

COURSE in Scientific data handling and Image Processing

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COURSE DESCRIPTION

(4-5 lines)

The course provides an introduction to the common techniques used in science to extract relevant information from large astrophysical data sets. The course will deal with digital processing of signals, focusing on image processing, transformation, and object classification.

LEARNING OUTCOMES

- ✓ The course offers an overview of the main mathematical and statistical methodologies for signal extraction and visualisation of scientific data, providing the appropriate skills to retrieve the most useful information hidden in the large datasets.
- ✓ In the labs, these methodologies, will be applied to a number of scientific data set acquired at the most advanced astrophysical facilities available, giving the opportunity to familiarize with modern software tools of scientific data manipulation and visualization.

METHODOLOGY

Lectures to learn the theoretical principles and laboratories dedicated to the application specific techniques to extract relevant information from large data samples

ASSESSMENT

Written exam; weighting: 80%
Project; weighting: 20%

OUTLINE

- 1) Introduction to science data acquisition and storage
- 2) Signal and Noise in scientific data
- 3) Fundamentals of Digital Image Processing
- 4) Fourier transform and frequency-domain filtering
- 5) Image transformation and denoising

- 6) Wavelets
- 7) Image restoration and enhancement
- 8) Pattern Classification Methods
- 9) Virtual observatories
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- Lab
- 1) 1D signal analysis
- 2) 2D signal analysis
- 3) Wavelet analysis

TEXTBOOKS

PPT slides and notes prepared by the teacher.

ADDITIONAL SUGGESTED READING