

# LEARNING GUIDE

## Information for the student

### Descriptive Data

<b>COURSE:</b>	Recognition techniques for audiovisual signals
<b>SUBJECT:</b>	Audiovisual
<b>ECTS:</b>	5
<b>CHARACTER:</b>	Optional
<b>TITLE:</b>	MSc in Systems and Services Engineering for the Information Society
<b>COURSE:</b>	1 (2º semester)
<b>SPECIALIZATION:</b>	-

<b>ACADEMIC YEAR</b>	2011-2012		
<b>TEACHING PERIOD</b>	September-January	February-June	
		X	
<b>LANGUAGE</b>	Spanish	English	Both
			X

<b>DEPARTMENT:</b>	Circuits and Systems Engineering		
<b>LECTURERS</b>			
<b>NAME</b> (C = Coordinator)	<b>ROOM</b>	<b>e-mail</b>	
Juana M <sup>a</sup> Gutiérrez Arriola (C)	7008	juana.gutierrez.arriola@upm.es	

<b>PREVIOUS REQUIRED BACKGROUND TO FOLLOW THE COURSE</b>	
<b>APPROVED COURSES</b>	<ul style="list-style-type: none"> <li>• Audio and video signal processing</li> </ul>
<b>OTHER REQUIRED LEARNING RESULTS</b>	<p>Practice with MATLAB for digital signal processing</p> <p>Advance knowledge of processing of speech signal</p> <p>Advanced knowledge of image processing</p> <p>Communication and writing skills</p>

# Learning Objectives

COMPETENCES AND COURSE ASSIGNED LEVEL		
Code	COMPETENCE	LEVEL
CGEN.2	Possesses learning skills that enable her/him to continue studying in a way that will be largely self-directed or autonomous	N4
CGEN.8	Applies the acquired knowledge and solves problems in new or unfamiliar environments within broader and multidisciplinary contexts, related to his/her area of expertise, is able to integrate knowledge.	N5
CGEN.9	Is able to research, develop and innovate in the field of Information Society Engineering	N5
CEP.2	Applies spectral analysis techniques	N3
CESE.1	Analyses and develops processing techniques to enhance audio and video signals	N4
CESE.2	Analyses and designs recognition algorithms for audio and video signals	N4
CEI.1	Is able to produce and execute a research plan in the field of Information Society Engineering	N4
CEI.2	Understands and criticises scientific documents in the field of Communications and Information Technologies	N5
CEI.3	Communicates research results	N4
CEI.4	Is able to present publically research works and defends its conclusions	N5

Code	COURSE LEARNING RESULTS
RA01	Chooses the right spectral estimation technique for the application
RA02	Designs filter banks for audio and video signals and applies them to transforming, coding and recognition
RA03	Analyzes and applies common transforms to audio and video signals
RA04	Selects and applies enhance methods for images
RA05	Designs and evaluates image recognition techniques for artificial vision
RA06	Designs and evaluates image recognition techniques for biometric identification
RA07	Designs and evaluates recognition techniques applied to musical signal

# Contents and Learning Activities

LECTURE/CHAPTER	EPIGRAPH
<b>Chapter 1: General description of a recognition system</b>	1.1 Applications
	1.2 System
	1.3 Resources
<b>Chapter 2: Project definition</b>	2.1 Speech recognition
	2.2 Speaker recognition
	2.3 Face recognition
	2.4 Hand recognition
<b>Chapter 3: Acquisition and pre-processing of audio-visual signals</b>	3.1 Speech recording
	3.2 Image acquisition
	3.3 Pre-processing techniques
<b>Chapter 4: Segmentation of audiovisual signals</b>	4.1 Speech and audio segmentation
	4.2 Image segmentation
<b>Chapter 5: Feature extraction</b>	5.1 Features for speech recognition
	5.2 Features for speaker recognition
	5.3 Features for face recognition
	5.4 Features for hand recognition
<b>Chapter 6: Classifying and recognition</b>	6.1 Speech recognition
	6.2 Speaker recognition
	6.3 Face recognition
	6.4 Hand recognition
<b>Chapter 7: Music recognition</b>	
<b>Chapter 8: Artificial vision</b>	
<b>Project</b>	

**BRIEF DESCRIPTION OF THE ORGANIZATIVE MODALITIES USED  
AND EMPLOYED LEARNING METHODS**

<b>THEORY</b>	The first eight weeks there will be a one hour lecture to explain the basic concepts of each chapter.
<b>PROBLEMS</b>	Examples and problems will be chosen to illustrate the basic concepts.
<b>LABORATORY</b>	Guided practices will provide the basic algorithms to build the final recognition system.
<b>AUTONOMOUS WORK</b>	<p>Assignments will be delivered and evaluated during the term.</p> <p>Two quizzes will have to be completed by the student in Moodle.</p> <p>The student will be evaluator of the other projects according to template 1.</p>
<b>GROUP WORK</b>	The class will be divided in groups of two or three students. Each group will develop a project assigned during the second week of the term.
<b>SUPERVISION</b>	The teacher could advised the student during the class, in its office at fixed times known by the students or through subject forum and e-mail.

