UNIVERSITÀ DI PISA

INTERACTIVE SYSTEMS AND AFFECTIVE COMPUTING

DANIELE MAZZEI

Anno accademico	2020/21
CdS	BIONICS ENGINEERING
Codice	916II
CFU	12

Moduli	Settore/i	Tipo	Ore	Docente/i
AFFECTIVE COMPUTING	ING-INF/06	LEZIONI	60	MIMMA NARDELLI ENZO PASQUALE SCILINGO
INTERACTIVE SYSTEMS	INF/01	LEZIONI	60	LORENZO COMINELLI DANIELE MAZZEI

Learning outcomes

Knowledge
AFFECTIVE COMPUTING: Students will gain knowledge about theories of emotion and mood disorders. Specifically they will learn how to model emotions and how to correlate them to the patterns of physiological signals.
DESIGN OF INTERACTIVE ROBOTS AND MACHINES: students will acquire knowledge related to the world of human computer and humna robot interaction. Foundalmetals of design and development of interactive systems will be introduced together with most used software and hardware developing platforms.

Assessment criteria of knowledge
AFFECTIVE COMPUTING: The gained knowledge will be assessed through ongoing tests.
DESIGN OF INTERACTIVE ROBOTS AND MACHINES: The gained knowledge will be assessed through ongoing tests and with a final project to be discussed during the exam oral session.

Skills
AFFECTIVE COMPUTING: Students will be able to process physiological data applying advanced linear and nonlinear methods trying to correlate that to the emotional experiences.
DESIGN OF INTERACTIVE ROBOTS AND MACHINES: students will be able to design and define (in functional terms) a human-machine behavior and relationship scheme for a smart object, robot or digital device. Studentes will be also able to design a prototype aimed at testing the intercatcive capabilities of a smart object or robot.

Assessment criteria of skills
AFFECTIVE COMPUTING: It is planned a final project with an experimental paradigm.
DESIGN OF INTERACTIVE ROBOTS AND MACHINES: final project with oral presentation and discussion

Behaviors
AFFECTIVE COMPUTING: Real experimental data will be collected with a suitable protocol

DESIGN OF INTERACTIVE ROBOTS AND MACHINES: student will be able to acquire and/or develop sensitivity to the problems of social and hemapic interaction between humans and robots and between humans and machines. The students will be also able to manage responsibility for the execution and formalization of an interactive product design project

Assessment criteria of behaviors
AFFECTIVE COMPUTING: Assessment will be done through the design a final experimental protocol
DESIGN OF INTERACTIVE ROBOTS AND MACHINES: Assessment will be done through the evaluatio of the final project

Prerequisites
N/A

Co-requisites
N/A

Prerequisites for further study
N/A

Teaching methods
AFFECTIVE COMPUTING: Frontal lesson and laboratory practice
DESIGN OF INTERACTIVE ROBOTS AND MACHINES: Frontal lesson and in-class practice

Syllabus
AFFECTIVE COMPUTING:
Neurophysiology of emotion: limbic system, prefrontal cortex, emispheres and insular cortex. Autonomic nervous system: fight or flight and rest and digest theories
Primary and secondary emotions and decision making
Theories of emotion and computational models
ECG: elettrophysiology, leads, circuit design
Pan-Tompkins algorithm. Respiration activity: physiology and methods of acquisition
ECG and respiration monitoring systems: contact and contactless
Cardio-pulmonary coupling and biofeedback
HRV signal: feature extraction in time and frequency domains
Respiration signal: feature extraction, Introduction to non-linear analysis
Linear stability analysis and Takens theorem
Phase space reconstruction, Fractals, correlation dimension and Lyapunov exponents
Hurst exponent, detrended fluctation analysis, approximate end sample entropy algorithms
Fuzzy and distribution entropy algorithms, Multiscale entropy algorithm
Multivariate algorithms, Poincaré plot, symbolic analysis
Brain emotional computer interfaces
Eye tracking: working principle, systems and applications
Affective haptics
EEG emotion classification
Mood disorders
EEG mental disorders
Emotional face detection
Electrodermal activity: physiology, models, methods of analysis and feature extraction
Speech and voice processing: models, methods of analysis and feature extraction

DESIGN OF INTERACTIVE ROBOTS AND MACHINES:

- Introduction: foundamentals of human-robot and human-machine interaction, Definition of social robot and smart object, examples of human-robot and human-machine interaction paradigm and artifacts, example of human like social robots, Definition of smart objects and internet of things (IOT) device
- Interactive systems control paradigms
- Internet of things and ubiquitous devices
- AI for robots and inteacrtive systems: Intelligent Agents, Expert Systems, The Embodied Mind
- Smart systems perception: basics of sensors, actuators, and acquisition devices
- Prototyping and pretotyping
- Programming a smart device

Bibliography
both modules: Notes provided by the teacher

Non-attending students info
N/A

Assessment methods
both modules: Practical and oral test

Work placement
DESIGN OF INTERACTIVE ROBOTS AND MACHINES: final projects based on problems and challenges proposed by companies are available

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on request

Additional web pages
N/A

Notes
N/A

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