Thesis title

Social learning and behavior modelling on climate change

Short description

Climate change is arguably the most severe and complex challenge facing today, a cross-cutting issue affecting many sectors and connected to other global challenges, such as the twin-challenge toward promoting sustainable water use and ensuring food security. Agricultural systems, the most vulnerable economic sector to climate and natural conditions, are adversely influenced by climate change through increased water stress, change in run-off patterns, seasonality fluctuation, and temperature variations. To deal with these threats, farmers continuously make changes in their practices[1,2], including crop diversification and resistant varieties, adjusting planting dates, ensuring soil and water conservation techniques, or subscribing to risk transfer mechanisms.

Farmers' ability to respond to climatic variability and extreme events builds on their vulnerability[3], which depends not only on their exposure but also on their adaptive capacity and resilience[4]. Existing literature argued that farmers' responses to climate change require technologically appropriate interventions with instrumental measures (informative, innovative or economic)[5] but, most importantly, a better understanding of their awareness and attitude facing climate change[6]. Local perceptions from qualitative data tools (interviews, surveys) provide essential baseline climate information and narrative storylines for understanding individual and collective exposure to climate risks, essential for effective policy formulation and decision-making[7]. However, how qualitative data can be managed and validated as an input driver in behaviour modelling[8,9] to fix farmers' adaptation pathways?

This thesis aims to evaluate the ability of qualitative data (survey and semi-structured interviews) in building robust information for behavior modelling through farmers' perceptions. The student is expected to carry out the following activities:

1. Literature review: reviewing the state of the art of behavior modelling, with a specific focus on which processes and requirements should be considered when using qualitative data for individuals (farmers) monitoring
2. Data collection available: a triple-loop survey on farmers' awareness, perceived impacts and adaptation measures/barriers + narrative climate storylines from stakeholders
3. Data analysis and computational experiments:
    - clustering algorithms (farmers' profile) supported by spatial analysis
    - comparison between farmer's perception and meteorological/climate data
    - behavior modelling combining observational data from farmers (survey) and decision-makers (interviews) with a multi-objective optimization approach
    - new utility functions ("what-if"), optimization problems and risks, and adaptation capacity scenarios in demonstration case studies (e.g. irrigations systems and river districts from the Lombardy region, northern Italy)

Relevant courses and knowledge: Natural Resources Management

Number of Students: 1 or 2

Requisites*:* The student should be comfortable with data handling and programming skills (Matlab or Python). Background on Integrated Assessment Models and/or Agent-Based modelling will be positively considered, as well as interest in social studies.

References

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