



VIU
Graduate
seminar
**TOWARDS Geo-Data
science: EXTRACTING
KNOWLEDGE FROM
HETEROGENEOUS
Geoenvironmental
Data**

**Towards Geo-Data Science:
extracting knowledge from heterogeneous
geoenvironmental data**

May 20-24, 2024

**Venice International University
Isola di San Servolo, Venice**

VIU Graduate Seminar

Towards Geo-Data Science: extracting knowledge from heterogeneous geoenvironmental data

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University

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Scientific Coordinator:

Marj Tonini
University of Lausanne

Defined for the first time by Peter Naur as "*The science of dealing with data*", the term Data Science evolved over time around the original concept of "...*converting data into information and knowledge*" (IASC, 1977). In environmental and earth sciences, physical geography, humanities and social sciences, the use of Data Science procedures is emerging only recently, proving to be extremely efficient to deal with the complexity of the investigated phenomena and the heterogeneity of the underlying data sources. This leads modern environmental scientists to interact with other disciplines, apparently far from their domain. Emblematic from this perspective are the ones related to history and philosophy of science.

The quantitative analysis of information coming from historical records represents an exciting research field, requiring a truly holistic approach. On the other hand, epistemological and philosophical considerations on the relationship between geoscience and society are of fundamental importance for understanding past, present, and future geosphere-anthroposphere interlinked and reflexive dynamics. This openness is increasingly important as society struggles to respond to the implication of anthropogenic pressures on different issues, such as natural hazards and climate change, or the harmful impacts of human activities on biodiversity, water and air quality, and human health. In addition, the technological developments achieved by laboratory instruments, including geophysical, proximal and remote sensing devices, increase exponentially the amount and the heterogeneity of geoenvironmental data potentially available.

Thus, there is a real need for the development of new techniques allowing to extract insight from data and to transform this information into knowledge. While the choice of a specific methodology depend on the objectives of the study, there is no single model that always perform better than another, and finding satisfying solutions in specific applications requires a good understanding of the strengths and weaknesses of the existing methodological approaches.

This Graduate Seminar will be led by

- University of Lausanne, Switzerland
- Luav University of Venice, Italy
- University of Ca' Foscari, Venice, Italy

Faculty

Marj Tonini, University of Lausanne, Switzerland
(Scientific Coordinator)

Sebastiano Trevisani, Luav University of Venice,
Italy (Co-coordinator)

Pietro Omodeo, University of Ca' Foscari, Venice,
Italy (Co-coordinator)

Mikhail Kanevski, University of Lausanne,
Switzerland

Francesco Luzzini, Ca' Foscari University of
Venice, Italy, and Johns Hopkins University, USA

Alejandra Morán-Ordóñez, University of
Lausanne, Switzerland

Filippo Catani, University of Padua, Italy

Paolo Fabbri, University of Padua, Italy

Dario Camuffo, National Research Council of Italy

Donata Canu, National Institute of Oceanography
and Applied Geophysics OGS, Italy

Methodology

The Graduate Seminar will involve both theoretical lecturers and practical exercises. Open discussions with the participants will be stimulated and debates animated. The last day will be dedicated to students' practical activities working on their own datasets. The presentation of a personal research project integrating the techniques appropriate to the individual case studies will be encouraged.

Topics

- Theoretical prospective of the role of geoenvironmental data and other source of information for the characterization, analysis, and modelling of the geosphere and the anthroposphere, from historical times to present.
- The derivation of quantitative data from historical documents will also be introduced in this first part of the seminar, crucial for stimulating open discussions among the participants.

- Practical concepts and environmental applications of the main techniques of analysis in Geo-Data Science, in particular geostatistics and machine learning. This second part includes exercises on personal computers, covering approximately 60% of the total time of the seminar.

Learning outcomes for participants

By the end of this Graduate Seminar students will gain a good understanding of main theoretical and practical concepts of Geo-Data Science and its applications.

Theoretical lecturers will enable students to learn about the quantitative analysis of geoenvironmental data in the context of sustainability and management of the environment in current and historical times, as well as the role of expert-knowledge on the application of geocomputational approaches. These lecturers seek to promote a wide and holistic view on geoenvironmental and geoengineering issues.

Practical exercises will provide the students with a deeper knowledge in spatial data analysis, with elements of geostatistics and machine learning, letting them to perform further autonomous developments. In particular students will be able to handle different methods of Data Science, such as exploratory data analysis and data visualization; key concepts of Geostatistics (spatial continuity, interpolation, random functions) with practical skills in the implementation of kriging algorithms; unsupervised and supervised machine-learning approaches for regression, classification, and prediction mapping.

Who can apply?

This Graduate Seminar is offered to advanced Master, early PhD students and junior researchers in Earth/Environmental Sciences, Biology and Spatial ecology, Physical geography, and equivalent disciplines. Students in Architecture, Humanities, Planning and Arts related disciplines can also apply. The participants should have a good knowledge of

mathematics and statistics; skills in geographical information systems and notions in R programming language are also required. Students need their laptops for the practical parts of the seminar.

Fees & Grant Support

Students from the VIU member institutions will pay no participation fees. Grant support is also available to support, partially or fully, the costs of international travel and accommodation. The participation fee for students of non-member institutions is Euro 1.150 VAT included. The fee is inclusive of tuition, course materials, accommodation, lunches, social events and taxes. Students from non-member institutions are not eligible for VIU grant support. VIU Alumni are eligible for a reduced fee.

Credits

Participation in the Graduate Seminar is considered equivalent to **2 ECTS**.

The program is available on the VIU website.

Applications

November 15, 2023 – January 31, 2024 via the VIU website

Applicants must submit the application form, a letter of motivation – which should include a brief description of the candidate's research interests, a curriculum vitae and a photo.

VIU Graduate Seminars

These are thematic intensive seminars given in a concentrated period on subjects of universal interest, open to a broad spectrum of disciplines. They are suited to both Master's and PhD students as well as junior researcher and are open to candidates from all the VIU member institutions. The young researchers will receive support in defining their research proposal. Significant cooperation among departments in the member institutions is expected.

Venice International University is a consortium of 21 institutions, representing 14 countries throughout the world. The mission of VIU is to foster cooperation among VIU member institutions while facilitating the exchange of

knowledge and ideas, by developing, promoting and organizing joint academic, research and training/capacity-building program. Students from non-member institutions may participate in selected academic programs. The academic programs at VIU are distinguished by a markedly interdisciplinary approach to the topics, and by the international perspectives that the participants contribute to the discussions. The VIU campus is on the island of San Servolo in Venice, Italy.

Location



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