CIMET Image Analysis and Processing

Course name: Image Processing and Analysis
Course code: CIMET IPA
Course level: Master
ECTS Credits: 5.00

Consortium Course Manager: Senior Lecturer Hubert Konik (UJM)

Course instructors: Hubert Konik (University Jean Monnet, Saint-Etienne), José Antonio Diaz Navas & Rafael Huertas & Luis Gómez Robledo & Timo Eckhard (University of Granada)

Education period (Dates): 1st semester
Language of instruction: English

Expected prior-knowledge: scientific graduate level. Matlab/C++ basic knowledge

Aim and learning outcomes:

This course is a graduate-level introductory course to the fundamentals of digital image processing and analysis. It emphasizes general principles of image processing, rather than specific applications. We expect to cover topics such as digital image definition, basic transformations, sampling and quantization, point operations, linear image filtering, transforms and histogram processing, spatial, frequency and nonlinear filtering, image segmentation, texture analysis, color representations and spaces, image restoration, simple feature extraction and recognition tasks.

Programming assignments will use MATLAB and the MATLAB Image Processing Toolbox, though the use of other computer languages and/or software packages will be accepted.
Additional seminars will be organized to introduce specific tools or applications to enlarge the covering of image processing and analysis (compression, reconstruction, wavelets and multiresolutions approaches, ...).

Topics to be taught (may be modified):

- Introduction and overview of image processing; Image formation & sensing; sampling & quantization; pixel connectivity; digital images format
- Arithmetic/logic operations; 1-1 image processing; gray level transformations
- Histogram processing; equalization, thresholding, gray level transformation
- Spatial filtering; smoothing; sharpening; Laplacian; gradient and other derivative filters
- Filtering in the frequency domain; lowpass filters; highpass and other filters; Fourier transform
- Image restoration; noise reduction using spatial filters; adaptive filtering; noise reduction using frequency domain techniques; image degradation; inverse filters
- Point, line and edge detectors; operators
- Image segmentation; region growing; region splitting and merging; region adjacency graph
- Color images; color spaces; color space transformations; pseudocolor transformations; Color image transformations and color image processing
- Image analysis; texture analysis; features extraction; shape descriptors
- Pattern recognition; template matching; correlation; graph matching; objects recognition

Practical Laboratory Sessions:
Matlab/C++ laboratory topics in order to implement and master basic issues explained in the lectures.

Teaching methods: Lectures and lab classes, and homework exercises.

Examination: 50% for Final exam and 25% exercises and 25% project work.

Literature and study materials:

Reference book:

Digital Image Processing, 3rd Edition (DIP/3e), by Rafael C. Gonzalez and Richard E. Woods, Prentice Hall (2008)

Additional textbook:
Color Image Processing: Methods and Applications (Image Processing), by Rastislav Lukac & Kostantinos N. Plataniotis, CRC (2006)

The Image Processing Handbook, Fifth Edition (Image Processing Handbook), by John C. Russ, CRC (2006)

Image Processing: Analysis and Machine Vision by Sonka, V and Hlavac and R.Boyle, 3rd edition, Thomson (2008)

Additional information:

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