Audio Processing and Recognition

Course Code:

CSE 426

Course Period:

Spring

Course Type:

Area Elective

Credits:

3

Theoric:

3

Practice:

0

Laboratory Hour:

0

ECTS:

5

Prerequisite Courses:

Signals and Systems [1]
Course Language:

English

Course Coordinator:

Dionysis Goularas [2]
Courses given by:

Dionysis Goularas [2]
Course Objectives:

The aim of this course is to provide students with knowledge and abilities to understand sound signal and audio processing techniques and the principles of speech recognition.

Course Content:

The objective of this course is to provide the fundamental concepts on digital image processing. Cognition of sound, Filter analysis in time and frequency domain, Cepstrum analysis, mel frequencies, speech analysis and recognition are some of the fields that will be covered during this course. At the end of this course, the student will be able to understand how audio signals are treated and will acquire a basic knowledge on this domain.

Course Methodology:

1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study

Course Evaluation Methods:

A: Testing, B: Experiment, C: Homework, D: Project

Course Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods
1) Ability to use theoretical and applied information in order to understand and implement algorithms of audio processing.	1	1,2,3	A, C, D
2) Ability to identify, formulate, and solve problems related with frequency and speech analysis in an audio signal.	2	1,2,3	A, C, D

COURSE CONTENT

Week	Topics	Study Materials
1	Physical Sound Properties, Anatomy of the Ear	Textbook
2	Cognition of Sound, Psychoacoustics	Textbook
3	Masking, Audio illusions, Pitch and Pitch Strength	Textbook
4	Time domain analysis, frequency domain analysis.	Textbook
5	Filters and Filter Design I	Textbook
6	Filters and Filter Design II	Textbook
7	Audio formats, Audio compression	Textbook

8	Midterm	Textbook
9	Cepstrum analysis, Mel frequencies	Textbook
10	Pitch determination, text-to-speech systems	Textbook
11	Audio analysis, pitch Extraction	Textbook
12	Audio features extraction	Textbook
13	Audio classification	Textbook
14	Voice over IP	Textbook

RECOMMENDED SOURCES

Textbook	Speech and Audio Signal Processing. Processing and Perception of Speech and Music. Ben Gold, Nelson Morgan. John Wiley & Sons. 2000
Additional Resources	Applied Speech and Audio Processing: With Matlab Examples. Ian McLoughlin [3]. Cambridge University Press. 2007

MATERIAL SHARING

Documents
Assignments
Exams

ASSESSMENT

IN-TERM STUDIES	NUMBER	PERCENTAGE
Mid-terms	1	50
Assignment	3	17
Project	1	33
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					**X**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					**X**
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	15	2	30
Midterm examination	1	2	2
Homework	3	8	24
Project	1	25	25
Final examination	1	3	3
Total Work Load			120
Total Work Load / 25 (h)			4.8
ECTS Credit of the Course			5