

PhD Physics course at Bari University (Cycle)

Title	Statistical and computational models for physical data analysis
Proponent	Dr.ssa Sabina Tangaro
# CFU (1 CFU = 8 hours)	3
Schedule	Settembre
Brief Summary of the course	<p>In the course the main concepts of soft computing and methods of analysis of signals and images will be treated. The examples of application will presented using MATLAB.</p> <p>The proposed training program is divided into a series of frontal lectures and laboratory exercises in order to indicate the application requirements of efficient and automated techniques of pattern recognition.</p> <p>In particular, the main sources of noise present in the data acquisition systems and the principles of both the processing and the data restoring methods are described.</p> <p>Afterwards, both the linear and nonlinear operators for signals and images analysis, the feature extraction methods, the clustering and classification systems are presented.</p> <p>In the exercises part the students will acquire some important skills to be able to independently address a pattern recognition problem.</p>

<p>Programme</p>	<p>1 – Signal processing</p> <ul style="list-style-type: none"> ○ methods for the improvement of the SNR ○ properties of image processing operators, ○ pixel and window processing operators ○ linear and non-linear operators, ○ rank operators, <p>2 - feature extraction</p> <ul style="list-style-type: none"> ○ features di Haralick ○ features di Haar ○ Principal component analysis; <p>3 - machine learning for prediction, identification and classification</p> <ul style="list-style-type: none"> ○ supervised and unsupervised learning ○ linear and non-linear classifiers ○ clustering and community detection ○ neural network ○ fuzzy logic ○ complex network <p>5 - criteria decision and automated systems</p> <ul style="list-style-type: none"> ○ training, test and validation ○ cross-validation ○ evaluation metrics <p>6 - Exercises with MATLAB</p>
<p>Recommended texts</p>	<p>Data-Mining – Paolo Giudici Neural Network - Simon Haykin</p>
<p>Assessment methods</p>	<p>Report and oral discussion on a proposed topic</p>