

| Degree | Type | Year |
|---|------|------|
| Research and Innovation in Computer based Science and Engineering | OP | 1 |

Contact

Name: Miguel Hernández Cabronero

Email: miguel.hernandez@uab.cat

Teachers

Sebastià Mijares Verdú

Teaching groups languages

You can view this information at the [end](#) of this document.

Prerequisites

There are no formal prerequisites, but students are expected:

- to be proficient in the English language
- to have sufficient competency in at least one programming language

Objectives and Contextualisation

L'objectiu principal és estudiar mètodes avançats de compressió de dades, la seva aplicació i el seu disseny. Qui superi amb èxit l'assignatura hauria de ser capaç d'identificar la necessitat de compressió en escenaris pràctics i d'aplicar principis de l'enginyeria i de la teoria de la informació per dissenyar i validar solucions viables. També s'espera que l'estudiantat es familiaritzi amb l'estructura i els continguts dels articles de recerca habituals sobre el tema de la compressió de dades.

Learning Outcomes

1. CA06 (Competence) Graduates will be able to design reliable, efficient and secure data transmission and storage systems, using error-correcting codes, compression and security techniques.
2. CA07 (Competence) Graduates will know how to plan and develop research projects in the field of information processing.
3. KA09 (Knowledge) Graduates will be able to describe different error correction systems used in optical and distributed storage devices and in steganography.

4. KA10 (Knowledge) Graduates will be able to describe different methods for compressing still images, video, satellite images and other types of data.
5. KA11 (Knowledge) Graduates will be able to describe different security mechanisms used for network communications, opportunistic networks and anonymous networks.
6. SA11 (Skill) Apply different encryption methods for error correction in the field of storage and steganography.
7. SA12 (Skill) Apply different data compression algorithms.
8. SA13 (Skill) Use different security mechanisms in communications.

Content

The specific contents for this course are:

- Input/output of samples and data for compression.
- Information theory and compressibility.
- Compression pipeline: prediction, quantization, entropy coding.
- Compression assessment: performance and fidelity metrics, including subjective quality assessment.
- Machine Learning for data compression.
- Information theory-computer security interface.

Activities and Methodology

| Title | Hours | ECTS | Learning Outcomes |
|-----------------------------------|-------|------|------------------------------|
| Type: Directed | | | |
| "Develop" and "Deepen" sessions | 34 | 1.36 | CA06, CA07, KA10, SA12, CA06 |
| Type: Supervised | | | |
| "Develop" sessions | 14 | 0.56 | CA06, CA07, KA10, SA12, CA06 |
| Type: Autonomous | | | |
| Preparation of "Deepen" sessions | 47 | 1.88 | CA06, CA07, KA10, SA12, CA06 |
| Preparation of "Develop" sessions | 45 | 1.8 | CA06, CA07, KA10, SA12, CA06 |

The methodology of this subject is based on the active study of curated materials and the practice with hands-on challenges offered during the course.

Three session types will be conducted during the course:

- Discover sessions: students will be exposed to new concepts via oral discussions and selected materials. Short, individual exercises will be proposed as homework until the next session.
- Deepen sessions: after a *Discover* session, students will discuss their solution to the proposed exercises and explore further, progressively more complex scenarios in one or more Deepen sessions.
- Develop sessions: at the end of each Discover-Deepen-Develop unit, one session will be devoted to autonomous, semi-supervised practice of the concepts pertaining to that (or previous) units. The results of these sessions will be the main object of consideration when evaluating the course.

A temporal plan including the session types is presented to the students at the beginning of the course.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|---|-----------|-------|------|--|
| Semi-supervised assignments during the "Develop" sessions | 100% | 10 | 0.4 | CA06, CA07, KA09, KA10, KA11, SA11, SA12, SA13 |

Evaluation of this course is performed based on the submissions individually produced by students during the proposed "Develop" sessions.

In each of these sessions, students will be asked to complete predefined exercises ("challenges") and submit their solutions at the end of the session.

Submissions will be evaluated numerically using a rubric that will be made public after its application.

The course's final assessment will be obtained as the arithmetic mean of all proposed submissions for those "Develop" sessions. A temporal plan for the "Develop" sessions is made available to the students at the beginning of the course.

Students failing the subject (less than 50% of average score) will be presented with a final exercise under the same conditions, which must be successfully (again, with at least 50% of the maximum score) completed to pass the course.

Notes:

- In this course, the use of Artificial Intelligence (AI) technologies is not allowed in any of its phases. Any work that includes fragments generated with AI will be considered an academic dishonesty and may result in partial or total penalties on the activity grade, or more severe sanctions in cases of serious violations.
- In order to get the "not evaluable" assessment, the student cannot have submitted more than one solution to the challenges of the "Develop" sessions.
- This subject does not contemplate a "single evaluation" path of assessment.

Bibliography

- Salomon, David. Data compression: the complete reference. Springer Science & Business Media, 2004. Online: https://bibcercador.uab.cat/permalink/34CSUC_UAB/avjib/alma991010869738406709.
- D. Taubman, M. Marcellin. JPEG2000: Image Compression Fundamentals, Standards and Practice. Springer Science & Business Media, 2001.

Software

Custom software and code examples will be provided during the course.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject.

| Name | Group | Language | Semester | Turn |
|---|-------|----------|----------------|-----------|
| (PLABm) Practical laboratories (master) | 1 | English | first semester | afternoon |
| (TEm) Theory (master) | 1 | English | first semester | afternoon |