

Research theme title:

Integrating Swarm Sensors for Distributed Monitoring and Agent Based Modeling for Environmental Systems Control

Contacts:

Prof. Chiara Mocenni, chiara.mocenni@unisi.it

Curriculum of DAUSY:

C1 - AS for Automation

Hosting University/Research Centre

University of Siena, Italy

Department of Information Engineering and Mathematics (DIISM),

University of Siena

Via Roma, 56 - 53100 - Siena

Tel +39 0577 235897 - amministrazione.diism@unisi.it

PEC: pec.diism@pec.unisipec.it

Website: www.dii.unipi.it

Tutors:

Prof. Chiara Mocenni, chiara.mocenni@unisi.it

Prof. Andrea Garulli, andrea.garulli@unisi.it

Description:

The project aims to develop Agent-Based Models describing agents who make dynamic decisions impacting climate change in Italy. Such decisions will be either described as the strategies of several games, accounting for the different propensities towards sustainable behaviors, or by Markov Decision Processes, where the transition probabilities towards states where the decision maker's wellbeing is higher depend on some parameters discriminating different levels of awareness of climate change. Additionally, the models will embed data measuring climate-dependent phenomena, such as extreme rainfall events, and will be subject to feedback activating control strategies of DM's behaviors. To this aim, agents will collect distributed data on real-world phenomena and behaviors. The data will be preliminary processed using machine learning techniques, such as clustering algorithms to discriminate regions where the extreme events are more frequent and intense and others where these events are related to natural climate processes. Accordingly, the agents will be georeferenced to take into account specific features of regions of Italy. The study will consider several applications to investigate the environmental impact of agents from the point of view of their ability to handle common goods and places where they live. Examples of such applications are tourism and waste management.

Requirements:

Applicants must hold a master's degree, preferably in Engineering, with a good background in relevant areas of interest (i.e., machine learning, optimization, and control). Solid mathematical and coding skills are encouraged. Proficiency in both spoken and written English is required. The candidate should be highly motivated and interested in undertaking innovative and challenging research activities involving both theoretical analysis and experimental validation.

References:

1. Vitanza, E., Dimitri, G.M. & Mocenni, C. A multi-modal machine learning approach to detect extreme rainfall events in Sicily. *Sci Rep* 13, 6196 (2023).
2. Bizzarri, F., Giuliani, A., & Mocenni, C. (2022). Awareness: An empirical model. *Frontiers in Psychology*, 13, 933183.
3. Vitanza E., Dimitri M.G., Bizzarri F., and Mocenni C., Investigating the Impact of Extreme Rainfall Events on Individual Perception of Climate Change, NOLTA International Symposium on Nonlinear Theory and its Applications, Catania, September 26–29, 2023.

4. *Dimitri M.G., Parri L., Pozzebon A., Vitanza E., Fort A. Mocenni C., WeAIR: Wearable Swarm Sensors for Air Quality Monitoring to Foster Citizens' Awareness of Climate Change*, IEEE International Conference on Metrology for eXtended Reality, Artificial Intelligence and Neural Engineering (MetroXRINE), Milano, October 25-27, 2023.

Type of scholarship:

DM 118/2023 – Project on PNRR (Italy's Recovery and Resilience Plan)

Study and research period outside the Hosting Institution:

- Duration of the study and research period at the company or research center or Public Administration: from 6 to 12 months
Name of receiving company or public administration: to be defined
- Duration of the study and research period abroad: from 6 to 18 months
Name of receiving institution: to be defined