Multimedia information coding in communications

Academic Year: (2022 / 2023) **Review date: 06-02-2023**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: PELAEZ MORENO, CARMEN

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Linear Systems

OBJECTIVES

The main objective of this course is to acquire a working knowledge of media coding algorithmia, standards, their present state of the art and limitations and their use in telecommunications.
Students who successfully complete this course should meet the following programme outcomes.

In particular:

a) an ability to apply theoretical knowledge to engineering problems.
b) analytical skills, synthesis capabilities and an ability to integrate knowledge from different disciplines.
c) acquisition of critical thinking capabilities and broad education necessary to understand the economical impact of the coding technologies, standards and governmental regulations on the development of telecommunication services.
d) A recognition of the need for, and an ability to engage in life-long learning.

1) Theoretical knowledge on media coding and the problems and solutions for their transmission over modern communications networks.
2) An ability to choose, apply and adapt a media coder to meet identified needs such as quality, bandwidth, delay or complexity constraints by conducting experiments in the laboratory and interpreting the results.
3) Skills for reading and interpretation of standards specifications.

DESCRIPTION OF CONTENTS: PROGRAMME

Topic 0. Fundamentals of the digitalization of multimedia information.
Topic 1. Image coding
Topic 2. Video coding
Topic 3. Speech coding
Topic 4. Audio coding
Topic 5. Coded multimedia information transmission

LEARNING ACTIVITIES AND METHODOLOGY

The course structure consists of two different types of session: lectures and laboratory exercises.

LECTURES (4 ECTS)

The mathematical principles of media coders are presented in the lectures mostly aided with slides and multimedia demonstrations to illustrate certain aspects.

The economical impact of the bandwidth occupation in communication networks and the standarization of the media coders is a fundamental issue emphasized in the lectures. The algorithms needed to design a coder to meet specific constraints are explained.

The economical implications of choosing among the different media coders available are always emphasized in the lectures: mainly, the trade-offs between quality, computational requirements, delay

and bandwidth. The impact of governmental regulations on matters such as the assignation of radio-frequency bands and the process of producing standards are also explained in the lectures.

Up to date examples and news on multimedia processing algorithms are always sought in the lectures even presenting protocols not yet well established, showing trends and emphasizing evolution thus promoting the idea of the need of a life-long learning.

LABORATORY PRACTICE (2 ECTS)

Four laboratory assignments (one for each media covered in the subject program) are aimed at achieving an understanding of the coding methods and an ability to design and conduct experiments by changing the free parameters of the coders and analyzing their consequences and trade-offs. The students empirically observe the trade-offs between employed bandwidth, quality, delay and complexity and are asked to decide on the free parameters that configure a coder.

The standardization of the media coders is a fundamental issue in media coding. A laboratory assignment is devoted to develop skills for reading and interpreting standards' specifications to enable students to assess the adequacy of a standard for a given engineering problem and identify the degrees of freedom left for the implementer or the user. The students are required to seek for specific modules and characteristics having to answer a questionnaire.

Some programming skills are required in the lab projects though they are not specifically worked upon. Also reading and interpretation skills of media standards especifications are develop in one of the lab assignments.

ASSESSMENT SYSTEM

The final assessment consists of two parts:

1. The average of the results of the four questionnaires corresponding to each of the lab assignments (40 %) and questionnaires (5%)
2. Overall exam (55%) with a minimun mark of 40%.

% end-of-term-examination:	55
% of continuous assessment (assigments, laboratory, practicals…):	45

BASIC BIBLIOGRAPHY

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- Chou, Philip A. Multimedia over IP and wireless networks: compression, networkings and systems, Ed. Elsevier, 2007
- Franklin Kuo, Wolfgang Effelsberg, J.J. García-Luna-Aceves Multimedia Communications. Protocols and Applications, Prentice Hall, 1998..
- J. Gibson, T. Berger, T. Lookabaugh, D. Lindbergh, R.L. Baker Digital Compression for Multimedia. Principles and Standards,, San Francisco, CA Morgan Kaufman; 1998..
- Rafael C. González, Richard E. Woods, Digital Image Processing (Second Edition), Upper Suddle River, NJ, Prentice Hall, 2001.
- Sadka, Abdul H Compressed video communications, John Wiley & Sons, 2002
- T. Painter and A. Spanias Peceptual Coding of Digital Audio Proceedings of the IEEE, vol. 88, no. 4,, Apr. 2000..

ADDITIONAL BIBLIOGRAPHY

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- A.M. Kondoz Digital Speech: Coding for Low Bit Rate Communications Systems, Chichester, England: John Wiley & Sons; 1994..
- Al-Mualla, Mohammed Ebrahim Video coding for mobile communications: efficiency, complexity, and resilience, Academic Press, 2002.
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- John Watkinson The Art of Digital Audio (Third Edition), Ed. Focal-Press, 2012
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- R. J. Clarke Digital Compression of Still Images and Video., London, UK Academic Press; 1995..
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