Doctoral course in "Big data and artificial intelligence"

Coordinator: Prof. Barbara Martini - SSD ING-INF/05

Administrative Office: Piazza Mattei, no. 10 - Rome (RM) 00186

Expected course start date: 01 December 2024

Duration: 3 years

Areas CUN: 06 - Medical Sciences, 08 - Civil Engineering and Architecture, 09 - Industrial and Information Engineering, 12 - Legal Sciences, 13 - Economics and Statistics, 14 - Political and Social Sciences.

Curricula:
- Big data management for the digital transition
- Artificial intelligence for industry 5.0 and circular economy

Places: n. 9 Total places, of which 7 with scholarship, 2 without scholarship.

DETAILS OF COMPETITIVE PLACES:

No. 3 scholarships funded by *Universitas Mercatorum*
- **Project theme 1: AI solutions for industrial processes** The aim of the research is to develop advanced AI solutions for the manufacturing sector, focused on regenerative models and operator-machine interaction in the perspective of Industry 5.0. Algorithms for the customized adaptation of interactions will be studied, improving efficiency, security and cooperation in complex production environments. Generative AI techniques will be explored for innovative designs, process simulations in distributed infrastructures, and predictive analytics with a focus on data protection and AI Act compliance. - **Project theme 2: Analysis of complex economic data** The research project aims to focus on the part of information production based on territorial statistics, with particular reference to economic and business data, integrated with metadata acquired from different sources. The complex data provide additional information to analyse economic phenomena, although methodological questions remain open. The objective of the project is the integration of different sources in real-time information to grasp the dynamism in space and time of the economic complexity of the observed phenomenon. - **Project theme 3: Technologies and Infrastructure** The goal of the research is to develop advanced human-centered AI solutions for professional and institutional settings. Research will focus on (use of) distributed computational resources, integrating edge intelligence, high-speed sensors and networks, and heterogeneous systems and data to improve deployment, operational efficiency, and process security. Generative models will be evaluated and advanced ML/DP algorithms developed for the optimization of emerging composite and/or adaptive systems that will be tested in real-world contexts. **Research activities:** periods of study and research at the University/ Company/ Public Body/ Research Centers, etc... (divided into the 3 years of the course) ; study and research periods abroad (6 months).

No. 2 scholarships funded by *Università Telematica San Raffaele*

- **Project theme 1: Big Data Analysis to assess the impact of the environment, territory and work environments on human health and quality of life.**
  The aim of the research is to develop a project in which predictive models and/or analytical tools that use big data allow to identify, quantify and monitor the effects of environmental, territorial and occupational variables on human health and quality of life. This theme represents an opportunity to combine technological innovation with health research, with the ultimate goal of promoting a healthier environment and a better quality of life in different contexts.

- **Project theme 2: Application of Big Data and artificial intelligence for nutrition customization.**
  The goal of the research is to explore the use of Big Data and AI techniques to customize nutritional regimens based on individual characteristics. Research focuses on integrating data from different sources, such as dietary logs, genetic data, biochemistry, and lifestyles, to develop predictive models that can improve the effectiveness of personalized diets.

Research activities: periods of study and research at the University/ Company/ Public Body/ Research Centers, etc... (divided into the 3 years of the course) ; study and research periods abroad (6 months).

No. 2 scholarships for the resources of the PNRR, pursuant to D.M. 630/2024, M4C2 - Inv. 3.3

- **No. 1 scholarship co-financed by the Company "*Next Generation Robotics Srl*"**
  Project theme: Digital data management as part of the digitalization of the inspection and monitoring processes of railway rolling stock.
  The Research Project aims at the management of the digital data from its generation during the acquisition through autonomous robotic technologies, to its management, up to its analysis through I.A. techniques aimed at the recognition of faults and defects, as part of the digitisation of inspection and monitoring processes for railway rolling stock. Everything will be oriented to the implementation of predictive maintenance logic in the specific operating context.

- **No. 1 scholarship co-financed by the Company "Qbrobotics *Srl*"**
  Project theme: The integration of devices with AI for collaborative robotics in the Industrial, Biomedical and Service Robotics sector.
  The goal of the research is to integrate artificial intelligence (AI) into collaborative robotics to improve efficiency and sustainability in various sectors, including industry, health and agri-tech. AI is particularly useful for processing large amounts of data and obtaining accurate information, which in turn enables better decisions and optimisation of operational strategies, setting a new standard for agriculture and health making it more sustainable and efficient.

Research activities: periods of study and research at the Company (18 months in 3 years); study and research periods abroad (6 months).

No. 2 places without scholarship

- **Project theme:** free.

Research activities: periods of study and research at the University/ Company/ Public Body/ Research Centers, etc... (divided into the 3 years of the course) ; study and research periods abroad (6 months).

