthreads --enable-version3 --cc=clang --host-cflags= --host-ldflags= --enable-ffplay --enable-gnutls
--enable-gpl --enable-libaom --enable-libbluray --enable-libdav1d --enable-libmp3lame --enable-libopus --enable-librav1e --enable-librubberband --enable-libsnappy --enable-libsrt --enab
le-libtesseract --enable-libtheora --enable-libvidstab --enable-libvorbis --enable-libvpx --enable-libwebp --enable-libx264 --enable-libx265 --enable-libxml2 --enable-libxvid --enable-l
zma --enable-libfontconfig --enable-libfreetype --enable-frei0r --enable-libass --enable-libopencore-amrnb --enable-libopencore-amrwb --enable-libopenjpeg --enable-libspeex --enable-lib
soxr --enable-libzmq --enable-libzimg --disable-libjack --disable-indev=jack --enable-avresample --enable-videotoolbox
  libavutil      56. 70.100 / 56. 70.100
  libavcodec     58.134.100 / 58.134.100
  libavformat    58. 76.100 / 58. 76.100
  libavdevice    58. 13.100 / 58. 13.100
  libavfilter     7.110.100 /  7.110.100
  libavresample   4.  0.  0 /  4.  0.  0
  libswscale      5.  9.100 /  5.  9.100
  libswresample   3.  9.100 /  3.  9.100
  libpostproc    55.  9.100 / 55.  9.100
Input #0, image2, from 'mandril3_bw.jpg':
  Duration: 00:00:00.04, start: 0.000000, bitrate: 4068 kb/s
  Stream #0:0: Video: mjpeg (Baseline), yuvj444p(pc, bt470bg/unknown/unknown), 256x256, 25 fps, 25 tbr, 25 tbn, 25 tbc
Stream mapping:
  Stream #0:0 -> #0:0 (mjpeg (native) -> mjpeg (native))
Press [q] to stop, [?] for help
Output #0, image2, to 'mandril3_bw_comp.jpg':
  Metadata:
    encoder         : Lavf58.76.100
  Stream #0:0: Video: mjpeg, yuvj444p(pc, bt470bg/unknown/unknown, progressive), 256x256, q=2-31, 200 kb/s, 25 fps, 25 tbn
    Metadata:
      encoder         : Lavc58.134.100 mjpeg
    Side data:
      cpb: bitrate max/min/avg: 0/0/200000 buffer size: 0 vbv_delay: N/A
frame=    1 fps=0.0 q=31.0 Lsize=N/A time=00:00:00.04 bitrate=N/A speed=8.51x
video:3kB audio:0kB subtitle:0kB other streams:0kB global headers:0kB muxing overhead: unknown
poblenou-136-15:Lab1Video Dani$
```

Note: This command has to be written directly on the terminal, since the line on the code which sends the order to execute the compression on the command line gives an error when trying to use the “-gscale:v” term.

Result (mandril3_bw_comp.jpg):



For the compression command in a jpg image, the hardest compression is the level 31. Values over 31 give the same result as using a 31.

After the compression, the image size is 6.6 times smaller. The original image's size is 36KB, the b/w one, 20KB, and the compressed b/w image has a 3KB size.

Exercise 5: DCT

Note: For a jpg image (like mandril3.jpg), the DCT has already been done. I created a function to transform an array using both DCT and IDCT, but I didn't succeed on implementing these transforms on images. Nonetheless, I left the code on the script to show my work.