Subjects from other master programs. Curs 2016-17

Suggested subjects from other UPC or UB master programs to MESIO UPC-UB students. They can choose up to 3 of these subjects.

Master in Data Mining and Business Intelligence: MIRI (FIB, UPC)

Focusing on Machine and Statistical Learning
a. Machine Learning (ML-MIRI)  
   Spring semester
b. Kernel based Machine Learning and Multivariate Modeling (KMLMM-MIRI)  
   Fall semester
c. Advanced Statistical Modeling (ASM-MIRI)  
   Fall semester

Focusing on Big Data Management
d. Open Data (OD-MIRI)  
   Spring semester
e. Complex and Social Networks (CSN-MIRI)  
   Fall semester
f. Cloud Computing (CLC-MIRI)  
   Spring semester

Master in Supply Chain and Transport Logistics (SCTL) ETSEIB and UPC
a. Introducció a la Cadena de Subministrament  
   Fall semester
b. Modelització de Sistemes de Transport i Logístics  
   Fall semester
c. Anàlisi de Dades de Transport i Logística  
   Fall semester
d. Mètodes Quantitatius a la Cadena de Subministrament  
   Fall semester
e. Models d’Optimització de Xarxes de Transport  
   Fall semester
f. Models Avançats de Demanda  
   Fall semester
g. Demanda de Sistemes de Transport  
   Spring semester
h. Models de Simulació de Trànsit  
   Spring semester
i. Transport de Mercaderies  
   Spring semester

Master in Automatic Control and Robotics (ETSEIB – UPC)

Scientific Python for Engineers (3 ECTS; )

Master in Biomedical Engineering (Faculty of Physics-UB and ETSEIB-UPC)

Biomedical Informatics (2.5 ECTS; )
Master in Data Mining and Business Intelligence, MIRI (FIB, UPC)

Focus on Machine and Statistical Learning

a. **Machine Learning (ML-MIRI)**  
   **Spring semester**
   The aim of machine learning is the development of theories, techniques and algorithms to allow a computer system to modify its behavior in a given environment through inductive inference. This inference is based on observed data that represent incomplete information about a phenomenon or process. Machine learning is a meeting point of different disciplines: statistics, artificial intelligence, programming and optimization, among others. The course is divided into conceptual parts, corresponding to several kinds of fundamental tasks: supervised learning (classification and regression), unsupervised learning (clustering, density estimation) and semi-supervised learning (reinforcement and transductive). Specific modeling techniques studied include artificial neural networks and support vector machines.

b. **Kernel based Machine Learning and Multivariate Modeling (KMLMM-MIRI)**  
   **Fall semester**
   The first part of the course is devoted to Kernel-Based Learning and Support Vector Machine for classification, regression and novelty detection. Kernel functions are defined, and their properties and construction are addressed. Then specific kernels for different data types are introduced, such as real vectors, categorical information, feature subsets, strings, probability distributions and graphs. The course also reviews the basic theoretical foundations of kernel-based methods, focusing on statistical learning theory.
   The second part of the course extends the multiple linear regression to the multivariate response variable case. The correlation coefficient between two variables is extended to two groups of variables by Canonical Correlation Analysis. Finally Partial Least Squares Regression is introduced as a technique that, in some sense, extends Principal Components Analysis to the regression context.

c. **Advanced Statistical Modeling (ASM-MIRI)**  
   **Fall semester**
   The course covers different statistical regression models: simple and multiple linear regression, parametric non-linear regression, generalized linear model, nonparametric regression, generalized nonparametric regression. The model selection and validation is emphasized. A fundamental part of the course is the study of real cases, both by teachers and by students at the weekly assignments.
Focus on Big Data

d. Open Data (OD-MIRI)  
Spring semester

Big Data is traditionally defined with the three V's: Volume, Velocity and Variety. Traditionally, Big Data has been associated with Volume (e.g., the Hadoop ecosystem) and recently Velocity has earned its momentum (especially, with the arrival of Stream processors such as Spark). In this course the student will be introduced to advanced database technologies, modeling techniques and methods for tackling Variety for decision making. We will also explore the difficulties that arise when combining Variety with Volume and/or Velocity.


e. Cloud Computing (CLC-MIRI)  
Spring semester

Cloud computing is a service model for large-scale distributed computing based on a converged infrastructure and a set of common services over which applications can be deployed and run over the network. In this course we will provide a background on the principles and the state-of-the-art of large-scale distributed computing, and the means to understand and apply the model and services of cloud computing. In terms of principles, the course looks at how scale affects systems properties, issues (such as virtualization, availability, locality, performance and adaptation), system models (game-theoretic, economic, evolutionary, control, complexity), architectural models (multi-tier, cluster, cloud), environment and application requirements (such as fault tolerance, content distribution). In the other side, Big Data has become a hot topic in the field of large-scale distributed computing in recent years, impossible to separate it from Cloud Computing. Particularly, the exponential and fast growth of very different types of data has quickly raised concerns about how to store, manage, process and analyze that data. The second part of the course will start with a brief review of Big Data technologies that will shape our near future as well as attempts to visualize in which direction this technology will take us. The goal is to help students become part of this profound transformation that is causing big data and encourage the desire to want to delve further into this exciting world of technology and become actively involved.


f. Complex and Social Networks (CSN-MIRI)  
Fall semester

Networks are structures that show up where there is any kind of interaction: in social behavior, in biological, physical or chemical processes, among many others. Important real-world processes such as the spread of disease or people’s buying patterns can be explained through the use and study of networks. This course will cover the fundamental aspects of networks: what are they and how can we measure them? What are their characteristics and properties? What type of processes are they able to carry out? How can we model them? Can we predict their behavior?

Master in Automatic Control and Robotics (ETSEIB – UPC)

**Scientific Python for Engineers** (3 ECTS; )

The goal of the class is to learn skills for scientific programming, focused on the application of advanced machine learning tools on robotics. Students will learn to develop structured and problem solving thinking in a competitive environment.

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Master in Biomedical Engineering (Faculty of Physics-UB and ETSEIB-UPC)

**Biomedical Informatics** (2,5 ECTS; )

The course is structured in two stages. First the instructors will provide broad introductory lectures and advanced lectures on the use of python and Scientific Python, R and interfacing of both languages to database systems. Students will be asked to read scientific papers, write reviews and present selected papers in the area of biomedical data mining, and they will be expected to participate and contribute to the class discussion. Classes will be mainly practical, with hands on interactive sessions aimed to solve small tasks while incrementally approaching to the data mining process. This first part will take half of the teaching time of the course. The second stage of the course contains no lectures and is focused to the development of a research project. This research project involves the design of the programmatic analysis of a very large (in terms of BigData) biomedical dataset in an open challenge format. In this team work project, students will use the acquired data mining techniques with the integration of Python, scientific python, R, to extract relevant information from the database, including statistics and visualization.