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Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

Consiglio Nazionale delle Ricerche

DATA SCIENCE SCHOOL: Tools and Methods for Analysing Complex Science, Technology and Innovation (STI) Systems

February 24-27, 2025
FOSSR-RISIS Winter School

FOSSR
Fostering Open Science in Social Science Research
Innovative tools and services to investigate economic and social change

RISIS
RESEARCH INFRASTRUCTURE FOR SCIENCE AND INNOVATION POLICY STUDIES

Winter School contents

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**. **Network Science (NS), Bayesian Networks (BN), Machine Learning (ML) and Spatial Model (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, BN and SM)**. The training will provide participants with the essential tools for a correct application of some popular NS, BN, 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.

Innovative Aspects

This course integrates **cutting-edge advancements** in Network Science, Bayesian Networks, Machine Learning, and Spatial Models, tailored specifically for analyzing complex STI systems. The program emphasizes practical application using **real-world datasets**, making it a valuable resource for those working with research data.

How to apply

Applications should be submitted within **January 30th, 2025** through the form at:
https://l.cnr.it/fossr-risis-winterschool
Contact person for info: **antonio.zinilli@cnr.it**

Notification of acceptance by Feb. 7th, 2025.
Participation in the Winter School will be limited to a **maximum of 40 attendees**.
If the number of registrations exceeds 40, a selection will be made based on the relevance of the educational or professional background, in relation to the course topics, as outlined in the submitted CV. In particular, basic requisites for admission will be: knowledge on basic principles of statistics; interest in STI studies.

Audience

The course is designed for individuals who are or wish to be involved in **creating, capturing, analysing, or generally managing research data within the social science disciplines**. The target audience includes, but is not limited to, early-career researchers, researchers aspiring to advance their careers, data managers, data stewards and technicians involved in the management, analysis and interpretation of research data, particularly within the social sciences.

CNR DSU

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The Winter School

The course offers an **in-depth exploration of advanced statistical techniques and methodologies**, focusing on **Network Models, Bayesian Modeling, Machine Learning, and Spatial Models**, specifically applied within the context of Research Infrastructures (RI). Participants will learn to effectively **engage with RIs and leverage their resources for research purposes, enhancing their understanding of data management and analysis in Science, Technology, and Innovation (STI) systems**

The course foresees four modules (one on NS, one on BN, one on ML, and one on SM) with the aim of balancing theory and applications. Participants will run some exercises assigned by the instructor under his supervision.
This course directly contributes to the objectives of the FOSSR (Fostering Open Science in Social Science Research) project by fostering the development of new competences and knowledge that are essential for working with the Open Science Cloud being developed under FOSSR. By training participants in the use of NS, BN, ML, and SM techniques, **the course supports the integration and analysis of diverse data sources within the Open Science Cloud, enabling researchers to generate more nuanced insights and promote data-driven decision-making in social science research.**

Agenda

Winter School coordinator: **Antonio Zinilli (CNR-IRCrES)**

Feb. 24

10:45 **Welcome introduction**
Salvatore Capasso (CNR-DSU)

11:00 **Basic concepts of Network Science**
Antonio Zinilli (CNR-IRCrES)

13:00 *lunch*

14:00 **ERGM Estimation in R**
Antonio Zinilli (CNR-IRCrES)

16:00 *Q&A*

Feb. 25

11:00 **Spatial models: fundamental concepts**
Barbara Guardabascio (University of Perugia)

13:00 *lunch*

14:00 **Estimating spatial models in R**
Barbara Guardabascio (University of Perugia)

16:00 *Q&A*

Feb. 26

11:00 **Basic concepts of Bayesian Networks**
Lorenzo Giammei (CNR-IRCrES)

13:00 *lunch*

14:00 **Bayesian Networks in R**
Lorenzo Giammei (CNR-IRCrES)

16:00 *Q&A*

Feb. 27

11:00 **An introduction to Machine Learning: Identification, prediction, trade-offs, and validation approaches**
Giovanni Cerulli (CNR-IRCrES)

13:00 *lunch*

14:00 **R session with applications to STI datasets**
Giovanni Cerulli (CNR-IRCrES)

16:00 *Q&A*

Duration
The course spans four days, from February 24 to February 27, 2025, with daily sessions from 11:00 AM to 4:30 PM.

Methodological Approach
The course is structured around interactive lectures, hands-on sessions using R, and dedicated Q&A segments, allowing participants to engage directly with experts and apply learned concepts in real-time.

Virtual Meeting and Working Space Platform
The course will be conducted online via a dedicated virtual learning platform, ensuring interactive participation and access to all necessary resources.

Knowledge Evaluation Methodologies and Tools
Participants' understanding will be assessed through practical assignments, active participation in Q&A sessions.

Accessibility and Inclusion Strategies
The course materials and the language will be in English and all sessions will be recorded and transcribed to ensure accessibility. The program is designed to be inclusive, with considerations for participants from diverse backgrounds and varying levels of expertise.

Organisational details

The course will be held online; the link will be provided to participants in due time before the beginning of the course.
Lessons will be held in English. Teaching materials, thematic literature and notes on the topics covered will be available to all participants in English.

The training is organised by CNR-IRCrES in the frame of the FOSSR project and of the RISIS project (Research Infrastructure for Science and Innovation policy Studies), with the support of CNR-DSU.

Scientific Committee: Antonio Zinilli (CNR-IRCrES), Barbara Guardabascio (University of Perugia), Lorenzo Giammei (CNR-IRCrES), Giovanni Cerulli (CNR-IRCrES).
Organising committee: Antonio Zinilli (CNR-IRCrES), Serena Fabrizio (CNR-IRCrES), Rita Giuffredi (CNR-IRCrES), Alessandra Maria Stilo (CNR-IRCrES).

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