

Syllabus

Subject

Subject / Group	11578 - Advanced Aspects of Multimedia Networks / 1
Degree	Master's in Telecommunications Engineering
Credits	5
Period	2nd semester
Language of instruction	English

Professors

Lecturers	Office hours for students					
	Starting time	Finishing time	Day	Start date	End date	Office / Building
Felipe Riera Palou felip.riera@uib.es	16:00	18:00	Monday	01/09/2019	31/07/2020	Despatx 109

Context

Digital multimedia content has been the driving force behind the rapid development of broadband mobile and fixed networks. Multimedia traffic in general, and video in particular, pose many networks design challenges due to their high rate requirements and low latency demands. To this end, sophisticated video compression algorithms along with multimedia transport protocols have been developed over the last 15 years that enables efficient video transmission. Parallelizing scientific progress, a plethora of industry standards have been proposed targeting different communication scenarios, namely, broadband wireless, broadband wired or broadcasting. This module will basically take off where Xarxes Multimedia (3rd. Grau en Eng. Telemàtica) lands. After a quick review of the basics of one-dimensional data compression and multimedia protocols, video compression will be treated in some detail covering the most fundamental techniques and studying how these are applied to the most recent standards in wired, wireless and broadcasting networks.

Requirements

This module builds upon the material covered in Xarxes Multimèdia (3er. Grau in Enginyeria Telemàtica), therefore students are expected to be familiar with that content.

Recommended

Knowledge of the material introduced in Xarxes Multimedia from Grau en Enginyeria Telemàtica. In particular: basics of information theory, lossless compression and 1-D lossy compression, fundamental multimedia networking protocols.

Skills



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Specific

- * CETT1*: Capacidad para aplicar métodos de la teoría de la información, la modulación adaptativa y codificación de canal, así como técnicas avanzadas de procesamiento digital de señal a los sistemas de comunicaciones y audiovisuales.
- * CETT3*: Capacidad para implementar sistemas por cable, línea, satélite en entornos de comunicaciones fijas y móviles.
- * CETT4*: Capacidad para diseñar y dimensionar redes de transporte, difusión y distribución de señales multimedia.
- * CETT6: Capacidad para modelar, diseñar, implantar, gestionar, operar, administrar y mantener redes, servicios y contenidos.
- * CETT9: Capacidad para resolver la convergencia, interoperabilidad y diseño de redes heterogéneas con redes locales, de acceso y troncales, así como la integración de servicios de telefonía, datos, televisión e interactivos.

Generic

- * CG4*: Capacidad para el modelado matemático, cálculo y simulación en centros tecnológicos y de ingeniería de empresa, particularmente en tareas de investigación, desarrollo e innovación en todos los ámbitos relacionados con la Ingeniería de Telecomunicación y campos multidisciplinares afines.
- * CG11: Capacidad para saber comunicar (de forma oral y escrita) las conclusiones- y los conocimientos y razones últimas que las sustentan- a públicos especializados y no especializados de un modo claro y sin ambigüedades.

Transversal

- * CB1: Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
- * CB4: Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades.

Basic

- * You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: http://estudis.uib.cat/master/comp_basiques/

Content

Range of topics

Unit 0. Review

Review of multimedia network fundamentals (2 sessions)

- * - Principles of information theory and lossless compression
- * - 1-D lossy compression (speech and audio)
- * - Compression in the transform domain (KLT, DCT/MDCT)
- * - Multimedia networking review

Unit 1. Fundamentals of image and video compression

- * - 2-D signals and systems concepts
- * - Transforms for image compression
- * - The human visual system
- * - From 2-D to 3-D signals and systems

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- * - Motion compensation
- * - Intraframe processing
- * - Interframe processing

Unit 2. Image and video standards

- * -JPEG
- * -MPEG 2/4
- * -H.261, H.263, H.264 and H.265
- * -Other standards

Unit 3. Multimedia networks

- * - Multimedia broadcasting
- * - Digital television (DVB-T, DVB-S, DVB-C, DVB-H)
- * - Digital radio (DAB)
- * - Multimedia delivery through mobile and wireless networks
- * - Multimedia delivery through fixed networks: IPTV

Unit 4. Multimedia content organization and retrieval

- * - MPEG-7
- * - MPEG-21

Teaching methodology

In-class work activities (1.2 credits, 30 hours)

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Theory sessions	Large group (G)	To develop the main ideas of the module through theory lessons	18
Seminars and workshops	Problem sessions	Medium group (M)	To discuss and solve the problem sheets corresponding to each theory unit.	6
Practical classes	Lab sessions and presentations	Medium group (M)	To gain hands-on experience of the most fundamental topics of the module. To allow the students to delve into a topic and present their findings to the rest of the class. To understand realistic industrial/business requirements related to multimedia transmission by visiting a company involved in multimedia content distribution/broadcasting	6

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Aula Digital platform.

Distance education tasks (3.8 credits, 95 hours)

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Modality	Name	Description	Hours
Individual self-study	Study	to consolidate the theoretical and practical content of the module.	95

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

A minimum mark of 5 must be attained in the Matlab project, the presentation and the final exam. Module's mark will be defined by $\text{Project} \times 0.15 + \text{Presentation} \times 0.15 + \text{Final Exam} \times 0.7$.

The skills defined by CETT1, CETT3, CETT4, CETT6 and CETT9 will be assessed by means of the final exam and to, a lesser extent, by the project reports. Given that projects will focus more on practical problems, these will serve to evaluate the skills defined in CG4 and CG11. The work and report of the project and presentation will evaluate the skills defined as CB1 and CB4.

Frau en elements d'avaluació

In accordance with article 33 of Regulation of academic studies, "regardless of the disciplinary procedure that may be followed against the offending student, the demonstrably fraudulent performance of any of the evaluation elements included in the teaching guides of the subjects will lead, at the discretion of the teacher, a undervaluation in the qualification that may involve the qualification of "suspense 0" in the annual evaluation of the subject".

Theory sessions

Modality	Theory classes
Technique	Objective tests (retrievable)
Description	To develop the main ideas of the module through theory lessons
Assessment criteria	A minimum mark of 5 should be achieved in the final exam.

Final grade percentage: 70%with a minimum grade of 5

Lab sessions and presentations

Modality	Practical classes
Technique	Student internship dissertation (retrievable)
Description	To gain hands-on experience of the most fundamental topics of the module. To allow the students to delve into a topic and present their findings to the rest of the class. To understand realistic industrial/business



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requirements related to multimedia transmission by visiting a company involved in multimedia content distribution/broadcasting

Assessment criteria A minimum mark of 5 should be achieved in both the matlab-based project and presentation.

Final grade percentage: 30%with a minimum grade of 5

Resources, bibliography and additional documentation

Course slides and supplementary material will be posted in the corresponding module's page at UIBdigital

Basic bibliography

Communicating pictures. A course in image and video coding
David R. Bull
Academic Press 2014

Complementary bibliography

Multimedia Networking. From Theory to Practice
Jennq-Neng Hwang
Cambridge University Press 2009
Introduction to Data Compression, 4th Ed.
Khalid Sayood
Morgan Kauffman 2012
Multimedia Systems. Algorithms, standards and industry practices
Parag Havaladar and Gérard Medioni
Course Technology 2010
Digital Video and Audio Broadcasting Technology, 3rd Ed.
Walter Fischer
Springer 2010

