UNIVERSITÀ DI PAVIA

## Anno Accademico 2023/2024

# LABORATORY OF MACHINE LEARNING APPLIED TO PHYSICAL SYSTEMS

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| **Enrollment year** | 2021/2022 |
| **Academic year** | 2023/2024 |
| **Regulations** | DM270 |
| **Academic discipline** | NN (INDEFINITO/INTERDISCIPLINARE) |
| **Department** | DEPARTMENT OF MATHEMATICS "FELICE CASORATI" |
| **Course** | ARTIFICIAL INTELLIGENCE |
| **Curriculum** | PERCORSO COMUNE |
| **Year of study** | 3° |
| **Period** | 2nd semester (04/03/2024 - 18/06/2024) |
| **ECTS** | 3 |
| **Lesson hours** | 36 lesson hours |
| **Language** | English |
| **Activity type** | ORAL TEST |
| **Teacher** | GEROSA DAVIDE (titolare) - 3 ECTS |
| **Prerequisites** | Introduction to physics as provided in the relevant first- and second-year classes. Basic knowledge of the Python programming language. |
| **Learning outcomes** | - Describe physical systems using the appropriate mathematical formulation.<br>- Apply machine-learning algorithms to the resulting problem.<br>- Understand the advantages and limitations of machine learning algorithms given the specific problem at hand. |
| **Course contents** | - Intro: Computing and machine-learning in physics and astronomy.<br>- Intro: The typical tasks of a computational physicist.<br>- Example: A prototypical physical system.<br>- Task: The "classical" computational solution.<br>- Task: The machine-learning solution.<br>- Project development and reporting. |

## Teaching methods

Each class will pair traditional lectures (to introduce the relevant problems) with hands-on exercises and demonstrations (to tackle the relevant problem). These computational activities are the key content of the course.

**Reccomended or required readings**

- Statistics, Data Mining, and Machine Learning in Astronomy: A Practical Python Guide for the Analysis of Survey Data. Željko Ivezi?, Andrew J. Connolly, Jacob T. VanderPlas, and Alexander Gray. Princeton University Press
- Machine Learning for Physics and Astronomy. Viviana Acquaviva. Princeton University Press.

## Assessment methods

Students will develop a computational project. This will be started during the lectures and completed asynchronously. The project report and associate code, likely in the form of a Jupyter notebook, will then be submitted for evaluation.

## Further information

Lectures will take place at Milano-Bicocca.

## Sustainable development goals - Agenda 2030

Istruzione di qualità.
Uguaglianza di genere.
Industria, innovazione e infrastrutture.
$lbl_legenda_sviluppo_sostenibile