



University of Genova

Department of Earth, Environmental
and Life Sciences

Doctorate Course in Earth and
Environmental Science and
Technology

Università degli Studi di Genova



Dottorato in Scienze e Tecnologie
per l'Ambiente e il Territorio

Curriculum in Geology

Research Theme n. 2

Titolo “Intelligenza Artificiale e processi geo-idrologici: approcci innovativi nella gestione del rischio”

Title “Artificial Intelligence and Geo-Hydrological Processes: Innovative Approaches to Risk Management”

Tutor Francesco Faccini

Co-tutor Danilo Godone (CNR-IRPI Torino)

Program description including the formation program abroad

Geo-hydrological risk management involves multiple phases and processing steps. The need to handle large volumes of complex data—both in terms of their interpretation and organization, as well as their synthesis and analysis—requires significant time and computational capacity. The continuous development and widespread adoption of Artificial Intelligence (AI)-based tools have revolutionized analysis and evaluation processes across various scientific fields. Particularly, large language models (LLM) interfaces could be used as a tool to support the management, reading and comprehension of data, especially if they are numerous, not organized/standardized or from historical/archival sources. The collected information will constitute the knowledge basis of geo-hydrological risk in a selected study area. If LLMs will succeed in, correctly, reading the abovementioned documents, the extracted data will be used to structure an event database. Contemporarily, LLMs will be used to monitor and track documents and news to update in real-time the database with newly occurred events.

In addition to textual information, the tools will be trained to extract information from technical schemes and map. These data will integrate the database, too.

All the collected information will serve as the basis for an integrated risk management of the study area.

The work will be carried out by the employment of already existing LLMs (Gemini, DeepSeek...) through an iterative interaction through prompt compilation and revision to develop and optimize code for managing such information, and to contribute to the workflow of analysis, assessment, and mapping of geo-hydrological risk.

A training period abroad is planned at the Department of Environmental Systems Science (USYS TdLab) at ETH Zurich (Dr. Benjamin Hofmann)

Financial support:

Additional financial support may be provided from the supervisors' personal research funds (Project PNRR Raise, Robotics and AI for Socio-economic Empowerment, F. Faccini)

Tutor's publications in the last 3 years

Paliaga G., Terrone M., Bazzurro N., Marchese A., Faccini F. (2025) - Rainfall-Induced Shallow Landslide Susceptibility for Risk Management of Underground Services in a Mediterranean Metropolitan City. Land, 14, 2118. doi.org/10.3390/land14112118

Paliaga G., Ward S. N., Luino F., Faccini F., Turconi L. (2024) - What If an Intense Rain Event Should Trigger Diffuse Shallow Landslides in a Small Mediterranean Catchment? Numerical Modeling Through Remote Sensing Techniques. Remote Sensing, 16(24), 4658. https://doi.org/10.3390/rs16244658

Loglisci N., Boni G., Cauteruccio A., Faccini F., Milelli M., Paliaga G. & Parodi A. (2024) - The role of citizen science in assessing the spatiotemporal pattern of rainfall events in urban areas: a case study in the city of Genoa, Italy, Nat. Hazards Earth Syst. Sci., 24, 2495–2510, doi.org/10.5194/nhess-24-2495-2024.

Godone D., Allasia P., Notti D., Baldo M., Poggi F., Faccini F. (2023) - Coexistence of a Marginal Mountain Community with Large-Scale and Low Kinematic Landslide: The Intensive Monitoring Approach. Remote Sensing (ISSN: 2072-4292), 10.3390/rs15133238