REQUIREMENTS FOR ADMISSION:

Possession, by 31.10.2024, of one of the following master's degrees or corresponding degree obtained according to the previous legislation:

LMG/01 Class of master's degrees in law
LM-4 Architecture and Building Engineering-Architecture
LM-4 c.u. Architecture and construction engineering-architecture (five years)
LM-5 Archives and Librarianship
LM-6 Biology
LM-7 Agricultural Biotechnology
LM-8 Industrial biotechnology
LM-9 Medical, Veterinary and Pharmaceutical Biotechnology
LM-13 Pharmacy and industrial pharmacy
LM-16 Finance
LM-17 Physics
LM-18 Informatics
LM-20 Aerospace and Astronautical Engineering
LM-21 Biomedical Engineering
LM-22 Chemical Engineering
LM-23 Civil Engineering
LM-24 Building Systems Engineering
LM-25 Engineering of Automation
LM-26 Safety Engineering
LM-27 Engineering of Telecommunications
LM-28 Electrical Engineering
LM-29 Electronic Engineering
LM-30 Energy and Nuclear Engineering
LM-31 Management Engineering
LM-32 Computer Engineering
LM-33 Mechanical Engineering
LM-34 Marine Engineering
LM-35 Engineering for the environment and the territory
LM-40 Mathematics
LM-43 Computer methodologies for the humanities
LM-44 Mathematical-physical modelling for engineering
LM-51 Psychology
LM-52 International Relations
LM-53 Materials Science and Engineering
LM-54 Chemical Sciences
LM-55 Cognitive sciences
LM-56 Sciences of Economics
LM-58 Sciences of the Universe
LM-59 Public, Business and Advertising Communication Sciences
LM-60 Sciences of Nature
LM-61 Sciences of Human Nutrition
LM-62 Science of Politics
LM-63 Public Administration Sciences
LM-66 Computer Security
LM-69 Agricultural Sciences and Technologies
LM-75 Sciences and technologies for the environment and the territory
LM-76 Economics for the Environment and Culture
LM-77 Economics and Business Sciences
LM-79 Geophysical sciences
LM-80 Geographical Sciences
LM-81 Sciences for Development Cooperation
LM-82 Statistical Sciences
LM-83 Actuarial and Financial Statistics
LM-84 Historical Sciences
LM-86 Zootechnics and animal technologies
LM-88 Sociology and Social Research

LM-91 Techniques and methods for the information society
LM-92 Theories of Communication
LM-93 Theories and methodologies of e-learning and media education
LM/DS Defence and Security Sciences
LM/SC-GIUR Legal Sciences
LM Sc. Mat. Materials Science
LM Data Data science
LM-53 Engineering of materials
4/S (specialized in architecture and building engineering)
5/S (specializing in archiving and librarianship)
6/S (specialized in biology)
7/S (specialists in agricultural biotechnology)
8/S (specialists in industrial biotechnology)
9/S (specialists in medical, veterinary and pharmaceutical biotechnology)
14/S (specialized in pharmacy and industrial pharmacy)
19/S (specialized in finance)
20/S (specialist in physics)
21/S (specialist in geography)
22/S (specialist in jurisprudence)
23/S (specialists in computer science)
24/S (specialist in computer science for the humanities)
25/S (specialist in aerospace and astronautical engineering)
26/S (specialist in biomedical engineering)
27/S (specialized in chemical engineering)
28/S (specialised in civil engineering)
29/S (specialists in automation engineering)
30/S (specialist in telecommunications engineering)
31/S (specialist in electrical engineering)
32/S (specialist in electronic engineering)
33/S (specialists in energy and nuclear engineering)
34/S (specialized in management engineering)
35/S (specialist in computer engineering)
36/S (mechanical engineering specialists)
37/S (specialist in naval engineering)
38/S (specialized in engineering for the environment and the territory)
45/S (specialist in mathematics)
48/S (specialized in methods for evaluating complex systems)
49/S (specializing in methods for empirical research in the social sciences)
50/S (specialized in mathematical-physical modelling for engineering)
58/S (specialized in psychology)
59/S (specialized in advertising and business communication)
60/S (specialist in international relations)
61/S (specialist in materials science and engineering)
62/S (specialist in chemical sciences)
63/S (specialist in cognitive sciences)
64/S (specializing in economics)
66/S (specializing in universe sciences)
67/S (specializing in social and institutional communication sciences)
68/S (specialist in nature sciences)
69/S (specialist in the sciences of human nutrition)
70/S (specializing in political science)
71/S (specialist in public administration sciences)
77/S (specializing in agricultural sciences and technologies)
79/S (specialized in agricultural sciences and technologies)
82/S (specialized in sciences and technologies for the environment and the territory)
83/S (specializing in economics for the environment and culture)

84/S (specializing in business studies)
85/S (specialist in geophysical sciences)
88/S (specialist in science for development cooperation)
89/S (specializing in sociology)
90/S (specialized in demographic and social statistics)
91/S (specialists in economic, financial and actuarial statistics)
92/S (specialized in statistics for experimental research)
100/S (specialized in techniques and methods for the information society)
101/S (specialized in communication theory)
102/S (specialized in theory and techniques of standardization and legal information)
DS/S (specialist in defence and security sciences)
LMG/01 CASE LAW)

In the case of a qualification obtained abroad, the assessment of the requirement will be carried out by the Selection Board.

Other requirements for foreign students:
- qualification obtained abroad recognized as equivalent to the Italian title for the purposes of enrolling in the doctorate;
- certified knowledge of the Italian language (level B1).

PROCEDURE FOR CONDUCTING THE TESTS:

How to select:
- **Evaluation of qualifications,** including the compulsory submission of a research project prepared according to the indications of the competition;
- **Interview** that will be carried out in the manner indicated by art. 6 of the notice of competition;
- **Language proficiency:** English language. For foreign candidates will also be evaluated the knowledge of the Italian language.

The test calendar will be published on the dedicated web page:
https://www.unimercatorum.it/ricerca/iscriversi-a-un-dottorato-40

Web page of the PhD:
https://www.unimercatorum.it/ricerca/dottorato-di-ricerca-in-big-data-ed-intelligenza-artificiale-24

Useful contacts: dottorati@unimercatorum.it