UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

DIPARTIMENTO INTERUNIVERSITARIO DI FISICA

General information		
Academic subject	Pattern Recognition	
Degree course	Physics	
Academic Year	II	
European Credit Transfer and Accumulation System (ECTS)	6	
Language	ENGLISH	
Academic calendar (starting and ending date)	I semester	
Attendance	Recommended	

Professor/ Lecturer	
Name and Surname	Roberto Bellotti
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Department and address	Dipartimento Interateneo di Fisica
Virtual headquarters (Microsoft Teams code)	
Tutoring (time and day)	Monday and Friday 10-12 am (on request)

Syllabus	
Learning Objectives	Acquire skills in processing and extracting information from highly complex spatio-temporal signals and images. Acquire skills in the design of predictive models.
Course prerequisites	The course requires: • a deep knowledge of statistics, linear algebra and probability; • notions of differential calculus.
Contents	• Preprocessing and filtering • Image segmentation • Feature Extraction • Classification • Clustering techniques • Elements of Machine Learning • Figures of merit
Books and bibliography	• Christopher M. Bishop: Pattern Recognition and Machine Learning • T. Hastie et al The Elements of Statistical Learning
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
120	39	16	65
ECTS			

Teaching strategy	

Expected learning outcomes	
Knowledge and understanding on:	• Basic concepts on data analysis • Big data programming skills • Visualization and presentation of data analysis results • Ability to work in a team.
Applying knowledge and understanding on:	• Modelling databases of real systems • Ability to understand the underlying dynamics of complex systems

Soft skills	• **Making informed judgments and choices**
	  ○ Apply the notions learned in multi-disciplinary contexts
	  ○ Apply mathematical concepts to real systems
	• **Communicating knowledge and understanding**
	  ○ Use of rigorous and precise language,
	  ○ Use of logical arguments
	• **Capacities to continue learning**
	  ○ Mathematical theory of Machine Learning
	  ○ Problem-solving strategies
	  ○ Modelling real systems

Assessment and feedback	
Methods of assessment	Oral presentation of a case-study

Evaluation criteria	• **Knowledge and understanding**
	Consistency of answers according to formulated questions
	• **Applying knowledge and understanding**
	  ○ Setting up and carrying out numerical examples
	• **Autonomy of judgment**
	  ○ Consistency with the subject of the program
	• **Communicating knowledge and understanding**
	  ○ Clarity and precision of presentation
	• **Communication skills**
	  ○ Ability to identify interconnection between the subjects of study
	• **Capacities to continue learning**
	  ○ Cross-discipline applications

Criteria for assessment and attribution of the final mark	Capability to select and apply descriptive and predictive data analytics methods. Skill to discover trends in analytical data stores using the data mining techniques of clustering, association, and decision trees. Adequate comprehension and global knowledge of concepts and arguments at the basis of the machine learning methods described throughout the course.
Additional information	