SHAKE THE FUTURE.

CENTRALE NANTES

ENGINEERING PROGRAMME

PROFESSIONAL OPTION

PERCEPTION AND SOUND DESIGN

AUTUMN SEMESTER

Établissement public sous tutelle du
ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation

GROUPE **CENTRALE**

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EXPERIMENTAL METHODOLOGY IN PSYCHOLOGY

PERCEPTION AND SOUND DESIGN, ENGINEERING PROGRAMME PROFESSIONAL OPTION
AUTUMN SEMESTER

Professor: Jean-François PETIOT

Objectives

To present the experimental method for the study of human auditory perception with hearing tests. To know how to set up a hearing perceptual experiment (choice of the experimental protocol, choice of the material, statistical analysis of data).

Course contents

1) The experimental method in psychometry
perceptual tests - protocols - sound quality

2) Organisation of hearing tests
Audio conformity - HRTF

3) Methods and tools for the analysis of psychometric data
Review of statistics. Descriptive statistics, modelling of data, statistical tests
Monovariate analysis (ANOVA, multivariate analysis (PCA - principal component analysis), multidimensional scaling (MDS), linear models - Classification (HAC), subjective/objective analyses

Lab 1: analysis of hearing tests - ANOVA - PCA - tests
Lab 2: free sorting task - multidimensional scaling (MDS) - classification (HAC)

Course material

Lebart L., Morienau A., Piron M. Statistique exploratoire multidimensionnelle. DUNOD, Paris, 2002.
McAdams S., Bigand E. Penser les sons. Psychologie cognitive de l'audition. PUF, 1994, Paris.

Keywords

Perceptual evaluation, hearing tests, sound quality, statistical methods

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	9 hrs	0 hrs	8 hrs	0 hrs

DIGITAL MUSIC

PERCEPTION AND SOUND DESIGN, ENGINEERING PROGRAMME PROFESSIONAL OPTION
AUTUMN SEMESTER

Professor: Mathieu LAGRANGE

Objectives

To present tools and methods for the management and the operation of musical databases.
To give the principles of the main audio coding formats.

Course contents

- MIR (Music Information Retrieval): automatic transcription, audio abstract.
- Indexation and compression of music: detection of musical genre, MP3 coding, AAC
- Distribution of music: fingerprinting (Shazam), micro services (the echo nest)
- Large scale musical recommendations (Big data): collaborative filtering (Last.fm), spark, hadoop
- New tools for browsing and creation - micro service based: http://new.musichackday.org/

Course material

Keywords

audio indexation, MIR, recommendation systems

Links with other programmes

Musicology - perception

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	16 hrs	0 hrs	12 hrs	0 hrs

Acoustics, Signal, Psychoacoustics

Perception and Sound Design, Engineering programme professional option
Autumn Semester

Professor: Jean-François PETIOT

Objectives

To present the tools and methods to represent, analyse and synthesize audio signals.
Basics of acoustics and sound propagations
Introduction to psychoacoustics and the study of sounds as perceived by humans.

Course contents

a) Basic tools for audio signal processing

- Classification of sounds
- spectral analysis - time-frequency representation - spectrogram - audio filtering
- digital sound

b) Basic acoustics

- Sound sources - Propagation - wave equation
- dimensions (intensity, power, decibels)
- the audio chain - captors - transducers - peripherals

Lab 1 Matlab: sound analysis - example of additive synthesis - filtering - soustractive synthesis - sound effects;
Lab 2 Audacity - audio editing - effects

c) Introduction to Psychoacoustics

- auditory physiology
- sound perception
- Masking effect - critical bands - auditory scenes organisation - audio streams - cocktail effect
- Psychoacoustic metrics (dBA, loudness, sharpness, roughness)

Lab 3: masking effect - beats - perpetual scales

Course material

Philippe GUILLAUME. Musique et acoustique - de l'instrument à l'ordinateur, Hermès, Lavoisier, 2005.
Olivier CALVET. Acoustique appliquée aux techniques du son. Educalivre, Casteilla 2002

Keywords

audio signals, acoustic, perceptions, audio editing, digital sound

Links with other programmes

First Year Course - from Measurement to Control

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	8 hrs	10 hrs	0 hrs	0 hrs

SOUND DESIGN

PERCEPTION AND SOUND DESIGN, ENGINEERING PROGRAMME PROFESSIONAL OPTION
AUTUMN SEMESTER

Professor: Jean-François PETIOT

Objectives

To present sound design as an applied creative process subject to constraints.

To make students aware of the contribution of sound design:

- for innovation
- for communication
- for the control of perceived quality
- for emotional user experiment
- for the sonification of interfaces

Mastering of different tools for sound creation (Audacity - PureData, Reaper)

Course contents

a) Introduction to sound design
History of sound design - context - stakeholders - contributions

b) Design and sound architecture (HEHO, NANTES)
design problematic - methodology - creativity - sound identities - communication with sounds - description of projects and analysis of creations.

c) Sound design in the car industry (Coll. PSA)

d) Research in Sound design (N. Misdariis, IRCAM)

Tutorial: introduction to PUREDATA

Labs: 12h
1. Design of a sound track - Audacity Reaper
2. Puredata: sonification of data
3. Puredata: sonification of gesture

Course material

Andy Farnell. Designing Sounds, MIT Press.
Ric Viers, Charles Maynes, Thomas Edery. Le guide ultime du sound designer, DIXIT.

Keywords

Sound creation, sound identity, sound architecture, sound art, emotions

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	21 hrs	12 hrs	0 hrs	0 hrs