

## ORGANIZING COMMITTEE



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RISIS2 EU Project

## ORGANIZATIONAL DETAILS

The course will take place in Rome (Via dei Taurini 19) from **February 20<sup>th</sup>, 2023 to February 24<sup>th</sup>, 2023**.

Maximum number of participants for the course is 20. Participants will be selected on the basis of their interests and CV.

Notification of acceptance and request of confirmation will be sent after the selection process is completed. No fee to be paid for researchers from European Institutions. Travel and accommodation will be covered only in case of researchers, early researchers and PhDs coming from European Institutions. Travel and accommodation will be in charge of the organization.

**DEADLINE FOR APPLICATION**  
**30<sup>th</sup> November 2022**

Applications and CV must be sent to:

[winter.school@ircres.cnr.it](mailto:winter.school@ircres.cnr.it)

## PARTICIPATION REQUIREMENT

Research track-record, with a preference for quantitative studies

Knowledge on basic principles of statistics

Interest in STI studies

# RISIS

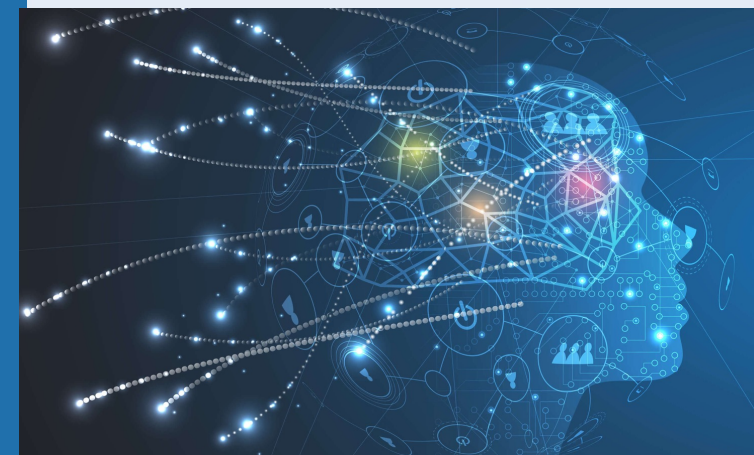


RESEARCH INFRASTRUCTURE FOR SCIENCE  
AND INNOVATION POLICY STUDIES

## DATA SCIENCE WINTER SCHOOL

**Tools and methods for analysing complex Science, Technology, and Innovation (STI) systems: A gentle introduction to Network Science (NS), Machine Learning (ML) and Spatial Models (SM)**

**From 20<sup>th</sup> to 24<sup>th</sup> February 2023**



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## COURSE OBJECTIVES

Recent years have witnessed an unprecedented availability of information on social, economic, and technological phenomena.

Researchers, practitioners, and policymakers have nowadays access to huge datasets (the so-called “Big Data”) on people, companies and institutions, web and mobile devices, satellites, etc., at increasing speed and detail.

Relational (big) data are also in a surge, thus documenting an increasing need to shed light on relationships among research and innovation actors.

NS, ML and SM are relatively new techniques able to enlarge our understanding of complex socio-technological systems, either by digging deeply into the data informative power (ML), or by increasing the understanding of the system relational dimension (NS and SM).

## AUDIENCE TARGETED

Target audience for this course are researchers in research policy and innovation studies with a quantitative orientation, who aim to extend their competence on ML, NS, and SA analysis.

The course is addressed to:

- Senior scientists, early career researchers and PhD students at the last phase of their training;
- Officers from the policy making level;
- Research associations.

## PROGRAM AND CONTENTS

### Day 1 – February 20, 2023

14:15-14:45 Registration

14:45-15:00 Welcome

15:00- 17:30 RStudio Introduction Edmondo di Giuseppe (IBE-CNR)

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### Day 2 – February 21, 2023

**MODULE: NETWORK SCIENCE - Antonio Zinilli (CNR IRCrES)**

9:30 - 10:30 Basic concepts of Network Science

10:30-11:00 Coffee break

11:00-12:30 ERGMs Introduction and Estimation

12:30-14:00 Lunch

14:00-15:00 Application scenarios (some illustrative examples of Network Science on specific datasets of Science Technology and Innovation (STI) systems)

15:00-16:00 Organization of the laboratory assignments. Creation of groups and provision of data and teamwork

16:00- 16:30 Coffee break

16:30- 17:30 Young participants' presentation of their assignments (Network models)

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### Day 3 – February 22, 2023

**MODULE: MACHINE LEARNING – Giovanni Cerulli (CNR IRCrES)**

9:30 - 11:00 An introduction to Machine Learning and Data Science for analyzing complex STI systems:

Identification, prediction, trade-offs, and validation approaches

11:00-11:30 Coffee break

11:30- 12:30 Resampling techniques: Bootstrap and Cross-validation

12:30-14:00 Lunch

14:00-15:30 Model selection and regularization: Optimal subset selection; Shrinkage Methods: Lasso, Ridge, and Elastic regression

## PROGRAM AND CONTENTS

15:30- 16:00 Coffee break

16:00- 17:00R session with applications to STI datasets

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### Day 4 – February 23, 2023

**MODULE: MACHINE LEARNING – Giovanni Cerulli (CNR IRCrES)**

09:30- 11:00 Tree-based models for regression and classification: Bagging, Random Forests and Boosting

11:00- 11:30 Coffee break

11:30- 12:30 Organization of the laboratory assignments  
12:30-13:30 Presentation of group work (Machine Learning models)

13:30-14:30 Lunch

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**MODULE: SPATIAL MODELS - Barbara Guardabascio (Università degli studi di Perugia)**

14:30-16:00 Spatial models: fundamental concepts

16:00-16:30 Coffee break

16:30-18:00 Estimating spatial models in R

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19:30 Social Dinner (Meeting point at Via dei Taurini, 19)

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### Day 5 – February 24, 2023

**MODULE: SPATIAL MODELS - Barbara Guardabascio (Università degli studi di Perugia)**

9:30-10:30 Application scenarios (some illustrative examples of Spatial models on specific datasets of Science Technology and Innovation (STI) systems)

10:30-11:30 Organization of the laboratory assignments. Creation of groups and provision of data and teamwork

11:30-12:00 Coffee break

12:00-13:00 Young participants' presentation of their assignments (Spatial models)

13:00-13.15 Closing remarks