Prerequisites (in terms of CS courses)
1SL1000 CIP
1SL1500 EDP
1CC4000 Signal Processing

Syllabus

1- Introduction

- Filtering, sampling
- Fourier series and transform
- Random processes

2- Wiener filtering and speech coding

- Linear denoising of random processes
- Speech models
- Linear prediction coefficients
- LPC coding

3 - Coding and quantization

- Source coding, entropy
- Lossless image compression (PNG)
- Universal coding and lossless sound compression (FLAC)
- Quantization

4 - Time-frequency representations

- Time-frequency orthogonal bases and frames (Short-time Fourier transform, DCT)
- JPEG image compression
- Audio masking and application to audio coding (MP3, Vorbis, etc.)

5 - Wavelet bases

- Wavelet orthogonal bases and fast wavelet transform
- Daubechies wavelets
- Application to image compression, JPEG2000
- Wavelet thresholding for image denoising

Class components (lecture, labs, etc.)
18h lectures
15h Tutorials/Labs
2h Final exam

Grading

Lab reports 30% Missed lab = 0 points for the lab Final exam 70%. Remedial exam : written exam 2h.

Course support, bibliography

A Wavelet Tour of Signal Processing, Stéphane Mallat, Academic Press

Resources

Personal computers, Python

Learning outcomes covered on the course

At the end of this course, the students will be able to
- Know the mathematical basis of non stationary signals representation
- Analyze signals using time-frequency representations
- Choose an appropriate representation for a given signal model
- Implement signal compression methods
- Recognize the limits of compression techniques
- Design, analyze and implement signal estimation methods

Description of the skills acquired at the end of the course

C1.2 Select, use and develop modelling scales, allowing for appropriate simplifying hypotheses to be formulated and applied towards tackling a problem.

C6.5 Operate all types of data, structured or unstructured, including big data.

C6.7 Understand information transmission.