TP 6: Applications

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1 "Fun" with sounds

1.1

On moodle you can find the sound files Voice2000.wav, Voice3000.wav, Voice4000.wav which were sampled at different frequencies. Apply different interpolation methods in order to have a sound sampled at a frequency of 44.1kHz. Can you obtain a good quality sound? Compute the distance between the reconstructed signal and the original sound file.

Hearing range: for humans it is on average between 20 to 20 000 Hz; for cats between 55 to 79 000 Hz; for dogs between 40Hz to 60 000 Hz; for bats between 15 000 Hz to 90 000Hz; river dolphin 2 000Hz to 110 000Hz; bottlenose dolphin 75 to 150 000Hz. Animals capable of hearing high frequency usually use echolocation.

Why a CD has a sampling rate of 44 100 Hz? *Because of Shannon theoreme: the human hearing is limited at a maximum frequency of 20kHz, therefore the sampling rate should be at a least 40 000Hz. The point of 44.1kHz or sometimes 48 kHz is used in order to give room for simple filters to operate without introducing audible artifacts.*

1.2

On moodle you have two sound files, Voice.wav and Singing.wav, along with the impulse response of a church (church.wav) and a dungeon (dungeon.wav). Make the two sound files Voice and Singing to sound as they have been recorded in a church, respectively a dungeon.

Music band do this all the time, they record an audio signal in a studio but they wish to make it sound like it was recorded at some live venue.

2 "Fun" with images

Using Fourier Transform, find the edges in the image lena_gray.tif, then compare with the result obtained using a classical technique such as Sobel, Canny or Prewitt.

Good to know: Edges are high frequencies!!! So call fft2() to transform your image to the frequency domain, remove the low frequencies. Then call ifft2() to transform back to the spatial domain.

Useful functions: imread, imshow, fft2, ifft2, edge