270133 - CDI - Data and Image Compression

Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2019
Degree: BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: - Fernando Martínez Sáez (fernando.martinez@upc.edu)
Others: - Jordi Quer Bosor (jordi.quer@upc.edu)

Prior skills

Basic mathematical language.

Degree competences to which the subject contributes

Specific:

CCO1.1. To evaluate the computational complexity of a problem, know the algorithmic strategies which can solve it and recommend, develop and implement the solution which guarantees the best performance according to the established requirements.
CCO1.2. To demonstrate knowledge about the theoretical fundamentals of programming languages and the associated lexical, syntactical and semantic processing techniques and be able to apply them to create, design and process languages.
CT1.2A. To interpret, select and value concepts, theories, uses and technological developments related to computer science and its application derived from the needed fundamentals of mathematics, statistics and physics. Capacity to solve the mathematical problems presented in engineering. Talent to apply the knowledge about: algebra, differential and integral calculus and numeric methods; statistics and optimization.
CT1.2C. To use properly theories, procedures and tools in the professional development of the informatics engineering in all its fields (specification, design, implementation, deployment and products evaluation) demonstrating the comprehension of the adopted compromises in the design decisions.
CT4.1. To identify the most adequate algorithmic solutions to solve medium difficulty problems.
CT4.2. To reason about the correction and efficiency of an algorithmic solution.
CT5.2. To know, design and use efficiently the most adequate data types and data structures to solve a problem.
CT5.3. To design, write, test, refine, document and maintain code in an high level programming language to solve programming problems applying algorithmic schemas and using data structures.
CT5.4. To design the programs' architecture using techniques of object orientation, modularization and specification and implementation of abstract data types.
CT5.5. To use the tools of a software development environment to create and develop applications.

Generic:

G3. THIRD LANGUAGE: to know the English language in a correct oral and written level, and accordingly to the needs of the graduates in Informatics Engineering. Capacity to work in a multidisciplinary group and in a multi-language environment and to communicate, orally and in a written way, knowledge, procedures, results and ideas related to the technical informatics engineer profession.
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a
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Technical informatics engineer.
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.
G9. PROPER THINKING HABITS: capacity of critical, logical and mathematical reasoning. Capacity to solve problems in her study area. Abstraction capacity; capacity to create and use models that reflect real situations. Capacity to design and perform simple experiments and analyse and interpret its results. Analysis, synthesis and evaluation capacity.

Teaching methodology

In the theory classes, the fundamentals of the different compression methods will be explained. Later will be implemented in the laboratory classes.

Learning objectives of the subject

1. To understand what is lossless compression, the circumstances in which it is applicable, and the most important methods to achieve it.
2. To know the basic principles of information theory and the ways they are applied in relation to compression.
3. To become familiar with the concepts of lossy compression, the way the degree of compression and its fidelity are measured, and the most important methods used in practice.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>12h</th>
<th>8.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>12h</td>
<td>8.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>36h</td>
<td>24.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>6h</td>
<td>4.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>84h</td>
<td>56.00%</td>
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## Content

### Lossless coding

**Degree competences to which the content contributes:**

### Lossy compression

**Degree competences to which the content contributes:**
- Scalar and vectorial quantization. Discrete transforms. Wavelets. JPEG

## Planning of activities

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Hours</th>
<th>Specific objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of the lossless compression block in theory classes, laboratory sessions and problem solving sessions.</td>
<td>47h</td>
<td>1</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong> 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of the lossy compression block in lectures, laboratory sessions and problem solving sessions.</td>
<td>47h</td>
<td>3</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong> 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final exam</td>
<td>27h</td>
<td>2</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong> 2</td>
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<td></td>
</tr>
</tbody>
</table>
Qualification system

30 % Exam lossless compression.  
30 % Exam lossy compression.  
40 % Lab and problems.  

Bibliography

Basic:  

Complementary:  