2EL2410 – Signal compression and denoising

Instructors: Gilles Chardon
Department: DÉPARTEMENT SIGNAL, INFORMATION, COMMUNICATION
Language of instruction: FRANCAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 60
On-site hours (HPE): 35,00
Elective Category : Fundamental Sciences
Advanced level : Yes

Description

This course is an introduction to signal and image representations, analysis, compression and denoising, fundamentals of modern signal processing for music and video storage, image enhancing in smartphones, processing and medical and astrophysical images, etc.

With the ever increasing quantity of collected and stored data, signal compression (images, sounds, videos...) remains a major challenge in data sciences, limiting the amount of necessary storage, and data transfers on telecommunication networks. Image restoration techniques (of which denoising is a particular example) are used on recent smartphones to mitigate the limitations of photographic sensors in resolution and sensibility.

A common point of the methods introduced in this course is their frugality in computations, energy, and data necessary for their development and use.

After recalling fundamentals of signal processing and harmonic analysis (filters, Fourier transform and series, random processes...), a first overview of signal denoising and compression will be given by Wiener filtering and LPC coding of speech.

The introduction of entropy coding will allow the design of lossless coders for images (PNG) and sounds (FLAC).

Lossy compression algorithms, with superior compression rates, will then be considered (JPEG, MP3, etc.).

Finally, wavelet orthogonal bases will be defined, with applications in image compression (JPEG2000), and non-linear image denoising.

Quarter **number**
SG6