



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### 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

---