<b>DIDACTICAL RESOURCES</b>	
<b>BIBLIOGRAPHY</b>	“Pattern Classification. Second edition”. Richard O. Duda, Peter E. Hart, David G. Stork. Ed. Wiley-Interscience. 2001
	“Pattern Recognition. 4th edition”. S. Theodoridis, K. Koutroumbas. Ed. Elsevier. 2009
	“Introduction to pattern recognition: a Matlab approach”. S. Theodoridis, K. Koutroumbas. Ed. Elsevier Academic Press. 2010
	“Digital image processing using MATLAB”. R.C. Gonzalez, R.E. Woods, S.L. Eddins. Ed. Pearson Prentice Hall. 2004
	“Fundamentals of speech recognition”. L. Rabiner, B.H. Juang. Ed. Prentice Hall. 1993
<b>WEB RESOURCES (Institutional Platform)</b>	Slices of lectures
	Practice guides
	Project guide
	Papers
	Forum
<b>LABORATORY EQUIPMENT</b>	Personal computer or laptop
	MATLAB
	Headphones
	Microphone
	Digital camera

# Course work chronogram

<b>Chapter 1</b>				
<b>Week 1</b>				
Activity	Hours	Place	Methodology	Assessment
▪ Course presentation	0,5	Classroom	Lecture	
▪ Chapter 1 lecture	1	Classroom	Lecture	
▪ Initial survey	1,5	Laboratory	Individual	
▪ Complementary reading	2		Individual	
▪ Get resources from previous courses	1		Individual	
<b>Chapter 2</b>				
<b>Week 2</b>				
Activity	Hours	Place	Methodology	Assessment
▪ Chapter 2 lecture	1	Classroom	Lecture	
▪ Form groups	0,5	Classroom	Group	
▪ Choose and define project	1,5	Laboratory	Group	
▪ Read and prepare practice 1	2		Individual	
▪ Organise and plan project execution	2		Group	
<b>Chapter 3</b>				
<b>Week 3</b>				
Activity	Hours	Place	Methodology	Assessment
▪ Chapter 3 lecture	1	Classroom	Lecture	
▪ Practice 1. Applications of recognition techniques	2	Laboratory	Group	4%
▪ Finalise and deliver practice 1	1		Group	
▪ Complementary reading	1		Individual	
▪ Read and prepare practice 2	2		Individual	
<b>Chapter 4</b>				
<b>Week 4</b>				
Activity	Hours	Place	Methodology	Assessment
▪ Chapter 4 lecture	1	Classroom	Lecture	
▪ Practice 2. Data definition and acquisition	2	Laboratory	Group	4%
▪ Finalise and deliver practice 2	1		Group	
▪ Read and prepare practice 3	2		Individual	
▪ Individual study	1		Individual	
<b>Chapter 5</b>				
<b>Week 5</b>				
Activity	Hours	Place	Methodology	Assessment
▪ Chapter 5 lecture	1	Classroom	Lecture	
▪ Practice 3. Segmentation	2	Laboratory	Group	4%
▪ Quiz (Chapters 1-4)	1	Moodle	Individual	15%
▪ Finalise and deliver practice 3	1		Group	
▪ Read and prepare practice 4	2		Individual	
<b>Chapter 6</b>				
<b>Week 6</b>				
Activity	Hours	Place	Methodology	Assessment
▪ Chapter 6 lecture	1	Classroom	Lecture	
▪ Practice 4. Feature extraction	2	Laboratory	Group	4%
▪ Finalise and deliver practice 4	1		Group	
▪ Read and prepare practice 5	2		Individual	
▪ Individual study	1		Individual	

