UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Multimedia Data Processing

2526-1-F9202P030

Aims

Knowledge and understanding

The student will learn the fundamentals of analog to digital signal conversion, introducing in particular the concepts of sampling and quantization.
The student will understand these notions by considering multimedia signals (image, video, and audio) and other signals that can be used in human-machine interaction, particularly physiological signals and neural signals.

The student will learn the main methods of signal processing focusing primarily on images (contrast modification, filtering, and white balance, …)
The student will learn the fundamentals of lossy and lossless compression. Jpeg and mpeg compression will be presented in more detail, as examples of the application of different compression algorithms. The different types of image formats and their field of use will also be analyzed.
The student will learn the basics of affective computing, and its fields of application, especially in the area of human-machine interaction.

Applied knowledge and understanding

From a practical point of view, during face-to-face lessons, and laboratory activities the student will learn how to handle and process digital signals, with a particular focus on images and physiological signals.

Making judgements

Students through laboratory activities and required assignments will be able to assess their own preparation and level of understanding of theoretical aspects.

Communication skills

Students will be stimulated to discussion during frontal and laboratory activities. The main focus during these

interactions is to increase the ability to clearly, knowledgeably and unambiguously communicate technical content, ideas, problems. These skills fostered in itinere will be assessed through an oral examination test.

Learning skills

The structure of teaching in which theoretical lectures, and laboratory experiences alternate in parallel, guides in learning an effective study and learning method.

Contents

The course provides the basis for digitizing and encoding analogic signals: images, audio and videos, physiological and electrophysiological signals. It will provide skills for learning the applications of affective computing especially in the area of human-machine interaction. It will also provide skills for developing algorithms for processing digital signals, their encoding and compression.

Detailed program

1. Definition of one-dimensional signals, two-dimensional signals, N-dimensional signals

- Analog signal
- Digital signal

2 Analog to digital conversion

- Sampling theorem
- Filter Anti-Aliasing
- Quantization

3 Digital signals: sampling and quantization:

- Images
- Audio
- Video
- physiological and elettroficiological signals

4 Image processing

- Contrast enhancement
- High and low pass filtering
- White balance

5 Compression

- Main compression loss-less and lossy algorithms
- Audio Compression
- Image Compression (particularly JPEG)
- Video Compression (in particular MPEG)
- Main image Formats

6 Affective Computing
- definition
- models of emotions
- applications in the field of human machine interaction

Prerequisites

No prerequisite

Teaching form

The course consists of lectures (28 hours), and practical activities (24 hours). Several exercises will be carried out during the practical activities to verify the new expertise acquired. The course is taught in English.

The lectures will be delivered as follows:
21 hours of didactics, in presence.
7 hours of interactive teaching mode in presence.

24 hours of laboratory in interactive teaching mode in presence.

Textbook and teaching resource

slides published on the web site of the course

codes and exercises of the practical activities

TEXTBOOK

R. Gonzalez, R. Woods, Digital Image Processing, Pearson International Edition

Semester

second semester

Assessment method

Examination:
Oral exam + practical activities (4 mandatory)
Evaluation Type:
Final mark out of thirty

Oral exam
The exam (oral) consists of open questions about digitalization and compression of multimedia signals and signal processing mainly in the case of images. This part verifies the competencies acquired and it is based on what taught during the lessons, available on the slides and on the indicated text books.

Assignements
The practical activity is a fundamental part of the course. Periodic assignemts are proposed during the practical activity. These assignements remain valid for the academic year in which the teaching is delivered. **Four assignments are mandatory** to pass the axam.

Office hours

Friday from 11.00 to 12.00.

Sustainable Development Goals

INDUSTRY, INNOVATION AND INFRASTRUCTURE