Comprenssió

2012/2013

Code: 42235
ECTS Credits: 6

Degree	Syllabus	Type	Year	Semester
4313133 Còmput d'Altes Prestacions, Teoria de la Informació i Seguretat / High Performance Computing, Information Theory and Security	1094 Còmput d'Altes Prestacions, Teoria de la Informació i Seguretat / High Performance Computing, Information Theory and Security	P	1	0

Contact

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Use of languages

Principal working language: anglès (eng)

Prerequisites

The only requisit is to have one of the following degrees: Computer Science, Electrical Engineering, Telecomunications, Phisical or Mathematics.

Objectives and Contextualisation

The objective of this module consists of providing an introduction to information processing --emphasizing the mathematical theory of information and its treatment--, to data compression and/or image coding, and to the design of applications.

After completeness of the module, the student will be able of:

1. To formulate methods for the compression of data, with particular emphasis in images.

2. To decide what is the most convenient type of compression, depending on the characteristics of the images and of the transmission channel.

3. To analyze and to evaluate the implementation requirements for lossy, progressive lossy-to-lossless, and pure lossless compression.

4. To establish policies of data coding in the scope of system control.

5. To plan and to develop research projects with contents related to data compression.

Skills

- Analyse, synthesise, organise and plan projects related to information theory, security and high performance computing.
- Apply the methodology of research, techniques and specific resources for investigating and producing innovative results in a certain specialised field.
- Assure, guarantee, manage, certify and investigate the quality of advanced computing developments, processes, systems and products.
- Design solutions for complex information theory problems, analysing different technical and technological solutions and backing up these decisions with efficient criteria.
- Direct innovation and research projects and work teams in the area of information theory, security and high performance computing.

- Innovate in the search for new spaces / areas in one's field of work.
- Possess and comprehend knowledge that offers the basis and opportunity to be original in the development and/or application of ideas, frequently in a research context.
- Recognise the human, economic, legal and ethical dimensions of professional exercise.
- Show responsibility in the handling of information and knowledge, and in the management of multidisciplinary groups and/or projects.
- Students must possess learning abilities to enable them to continue studying in a way that will to a large extent have to be self-managed and autonomous.

Learning outcomes

1. Analyse and evaluate the requirements for compression with loss, without loss and progressively from loss to without loss.
2. Analyse, synthesise, organise and plan projects related with information theory, security and high performance computing
3. Apply the methodology of specific research, techniques and resources for investigating and producing innovative results in a certain specialised field
4. Decide which is the most appropriate type of compression depending on the characteristics of images and the transmission channel
5. Establish data codification policies in the area of control systems
6. Formulate data compression methods, particularly for images
7. Innovate in the search for new spaces / areas in one's field of work
8. Plan and develop research projects with content related to data compression
9. Possess and comprehend knowledge that offers the basis and opportunity to be original in the development and/or application of ideas, frequently in a research context
10. Recognise the human, economic, legal and ethical dimensions of professional exercise
11. Show responsibility in the handling of information and knowledge, and in the management of multidisciplinary groups and/or projects
12. Students must possess learning abilities to enable them to continue studying in a way that will to a large extent have to be self-managed and autonomous

Content

1. Discrete Wavelet Transform (DWT).

2. Embedded Encoding of Zero-Tree Wavelet Coefficients (EZW).

3. Lower Tree Wavelet (LTW).

4. Index Coding (IC).

5. JPEG2000 I. Stages and its aims.

6. JPEG2000 BPE and Rate Control methods.

7. JPEG2000 Extensions.

8. ROI Coding.

9. Distortion estimators.

10. Fast rate allocation for video transmission.

11. N-dimensional image coding.

12. JPIP and Pairwise Orthogonal Transform.

13. H.264 intra: Image coding.

14. H.264 inter: Video coding.

15. Visually lossless and Effects of Noise filtering in image coding.

Methodology

The methodology applied to the student work will combine the attended lectures, the laboratories, the independent work of the student,

the presentation of working papers throughout the course, and the oral and public dissertation about a specific subject previously approved.

Distribution of the tasks:

Attended activities: 30%

Guided learning activities (outside classroom): 40%

Learning self-activities (outside classroom): 30% presented/displayed.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Master Class	30	1.2	1, 4, 5, 6, 9, 10, 11, 12
Type: Supervised			
Supervised Work	30	1.2	6, 7
Type: Autonomous			
Autonomous Work	90	3.6	2, 3, 8

Evaluation

The final evaluation will take into account the portfolio delivered by the students, the attendance and participation in class, and the oral presentation.

1. Attendance and active participation are compulsory. At least an 80% of the lectures shall be attended. Absences might be compensated with a home-work after agreement with the teacher. Mark: 20% (minimum mark: 5 out of 10).

2. Before or after each session, some home-work will be proposed. Some home-works will be compulsory, others will be optional. Mark: 40% (minimum mark: 5 out of 10).

3. Oral presentation of a particular subject. Presentation in English is strongly advised. Mark: 40% (minimum mark: 5 out of 10).

Evaluatión activities

Title	Weighting	Hours	ECTS	Learning outcomes
Attendance and active participation are compulsory	20 %	0	0	1, 4, 5, 6, 9, 10, 11, 12

| Home-Work | 20 % | 0 | 0 | 6, 7 |
| Oral presentation of a particular subject | 40 % | 0 | 0 | 2, 3, 8 |

Bibliography

- Thomas M. Cover and Joy A. Thomas (1991). *Elements of Information Theory*, John Wiley & Sons, Inc.

- Mark Nelson (1991). *The Data Compression Book*, Prentice Hall.

- D.S.Taubman and M.W.Marcellin (2002). *JPEG 2000.* Kluwer Academic Publishers.

- David Salomon (2006, 4th Edition). *Data Compression: The Complete Reference* (Hardcover), Springer. ISBN 1-84628-602-5.