UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Digital Signal and Image Management

2526-2-FDS01Q017

Aims

Knowledge and Understanding
The student will acquire fundamental knowledge of theoretical and methodological principles related to analog-to-digital conversion, processing, analysis, understanding, and management of digital signals and images. Both traditional paradigms and newer techniques based on deep learning and machine learning will also be explored.

Applying knowledge and understanding
The student will be able to design and implement solutions for signal and image processing and analysis in the digital domain, using established software tools and libraries. He/she will also be able to apply these solutions to practical cases in different application contexts.

Making judgments
The student will develop the ability to critically analyze methodological and design choices (e.g., algorithms, architectures, preprocessing and understanding techniques) and to evaluate the performance of the adopted solutions in terms of correctness, efficiency and effectiveness with respect to the objectives of the problem.

Communication skills
The student will be able to present in a clear, rigorous and structured manner the techniques and models used, the results obtained and the implications of design choices, including through visualizations and technical reports, using language appropriate to the academic and professional context.

Learning skills
The course will provide the necessary notions to enable the student to independently explore advanced signal and image processing and interpretation techniques, including the latest developments in deep learning, while fostering continuous updating of their skills in a rapidly evolving field.

Contents

The student will acquire specific skills that will put him in a position to understand the process of digitization of the signals and images; to design and implement algorithms for the processing, analysis and classification of digital signals and images (based on both traditional techniques and on the recent deep learning and machine learning techniques), and to assess their effectiveness.

Detailed program

1 Analog-to-digital conversion, processing and descriptive feature extraction in signals and images

2 Signals classification and recognition

3 Images/videos classification and recognition

4 Indexing and retrieval methods for signals/images/videos in large archives

5 Analysis of case studies

Prerequisites

None

Teaching form

The teaching includes a part of theoretical lectures that will be held in the classroom, and a part of laboratory that will be held in the laboratory and/or classroom and will require the use of one's own PC. The two parts will be based both on delivery mode and interactive mode.

Textbook and teaching resource

Slides, articles and notes given by the professor.

Textbooks:

- Digital Image Processing, 4th Edition, Rafael C. Gonzalez, Richard E. Woods
- Digital Image Processing: Part I, Huiyu Zhou , Jiahua Wu , Jianguo Zhang (freely available at https://bookboon.com/en/digital-image-processing-part-one-ebook)
- Digital Image Processing: Part II, Huiyu Zhou , Jiahua Wu , Jianguo Zhang (freely available at https://bookboon.com/en/digital-image-processing-part-two-ebook)
- Y. Goodfellow, Y. Bengio, A. Courville, Deep Learning, 2015. MIT Press

Semester

First semester

Assessment method

Discussion of a project that can be done in a group of up to two people, with individual evaluation. The project concerns the realization of an application for the recognition of objects placed in real scenes. The project discussion will allow to verify the learning of the concepts explained in class and their correct application within the developed project.

Office hours

Just after the lessons or by request

Sustainable Development Goals