<b>Chapter 7</b>				
<b>Week 7</b>				
<b>Activity</b>	<b>Hours</b>	<b>Place</b>	<b>Methodology</b>	<b>Assessment</b>
▪ Chapter 7 lecture	1	Classroom	Lecture	
▪ Practice 5. Classification.	2	Laboratory	Group	4%
▪ Finalise and deliver practice 5	1		Group	
▪ Revise project plan	2		Group	
▪ Individual study	1		Individual	
<b>Chapter 8</b>				
<b>Week 8</b>				
<b>Activity</b>	<b>Hours</b>	<b>Place</b>	<b>Methodology</b>	<b>Assessment</b>
▪ Chapter 8 lecture	1	Classroom	Lecture	
▪ Practice 6. Project I	2	Laboratory	Group	
▪ Project execution	4		Individual /Group	
<b>Project</b>				
<b>Week 10</b>				
<b>Activity</b>	<b>Hours</b>	<b>Place</b>	<b>Methodology</b>	<b>Assessment</b>
▪ Practice 7. Project II	3	Laboratory	Group	
▪ Quiz (Chapters 5-8)	1	Moodle	Individual	15%
▪ Project execution	3		Individual /Group	
<b>Project</b>				
<b>Week 11</b>				
<b>Activity</b>	<b>Hours</b>	<b>Place</b>	<b>Methodology</b>	<b>Assessment</b>
▪ Practice 8. Project III	3	Laboratory	Group	
▪ Project execution	4		Individual /Group	
<b>Project</b>				
<b>Week 12</b>				
<b>Activity</b>	<b>Hours</b>	<b>Place</b>	<b>Methodology</b>	<b>Assessment</b>
▪ Practice 9. Project IV. First delivery	3	Laboratory	Group	10%
▪ Project execution	4		Individual /Group	
<b>Project</b>				
<b>Week 13</b>				
<b>Activity</b>	<b>Hours</b>	<b>Place</b>	<b>Methodology</b>	<b>Assessment</b>
▪ Practice 10. Project V	3	Laboratory	Group	
▪ Project execution	4		Individual /Group	
<b>Project</b>				
<b>Week 14</b>				
<b>Activity</b>	<b>Hours</b>	<b>Place</b>	<b>Methodology</b>	<b>Assessment</b>
▪ Practice 11. Project VI	3	Laboratory	Group	
▪ Project execution	4		Individual /Group	
<b>Project</b>				
<b>Week 15</b>				
<b>Activity</b>	<b>Hours</b>	<b>Place</b>	<b>Methodology</b>	<b>Assessment</b>
▪ Practice 12. Project VII	3	Laboratory	Group	
▪ Project execution	4		Individual /Group	
<b>Project</b>				
<b>Week 16</b>				

Activity	Hours	Place	Methodology	Assessment
▪ Project presentation	3	Classroom	Group	30%
▪ Project evaluation		Classroom	Individual	10%
▪ Complete and deliver evaluations	3		Individual	
<b>Project</b>				
<b>Week 17</b>				
Activity	Hours	Place	Methodology	Assessment
▪ Project and presentation delivery	3	Moodle		
<b>Week 19</b>				
Activity	Hours	Place	Methodology	Assessment
▪ Final Exam (Only for students that choose this type of assessment)	3	Classroom		100%

# Course assessment and evaluation system

## EVALUATION

### CUMULATIVE ASSESSMENT

Evaluated activity	Chapter	Week	Place	Assessment weight
▪ Practice 1	1	3	Laboratory	4%
▪ Practice 2	3	4	Laboratory	4%
▪ Practice 3	4	5	Laboratory	4%
▪ Quiz 1	1-4	5	PC-Moodle	15%
▪ Practice 4	5	6	Laboratory	4%
▪ Practice 5	6	7	Laboratory	4%
▪ Quiz 2	5-8	10	PC-Moodle	15%
▪ Project: intermediate delivery		12	PC-Moodle	10%
▪ Project presentation		16	Classroom	30%
▪ Project evaluation		17	Classroom	10%

Activity	Total mark
Practices	2
Quizzes	3
Project	5
<b>Total</b>	<b>10,0</b>

	Chapter 1	Chapter 2	Chapter 3	Chapter 4	Chapter 5	Chapter 6	Chapter 7	Chapter 8	Project	Total
<b>Works and exercises</b>									2,0	<b>2,0</b>
<b>Laboratory</b>	0,4		0,4	0,4	0,4	0,4				<b>2,0</b>
<b>Exam per chapter</b>	1,5				1,5				3,0	<b>6,0</b>
<b>Chapters total</b>	<b>0,9</b>		<b>0,9</b>	<b>0,9</b>	<b>0,7</b>	<b>0,7</b>	<b>0,4</b>	<b>0,5</b>	<b>5,0</b>	<b>10</b>

### QUALIFICATION CRITERIA

- Default assessment is continuous assessment. Students wishing to be assessed only through final testing must submit a written request in the first five weeks of the term. The request has to be delivered to the Secretary of the Department (Room 7002) or in her mailbox that is in the hallway of the ground floor of Block VII (box 1).
- Continuous assessment is defined in the previous table. In addition three conditions are required:
  - To get 5 points out of 10.
  - To make and deliver all practices.
  - To present the final project.
- Evaluation through final testing and extraordinary evaluation. There will be two tests, one Moodle quizz (25% of the mark) and a project presentation (75%).