## PhD program in Statistics **DSS Statistics Seminar** March 7, 2025, 14:00

In person Room 24 (CU002) Webinar https://uniroma1.zoom.us/j/83625004899?pwd=bXCtz0 mp759PUh2lkqT0BUoVa0Uegg.1 Passcode: 123456

Envíronmental rísk assessment vía concomítant-varíable multívaríate penalízed hídden semí-Markov models wíth autoregressíon

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Environmental risk assessment often requires modelling complex temporal influenced by multiple variables and characterized by processes environmental condition shifts. This work introduces a novel methodological framework based on concomitant-variable multivariate penalized hidden semi-Markov models (CV-MPHSMM) with autoregression to capture such dynamics. The proposed model extends traditional hidden semi-Markov models by integrating concomitant variables to account for external environmental factors influencing state transitions and sojourns, and by incorporating penalization techniques to enhance model interpretability and prevent overfitting in high-dimensional settings. Autoregressive components are included to model temporal dependencies within and between observed multivariate time series. Analytical expressions for multivariate risk measures are obtained under the CV-MPHSMM. The framework is applied to pollution, demonstrating its capacity to identify latent states, quantify transition probabilities, and detect environmental condition shifts. Simulation studies validate the robustness and flexibility of the proposed model in handling complex scenarios, while case studies highlight its practical utility in informing risk management strategies. The findings underscore the potential of CV-MPHSMMs with autoregression as a powerful tool for advancing environmental risk assessment and decision-making under uncertainty.



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