



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Big Data Analytics per I Processi Decisionali

2627-2-F5703R016

Course title

Big Data Analytics for Decision Making Process

Topics and course structure

Over the past decade, we have witnessed intensive investment in business infrastructures, which have considerably improved their data-collection capabilities. Ideally, we can state that many aspects of business are data-driven, and their trends can be analyzed using data: operations, manufacturing, supply chain management, marketing campaigns, etc.

The wide availability of business data is a driving force behind the development of methods for extracting information and knowledge to support decision-making.

This activity requires the support of technical specialists as well as domain and business experts. On the one hand, a technician can develop software (or write programs) capable of collecting and analyzing data; on the other hand, domain and business experts play a crucial role in ensuring the correct interpretation of the data, taking into account the elements that characterize the domain.

The course aims to provide knowledge of the paradigm shift underlying the data-driven organization. In particular, the course aims to provide basic technical skills to understand big data analytics approaches and to support various stakeholders in the decision-making process.

The course is organized as follows:

- Introduction to BI and Big Data Analytics: Data-driven organization and decision making; Big Data: characteristics, opportunities and critical issues; Understanding data-driven organizations; The value of knowledge – digital economy and data-driven decision making; The structure and subsequent evolution of BI and Big Data Analytics systems.
- The Evolution of BI Architectures (towards Big Data): Decision models based on business functions; Definition, selection and metrics for computing directional indicators (KPI – CSF).
- The Big Data Lifecycle: Phases, methodologies and the value for business purposes (Data as value); Models for data quality evaluation – structured vs unstructured data; Models and techniques for data analysis – how to use

data for fact-based decision making; Visualisation models for decision making – selecting the proper model for each stakeholder – data storytelling and indicators (Lab: data analysis and visualisation – Tableau).

- Getting value from Big Data Analytics and AI: Understanding Machine Learning: supervised and unsupervised learning; Introduction to Generative AI and Large Language Models: foundations, opportunities and limitations; Using GenAI to support business decision making: use cases, human oversight, data governance and ethical issues. Examples of business problems and Big Data Analytics solutions.

Objectives

In line with the professional profile of the degree programme, knowledge of the founding elements of big data analytics in business contexts is considered a valuable asset for graduates of the programme, in particular for human resources specialists.

Knowledge and understanding (Dublin Descriptor 1)

At the end of the course, students know and understand the key elements (business, process and management) of big data analytics solutions in business contexts, together with some technical notions needed to understand the building blocks of BDA solutions, the data lifecycle (collection, quality, management, analysis, visualisation), the fundamentals of machine learning (supervised and unsupervised learning, main tasks and evaluation metrics) and the principles of generative AI in support of decision-making processes, including opportunities, limitations and the ethical and data-governance implications.

Applied knowledge and understanding (Dublin Descriptor 2)

At the end of the course, students are able to: (i) frame and analyse a business decision problem from a data-driven perspective, identifying relevant data, stakeholders and indicators (KPI/CSF); (ii) assess the quality of a dataset and apply basic data preparation techniques; (iii) analyse databases to extract information in support of decisions; (iv) design visualisations and data storytelling suited to different stakeholders (Tableau laboratory); (v) use AI solutions, identifying approaches appropriate to a given problem, and critically interpret their results.

Making judgements (Dublin Descriptor 3)

The exercises, case analyses and group homework develop the ability to critically assess the pros and cons of the techniques introduced, the quality and reliability of data, and the suitability of analytics solutions with respect to the business problem (critical thinking, problem solving, analysis and synthesis skills).

Communication skills (Dublin Descriptor 4)

The in-class discussion of case studies and the presentation of the homework solution to the lecturer and to fellow students develop the ability to communicate data-analysis results to technical and non-technical audiences, including through data storytelling techniques and teamwork.

Learning skills (Dublin Descriptor 5)

The supplementary material provided, the international bibliography and the methodological approach of the course give students the tools to independently continue studying the evolution of big data analytics technologies and methods beyond the end of the course.

