UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Advanced Human-System Interfaces

2223-1-F9102Q030-F9102Q031M

Aims

The aim of the course is to introduce sensing technologies and to teach methodological approaches to develop advanced human-system interfaces

This goal is achieved by:
? Learning how to model human-machine interaction leveraging data from different types of sensors.
? Focusing on human-centric perspectives.
? Building experience with hands-on activities with sensors during lab activities.

Contents

The course contents are:

1. Affective Computing
2. Physical, Physiological and Electrophysiological Signals
3. Sensing Technologies
4. Computer Vision for Human-machine interaction
5. Soft and hard multimodal biometric systems
6. Brain Computer Interfaces
7. Data Protection and Ethics

Detailed program

Affective Computing

History and definition of affective computing
Theories of Emotions, emotion models and Measurements
Emotion recognition and affective computing
Design of proper experiments

Physical, Physiological and Electrophysiological Signals
External Signals: voice, gesture, face, behaviour, eye movement
Internal signals: heart beat, perspiration, respiration, muscle activity and brain waves

Sensing Technologies:
Overview of sensing technologies
Wearable sensing

Processing and analysis of sensing data
Computer Vision for Human-machine interaction
3D reconstruction for hand-body gesture detection and recognition
Open source platforms for emotion recognition (openface, opensmile, …)

Biometric systems
Biometric signals
1-to N and 1-to-1 systems
Behavioral biometrics & continuous user authentication

Brain Computer Interfaces
EEG signals
BCIs from research labs to real life applications
Real-Life Wearable EEG-Based BCI

Lab Activity:
Data collection using different devices (Leap motion, 3D cameras, EEG, GSR, PPG, EMG, respiration, etc.);
pre-processing and feature-extraction;
emotion and gesture recognition.

Data Protection and Ethics
Open issues

Prerequisites

no prerequisites

Teaching form

The course consists of lectures, and practical activities. Several exercises will be carried out during the practical activities to verify the new expertise acquired. Lectures will be held in presence, unless further COVID-19 related restrictions are imposed.

Textbook and teaching resource

Slides and material uploaded on the eLearning platform
Review papers on the presented topics
Journal and conference articles, relevant for the state of the art
Codes and exercises of the practical activities

Semester

Second semester

Assessment method

The exam is composed of two parts, equally weighted:

1. An oral or written exam to verify all the contents of the course,
2. The evaluation of a project that is defined during the lab activities, which implies data collection and analysis.

Office hours

send email for arranging an appointment

Sustainable Development Goals

INDUSTRY, INNOVATION AND INFRASTRUCTURE