

year	code and course name	module	ECTS	type	semester	educational activity type	ECTS	hours	faculty
1	F9101Q003 Data management and visualization	Data management (6 ECTS)	12	mandatory	First semester	lecture	4	32	Maurino Andrea
						practice exercise	1	10	Rula Anisa
						laboratory	1	9	Bianchi Federico
		lecture				2	16	Schettini Raimondo	
		lecture				2	16	Cabitzza Federico	
		laboratory				2	24	Uboldi Giorgio Roberto	
		Data visualization (6 ECTS)							

CV: <http://www.unimib.it/go/176181440>

### **Data management**

#### **Content of the course**

- Data life cycle
- NoSQL models
- Data distribution
- Data quality
- Geographical information systems
- Architectures for big data analysis

#### **Educational goals**

At the end of the module students will be able to select, design and query a database (relational or not) according to their application needs

Students will be able to use a NoSql database management system to acquire, memorize and query semi structured data

#### **Prerequisites**

Relational model

#### **Reference books**

- G. Harrison (2015) Next Generation Databases, Apress.

**Teaching methods** Lectures and exercise in room and on PC

**Assessment methods** projects

**Extended program**

1. Data life cycle
1. Acquisition
2. Storage
3. Integration
2. NoSQL models
  - Cap theorem
  - Document based system
  - Graph db
  - key value and columnar models
2. Data distribution
  - Replication
  - Fragmentation
3. Data quality
4. Geographical information systems
5. Architectures for big data analysis
  - Map Reduce
  - Main components (Hive, Spark, Flink, Impala...)

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**Data Visualization**

**Content of the course**

The course covers the methods, techniques and tools of data visualization and visual design by which to design, implement and evaluate systems that enable the interactive analysis of data and the flexible optimization of reporting (both in an organizational domain and in data journalism). To this aim, in this course strategies will be presented for the visualization of Web data through infographics and dashboards that are both informative and understandable, and that could be implemented without advanced programming skills using various instruments that range from the most common commercial software platforms (e.g., tableau) to the several open source packages accessible on the Web (JavaScript, HTML5, etc.). An important component of the course will cover the iterative design and then the acquisition of methods and techniques to assess the quality of these infographics and their concrete application to the continuous improvement of data visualization systems. In the laboratory hours, the students will also acquire the skills necessary to carry out a concrete application project of realistic complexity, which regards the production of a Web report with graphics and animated and interactive charts on topics of common interest and public utility.

**Educational goals**

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At the end of the course students will have acquired skills in analysis, development and evaluation of the quality of complex and interactive infographics.

### Prerequisites

Nobody

### Reference books

Münzner, T. (2014). Visualization analysis and design. CRC Press.

Ware, C. (2012). Information visualization: perception for design. Elsevier.

Scientific articles and handouts provided by the teachers.

### Teaching methods

Lectures with the support of slideware, discussion of practical cases through the forum, discussion of practical home-work projects.

### Assessment methods

A project in which to apply methods and techniques to create and evaluate a complex infographic or a Web report with a series of infographics related to each other. Written exam and an oral discussion of the project.

### Extended program

- Introduction to Visualization.
- Human Perception and Information Processing
- Data types
- Graphical perception (the ability of viewers to interpret visual
- (graphical) encodings of information and thereby decode information in graphs):
  - a. Signal Detection
  - b. Magnitude Estimation
  - c. Pre-Attentive Visual Processing
  - d. Using Multiple Visual Encodings
  - e. Gestalt Grouping
- Color for information display
- Examples and case studies
- Color management systems
- Picture visualization and fruition
- Data Transformation into sources of knowledge through visual representation.
- Requirements and heuristics for high-quality visualizations.
- Charts and standard views: relevance and appropriateness.
- Advanced and innovative tools for data visualization and advanced quantitative analysis.
- The evaluation of the quality of visualizations and infographics.
  - o Qualitative assessment: expert and heuristic;
  - o Quantitative assessment: user tasks; inferential statistical techniques.
  - o Validated psychometric questionnaires and their analysis and understanding.
- Workshops in which students will acquired practical skills to:

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- extract unstructured data from web (import.io, kimono, etc.)
- manage and manipulate data in tabular format (google spreadsheet, excel, etc.)
- explore and present static data (RAWGraphs, Gephi, illustrator, etc.)
- explore and build interactive data visualizations (Tableau Public, Carto)
- design a "data-driven" narrative in a data journalism context.