



Unidade Curricular

“Informação e Codificação”

António José Ribeiro Neves

an@ua.pt

<https://www.ua.pt/pt/uc/15264>



universidade
de aveiro



IEETA



Outline

General info

Learning objectives

Active learning

Contents

Bibliography

Final Remarks

General info (version of September 16th, 2024)

Instructor

António Neves (an@ua.pt)

Grading

- Theoretical component: Individual activities, 40%
 - In-class quizzes
 - Final written exam
- Practical component: 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

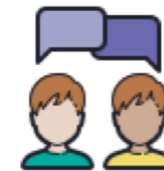
- Fundamental concepts of digital signal processing
- Critically evaluate and apply the principles of information theory and signal processing involved in efficient information representation
- Design, implement, and optimize data compression algorithms
- The operation of the main data compression algorithms
- Apply compression techniques to real-world problems
- The relationship between data compression, the notion of algorithmic entropy and data analysis and exploration
- Develop self-regulated learning strategies

Active learning

- This course will focus not only on technical knowledge but also on the development of critical thinking skills and self-regulated learning
- Students work on real-world problems to develop practical skills
- Students collaborate and learn from each other through discussions, peer reviews, and collaborative projects
- Encouraging students to reflect on their learning, think about their thought processes, and adjust strategies accordingly
- Students engage with lecture material (e.g., videos, readings) outside of class and focus on interactive problem-solving during in-class time
- Students take ownership of their learning by selecting topics, conducting research, and implementing their own ideas
- Encouraging students to ask questions, investigate concepts, and seek solutions through research and experimentation



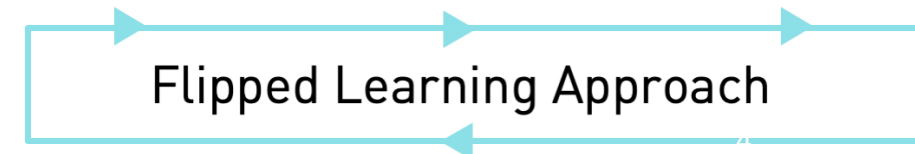
PREPARATION
MATERIALS



IN CLASS
ACTIVITIES



POST-CLASS
ASSIGNMENTS



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

Bibliography

- Weekly documentation is available on elearning
- Armando J. Pinho. Some notes for the course “Information and Coding”, Universidade de Aveiro, 2023.
- An Introduction to Information Theory. John R. Pierce. O'REILLY, 2019.
- Document and Image Compression. Mauro Barni. CRC Press, 2018, [Access here](#).
- Khalid Sayood. Introduction to data compression, Elsevier, 5th Ed, 2017, [Access here](#).
- David Salomon. Data compression—The complete reference, Springer, 4th Ed, 2007.
- M. Li and P. Vitanyi. 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.
- Signals and Systems. Simon Haykin, Barry Van Veen. 2nd Edition, John Wiley & Sons, 2003



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