

# Introduction to steganography and watermarking

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## Summary

This course focuses on steganography, namely the art of hiding information within other information. Here the term "information" is used in a general acceptance, possibly including all categories of information: text, images, sound, video.

Steganography can be thought as a science complementary to cryptography, and in this sense it is a natural subject for all people interested in cryptography, both as users and scholars.

Digital watermarking is a subject that sees an increasing popularity, due to the significant application of its techniques in protecting the digital rights of documents, images, videos etc.

This subject often uses steganography for associating extra information to the protected documents. In this case the approach should be secure wrt possible manipulations that try to make the extra data unusable.

## Brief Index

### Digital Signals (an introduction)

- Analog to digital and digital to analog conversion
- Sampling
- Quantization
- Type of signals
- Images; representations of images (discrete Fourier transform (DFT); discrete cosine transform (DCT); jpeg, png, gif)
- Sounds; representations of sounds (audio coding formats: MP3, AAC, Vorbis, FLAC etc.)
- Videos; representations of videos (with audio; video coding formats: MPEG-4 Part 2, H.264, H.265 etc.)
- Conversions of representations

### Digital Signal Processing (an introduction)

- Time/space domain
- Frequency domain
- Z-transform
- Discrete wavelet transform
- Noise and noise reduction
- Applications of digital signal processing
- Techniques (DFT, filters etc.)

### Steganography

- Definition
- Steganography vs. cryptography
- Types of steganography and examples (physical, digital messages, networks, printed etc.)
- Case study #1: text messages
- Case study #2: jpeg images
- Attacks to steganography
- Homeworks

### Watermarking

- Definition of digital watermarking and purpose
- Watermarking vs steganography

- Use cases (digital rights management)
- Integrating watermarking and cryptography
- Case study #3: printers
- Attacks to watermarking

#### Securing digital documents

- Securing an image on 3rd level DWT LL component
- Hiding a QR-code containing encrypted data
- Securing text documents
- Attacks based on OCR/non-OCR
- Elaboration of methodologies for categories of digital documents

#### Tools for steganography and watermarking

- Discussion on a set of tools
- Selection of a subset for practical demonstrations and homeworks

### **Required Background**

Good understanding of standard mathematical analysis (at basic university level). If not met it's still possible to present most topics under a more practical point of view. Useful the ability to use any computer algebra system (e.g., Matlab, Mathematica).