BACHELOR OF SCIENCE IN MATHEMATICAL AND COMPUTING SCIENCES FOR ARTIFICIAL INTELLIGENCE

This unique program* stands at the intersection of major scientific disciplines: **mathematics, computer science, physics, and economics**. All of them are crucial for analyzing natural and social phenomena and, in particular, to develop the **Artificial Intelligence (AI)** tools that **model the complex realities** stored in the vast datasets available today.

Bright, math-oriented students who want to acquire a deep and well-rounded **understanding of the natural and social worlds**, and who grasp the growing impact of AI, will see in this program a great opportunity. Through this **multidisciplinary path**, they will have the chance to step into the elite ranks of scholars and professionals who will guide the **development of future knowledge and its real-world applications, in AI** and elsewhere. They will learn **to nurture the emergence of new knowledge** and **to value new points of view**.

Demand for skillsets that combine **elements of STEM subjects** is very strong and growing. This BSc focuses on **critical and methodological abilities** from those same areas that will remain valid even as new technologies succeed one another, so graduates can confidently expect long and rewarding careers.

The study plan aims to provide a **rigorous** theoretical preparation, **in terms of contents and methods**, in different areas of **mathematics** and **computer science** and in the modelling techniques of **physics** and **economics**. Students receive methodological training in **data driven AI** (machine learning, computational statistics) and, at the same time, master the main **mathematical, computational and modelling methods** for the solution of quantitative problems and for making progress in the AI field itself.

In addition, **soft skills** such as effective communication and ability to work in a team are developed, enabling graduates to integrate and collaborate effectively in academic and professional contexts.

The BSc in Mathematical and Computing Sciences for Artificial Intelligence will open students' minds and empower them with the **best preparation to excel in the new digital era**.

PROGRAM STRUCTURE

FIRST YEAR

Main topics

- **Mathematical Analysis**
- **Computer Science**
- **Algebra and Geometry**
- **Probability**
- **Foundations of Physics I**
- **Foundations of Economics**

The first year implements one of the main ideas of our degree: within a unified framework, to give you a modern education in the concepts and methods of four major disciplines, Mathematics, Computer Science, Physics and Economics. Taught by leaders in their fields, first-year courses will empower you with a fundamental knowledge that will retain its value throughout your life, whatever new knowledge may emerge in the future.

First-year courses characterize our Bachelor of Science from the very beginning as a truly rigorous interdisciplinary degree. At the same time, they will give you the knowledge and connections that will enable you to understand the principles of mathematical and computational modelling in both the natural and the social sciences, and prepare you for the modern Artificial Intelligence (AI) tools which are essential for extracting information from large scale data.

Mathematical Analysis (modules 1 and 2), **Algebra and Geometry**, and **Probability** will provide you with the necessary mathematical knowledge and methods.

Computer Science (modules 1 and 2) will give you the basic notions of computer architectures, programming, data structures and algorithms.

Foundation of Physics I will introduce you to the core concepts of classical physics, also giving you a leading example of a natural science inquiry into the laws of nature. In **Foundations of Economics**, you will learn the main ideas and categories of economics, also as a paradigmatic example of a social science understanding of human actions and interactions.

*The program is subject to completion of approval process by Ministry of Universities and Research

SECOND YEAR

Main topics

- **Advanced Analysis and Optimization**
- **Advanced Programming and Optimization Algorithms**
- **Basic Modelling in Machine Learning**
- **Foundations of Physics II**
- **Decision Theory and Human Behaviour**
- **Mathematical Statistics**

Foreign language
AI Laboratory
Seminars in Digital Ethics and in Behavioural Skills

In the second year, you will proceed in acquiring concepts and methods in the different disciplines, but you will be also exposed to courses that are at their crossroads. Another of the main ideas of this Bachelor of Science finds its way: your preparation will grow to become a coherent mix of the mathematical, computational and modelling skills that are essential in the new digital era.

Advanced Analysis and Optimization and **Mathematical Statistics** will deepen your analytical skills. **Advanced Programming and Optimization Algorithms** will give you advanced notions in programming and algorithms. **Foundations of Physics II** will introduce you to electromagnetism and modern physics using some advanced mathematical analysis, while in **Decision Theory and Human Behaviour**, you will learn the formal modelling of human decision making, with its applications to the economics of risk and uncertainty.

Finally, **Basic Modelling in Machine Learning** will introduce you to the principles of one of the most impacting areas of modern **AI**.

The **AI Lab** and the seminars on **Digital Ethics** and on **Behavioural Skills** complete the second year by giving you some soft skills that are important in academic and professional worlds.

THIRD YEAR

Main topics

- **Machine Learning for Artificial Intelligence**
- **Stochastic Processes and Simulations in Natural Sciences**
- **Statistical and Quantum Physics**
- **Game Theory and Mechanism Design**
- **Mathematical Modelling for Finance**
- **Modelling for Neurosciences**

Electives
Exchange program
Internship
Final paper

In the third year, courses will blend mathematical, computing and modelling skills, with more than an glimpse in the direction of modern data-driven AI challenges.

You will see some advanced computing tools and methods in the **Machine Learning for Artificial Intelligence** course. In **Statistical Processes and Simulation in Natural Sciences**, you will learn the fundamentals of simulation and numerical methods, with their applications to natural sciences. **Statistical and Quantum Physics** builds on advanced mathematical and algorithmic tools to model complex physical systems. In **Game Theory and Mechanism Design**, you will learn the formal modelling of human interactions, a topic that underlies much of modern economics and plays a key role in computer science. **Mathematical Modelling for Finance** will present a most successful interplay of economics and mathematics. Finally, **Modelling for Neurosciences** will introduce you to the study of cognitive processes and their key role in understanding artificial and human intelligence.

A wide choice of **elective courses** will allow you to dive deeper into your favorite subjects, choosing among many intriguing topics in mathematics and computer science, as well as in natural and social sciences.

You will also have the opportunity to spend a semester at leading international universities and participate in internships in Italy and abroad. A final essay will conclude your undergraduate studies and introduce you to new challenges, be they on the job market or in further studies in MSc programs.

For more information and insights
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