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

WINTER SCHOOL ON

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

VENUE AND DATE

CNR-IRCrES, ONLINE PLATFORM, February 15-26, 2021

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, SM and ML 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, SM and ML 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;

The course foresees three modules (one on ML, one on NS, and one on SM) with the aim of balancing 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 ML, NS, and SA 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.

It is possible to download the RStudio software **here.**

PROGRAM OF COURSE

***Remote workgroups**

Students will have 1 day to work remotely between each assignment (17, 22, 25 February). During this day, each group will have 1 hour dedicated session of tutoring with modules instructors.

Day 1 – February 15, 2021

14:45-15:00 Welcome (Emanuela Reale – CNR IRCrES)

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

Day 2 – February 16, 2021

MODULE: NETWORK SCIENCE - Antonio Zinilli (CNR IRCrES)

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

10:30-11:00 Break

11:00-12:30 ERGMs Introduction and Estimation (Markov Chain Monte Carlo estimation for exponential random graphs)

12:30-14:00 Break

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

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REMOTE WORKGROUP February 17, 2021

Day 3 – February 18, 2021

MODULE: NETWORK SCIENCE - Antonio Zinilli (CNR IRCrES)

10.00-12.00 Young participants' presentation of their assignments (Network models)

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Day 4 – February 19, 2021

MODULE: SPATIAL MODELS - Thomas Scherngell and Martina Neuländtner (AIT)

9:30 - 11:00 Spatial models: Basic concepts and classes

11:00-11:30 Break

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

13:00-14:00 Break

14:00-15:00 Organization of the laboratory assignments. Creation of groups and provision of data and teamwork

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REMOTE WORKGROUP February 22, 2021

Day 5 – February 23, 2021

MODULE: SPATIAL MODELS - Thomas Scherngell and Martina Neuländtner (AIT)

10:00-12:00 Presentation of group work (Spatial models)

MODULE: MACHINE LEARNING - Giovanni Cerulli (CNR IRCrES)

14:30-16:00 An introduction to Machine Learning and Data Science for analyzing complex STI systems: Identification, prediction, trade-offs, and validation approaches

16:00-16:30 Break

16:30- 17:30 Resampling techniques: Bootstrap and Cross-validation

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Day 6 – February 24, 2021

MODULE: MACHINE LEARNING - Giovanni Cerulli (CNR IRCrES)

09:30-11:00 Model selection and regularization: Optimal subset selection; Shrinkage Methods: Lasso, Ridge, and Elastic regression

11:00 – 11:30 Break

11:30 – 13:00 Tree-based models for regression and classification: Bagging, Random Forests and Boosting

13:00 – 14:30 Break

14:30 – 15:30 R session with applications to STI datasets

15:30 – 16:00 Organization of the laboratory assignments

REMOTE WORKGROUP February 25, 2021

Day 7 – February 26, 2021

MODULE: MACHINE LEARNING - Giovanni Cerulli (CNR IRCrES)

09:30-11:30 Presentation of group work (Machine Learning models)

11:30-11:45 Closing remarks

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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.

FEES AND PAYMENTS:

NO FEES for European participants

For Extra European participants: **EUR 50,00**

Details on Payment will be provided after the selection.

ORGANISATIONAL DETAILS

The course will take place on ONLINE PLATFORM from February 15th, 2021 to February 26h, 2021.

HOW TO APPLY:

Application Form (link) and CV must be sent to **Dr. Marco De Biase, CNR - IRCrES**

marco.debiase@ircres.cnr.it

DEADLINE FOR APPLICATION: **18th November 2020**

ORGANISING COMMITTEE AND CONTACT DETAILS

TEACHING STAFF:

Dr. Antonio Zinilli (CNR IRCrES), Dr. Giovanni Cerulli (CNR IRCrES), Edmondo di Giuseppe (CNR IBE), Thomas Scherngell (AIT) and Martina Neuländtner (AIT).

ORGANIZING COMMITEE:

Dr. Antonio Zinilli, Dr. Giovanni Cerulli, Dr. Serena Fabrizio, Dr. Emanuela Reale, Dr. Marco De Biase (CNR IRCrES), Thomas Scherngell (AIT).

LOCAL CONTACT:

Dr. Marco De Biase, CNR IRCrES (marco.debiase@ircres.cnr.it).