RISIS
RESEARCH INFRASTRUCTURE FOR SCIENCE AND INNOVATION POLICY STUDIES

This project is funded by the European Union under Horizon2020 Research and Innovation Programme Grant Agreement n°824091

RISIS TRAINING – CALL FOR SUBMISSION

Consiglio Nazionale delle Ricerche
IRCrES
ISTITUTO di RICERCA sulla CRESCITA ECONOMICA SOSTENIBILE
RESEARCH INSTITUTE on SUSTAINABLE ECONOMIC GROWTH

DATA SCIENCE WINTER SCHOOL On

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)

VENUE AND DATE

CNR-IRCrES, ROME, February 20-24, 2023

COURSE PRESENTATION

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).

OBJECTIVES:

The training will provide participants with the essential tools for a correct application of some popular NS, ML and SM methods in various STI contexts. In particular:

- ML techniques proves useful for factor importance detection, as well as for classification purposes in a model-free stance;
- NS and SM techniques are useful to identify and study structure and dynamics of large and complex STI communities.theory and applications. Participants will run some exercises assigned by the instructor under his supervision.

EXPECTED OUTCOMES:

At the end of the course, participants will become familiar with:

- The basic workflow of NS, SM and ML
- Basic knowledge of R and main packages of R for NS, SM and ML
- Advanced analysis of RISIS datasets through descriptive and exploratory modelling, network models, spatial models and machine learning.

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TARGET AUDIENCE:

Target audience for this course are researchers in research policy, higher education, and innovation studies with a quantitative orientation, who aim to extend their competence on NS, ML and SM analysis. Basic requisites for admission will be:

- Knowledge on basic principles of statistics;
- Interest in STI studies.

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.

Participants will be asked to bring their PC (with RStudio software installed) when attending the course. It is possible to download the RStudio software here.

PROGRAM OF COURSE

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)**

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)

Day 3 – February 22, 2023

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

09:30-11:00 Spatial models: fundamental concepts

11:00-11:30 Coffee break

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11:30-13:00 Estimating spatial models in R

13:00-14:00 Lunch

14:00-15:00 Application scenarios (some illustrative examples of Spatial models

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 (Spatial models)

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

Day 4 – February 23, 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

15:30- 16:00 Coffee break

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

Day 5 – February 24, 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- 11:30Coffee break

11:30- 12:30 R session with applications to RISIS datasets

12:30- 13:30 Lunch

13:30- 14:30 Organization of the laboratory assignments

14:30-15:30 Presentation of group work (Machine Learning models)

15:30-15:45 Closing remarks

CONDITIONS FOR PARTICIPATION

SELECTION CRITERIA:

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.

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FEES AND PAYMENTS:

- 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.
- Scholars from non-European institution members must pay a participation fee of Euro 250 (which includes the social dinner).
- No costs are covered for people not involved in research activities (i.e., people from associations or policy level).

ORGANISATIONAL DETAILS

Send an email to winter.school@ircres.cnr.it with a clear indication of your interest for applying and attach an updated CV. You will receive the confirmation once the registration has been processed. In case you do not receive any notification from us within one week, please contact the same e-mail address.

DEADLINE FOR APPLICATION: **30th November 2022.**

ORGANISING COMMITTEE AND CONTACT DETAILS

TEACHING STAFF:

Dr. Antonio Zinilli (IRCrES-CNR), Giovanni Cerulli (IRCrES-CNR), Dr. Barbara Guardabascio (Università degli Studi di Perugia) and Edmondo di Giuseppe (IBE-CNR).

ORGANIZING COMMITEE:

Dr. Antonio Zinilli, Dr. Giovanni Cerulli, Dr. Emanuela Reale,

Dr. Alessia Fava (IRCrES-CNR).

LOCAL CONTACT:

Dr. Antonio Zinilli, Dr. Marco De Biase and Dr. Alessia Fava (IRCrES-CNR) (winter.school@ircres.cnr.it).

SCHEDULE OF THE COURSE:

The course will take place from February 20th, 2023 to February 24th, 2023.

VENUE:

IRCRES-CNR – Research Institute on Sustainable Economic Growth of the National Research Council of Italy, **Via dei Taurini 19, Rome, Italy** [MAP].