

PhD programme in Earth, Environmental and Resources Sciences

Instructor(s)	Francesco Carotenuto, DiSTAR-UNINA
Course Title	Spatial Distribution Modelling via Machine Learning Algorithms in R
Total Number of Hours	12 hours (3 CFU)
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Course Description

This course aims at providing Ph.D. students with advanced notions about applying different Machine Learning Algorithms to Geosciences problem solving. Students will learn about notions of spatial data Engineering for models' training and cross-validation strategies. The core focus of the classes will be the description of the architecture behind Extreme Gradient Boosting, Artificial Neural Networks and MaxEnt algorithms for generating spatial maps describing the probability of geological events and chemicals distribution.

Course Contents

1. Spatial Distribution Modelling in Geosciences
2. Data Engineering, model training and cross-validation strategies
3. Discriminative Machine Learning Algorithms
4. Generative Machine Learning Algorithms
5. Running Spatial Distribution Models in R with case studies

Learning Outcomes

By the end of the course, doctoral students will be able to:

- Understanding the architecture of Machine Learning Algorithms
- Understanding how to apply Machine Learning Algorithms to Geosciences' problem solving
- Generating R code to run Machine Learning Algorithms
- Generating spatial maps of geological risks and event distribution probability.



Teaching Format

Lectures, hands-on exercises, data analysis sessions, and discussion of real case studies.

Essential Bibliography

- **An Introduction to R** (available at: <https://cran.r-project.org/doc/manuals/r-release/R-intro.html>)
- **A Handbook of Statistical Analyses Using R** (available at: https://cran.r-project.org/web/packages/HSAUR/vignettes/Ch_introduction_to_R.pdf)
- Selected scientific papers and teaching materials provided during the course

Assessment Method (optional)

Active participation and practical exercises during the course