Methodologies

The course consists of lectures, alternated with complementary teaching methods (exercises, design work, case analyses), in a 75/25 ratio, allowing students to engage with the topics covered by presenting and exploring their own points of view. During the course, specialists in the field are expected to be invited to share testimonies of real-world cases.

In detail:

- 21 two-hour lectures (42 hours in total), delivered in lecture-based (“erogativa”) mode, in person;
- 7 two-hour complementary teaching activities (14 hours in total) — exercises, laboratory activities and case analyses — delivered in interactive mode, in person.

During the lessons, the lecturer begins with a part in which concepts are presented (lecture-based mode), followed

by an interaction with students that shapes the subsequent part of the lesson (interactive mode). No remote activities are planned (remote share equal to 0%, within the maximum limit of 30% set by ministerial directives). The course is taught in Italian; the teaching materials and part of the bibliography are in Italian and/or English.

Online and offline teaching materials

- Slides;
- Case studies;
- Complementary and in-depth teaching material distributed during the lessons;
- Slides and supplementary materials provided by the lecturer (in accordance with the bibliography), made available on the course e-learning platform.

Programme and references

- a) Provost, Foster, and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking. O'Reilly Media, Inc., 2013 — Ch. 1 Introduction: Data-Analytic Thinking; Ch. 2 Business Problems and Data Science Solutions; Ch. 10 Representing and Mining Text
- b) Viktor Mayer-Schönberger, Kenneth Cukier. "Big Data: A Revolution That Will Transform How We Live, Work, and Think" (Italian edition: "Big data: Una rivoluzione che trasformerà il nostro modo di vivere e già minaccia la nostra libertà", Garzanti, 2013). All chapters
- c) Mezzanzanica and Mercurio, "Big Data as Fuel of Skill Intelligence", available at https://link.springer.com/referenceworkentry/10.1007/978-3-319-63962-8_276-2
- d) Alex Pentland, "Social Physics" (Italian edition: "Fisica Sociale"), Chapter 5 and Appendix A
- e) Gozzo, Pennisi, Asero, Sampugnaro. "Big Data e processi decisionali", Ch. 1

Assessment methods

EMid-term assessment (for attending students). For attending students, a group homework assignment is planned, aimed at assessing students' skills in terms of: (i) teamwork, (ii) data understanding and definition of an approach to the problem, (iii) discussion of the solution identified and implemented for the end user. The homework is a partial group assessment; the final exam remains, in any case, individual. The homework grade, expressed out of thirty, contributes to the student's final grade with an indicative weight of 10%.

Final exam. The exam sessions are organised as follows:

- a one-hour written test, consisting of 2 open-ended questions (short essays) and 8 closed multiple-choice questions, aimed at assessing students' skills in terms of: (i) concepts and methodologies acquired (the closed questions test preparation on the exam programme); (ii) ability to frame and identify the key elements of a BDA process; (iii) ability to summarise the pros and cons of the techniques introduced (the open-ended questions test the capacity for independent reflection on the critical points of the programme and communication skills within the discipline);
- An oral exam on the topics covered in class (optional, at the student's request), aimed at exploring in greater depth the capacity for critical argumentation and communication skills; the oral exam may raise or lower the grade of the written test.

Assessment criteria and grading scale. The Examination Board assesses: the correctness and completeness of knowledge (closed questions); relevance, analysis/synthesis skills, and argumentative rigor (open-ended questions); for the homework, the quality of the proposed solution, the correct interpretation of the data, and the

effectiveness of the presentation. Indicative grading scale: 18–21 essential knowledge of the contents with limited analytical ability; 22–25 adequate knowledge with fair application skills; 26–28 broad and solid knowledge with good critical and application skills; 29–30 cum laude complete and in-depth knowledge, excellent critical analysis, synthesis and communication skills. For non-attending students, assessment is based entirely on the written test (and the optional oral exam, if any) covering the entire program and the indicated bibliography.

Office hours

By appointment, to be arranged with the lecturer by e-mail

Programme validity

two academic years

Course tutors and assistants

Sustainable Development Goals

DECENT WORK AND ECONOMIC GROWTH
