UNIVERSIDADE DE AVEIRO
DEPARTAMENTO DE ELECTRÓNICA, TELECOMUNICAÇÕES E INFORMÁTICA

Information and Coding (2025/26)

General info (version of September 3, 2025)

Instructor

- Armando J. Pinho (ap@ua.pt)

Grading

- Theoretical component: Individual final written exam, 40%
- Practical component: Mostly based on programming assignments, 60%
  - The assignments are performed in groups of three students
  - In the report of each assignment, it should be stated the percentage of participation of each member of the group
- Minimum of 8 points in each component

Learning objectives

At the end of this course, the students should know and understand:

- Fundamental concepts of digital signal processing
- The fundamentals of information theory and signal processing involved in efficient information representation
- The fundamentals and the need for the use of data compression algorithms
- The operation of the main data compression algorithms
- The relationship between data compression, the notion of algorithmic entropy and data analysis and exploration

Course contents

- Basic concepts of digital signal processing (sampling, quantization and representation of signals in the time and frequency domains)
- The notion of information: combinatorial, probabilistic, algorithmic
- Variable length codes
- Dictionary encoding
- Arithmetic coding

- Predictive, transform and sub-band coding
- Examples of some audio, image and video coding standards
- Application of compression techniques to data analysis and exploration

Website

- `http://elearning.ua.pt/`

Main bibliography

- Armando J. Pinho. *Some notes for the course "Information and Coding"*, Universidade de Aveiro, 2025.
- Signals and Systems. Simon Haykin, Barry Van Veen. 2nd Edition, John Wiley & Sons, 2003
- Khalid Sayood. *Introduction to data compression*, Elsevier, 5th Ed, 2017.
- David Salomon. *Data compression—The complete reference*, Springer, 4th Ed, 2007.
- M. Li and P. Vitányi. *An introduction to Kolmogorov complexity and its applications*, Springer, 3rd Ed, 2008.
- T. M. Cover and J. A. Thomas. *Elements Of Information Theory*, John Wiley & Sons, 2nd Ed, 2006.

Note: Other editions of these textbooks are also appropriate.

Final remarks

- This is a 6 ECTS course, implying, on average, a total of about $6 \times 30 = 180$ hours of work.
- Academic dishonesty will not be tolerated. Academic dishonesty involves acts, such as,
  - Cheating on an examination or quiz.
  - Substituting for another person during an examination or allowing such substitution for one's self.
  - Plagiarism. Act of appropriating passages from the work of another individual, either word for word or in substance, and representing them as one's own work. This includes any submission of written work (including programming code) other than one's own.
  - Collusion with another person in the preparation or editing of assignments submitted for credit, unless such collaboration has been approved in advance by the instructor. This includes the use of automated tools (also known as "AI tools") for producing code or text.

  If you have doubts regarding a certain action, ask the instructor.