

SEMINAR

CEAUL & CEMAT

ADVANCING MONTE CARLO SIMULATION WITH GANS, DIFFUSION MODELS, AND NORMALIZING FLOWS

ABSTRACT:

Recent years have seen remarkable progress in Monte Carlo simulation methods, driven by the integration of cutting-edge machine learning techniques such as Generative Adversarial Networks (GANs), diffusion models, and normalizing flows. These innovations enable the generation of complex, high-dimensional data, from highly realistic human faces to artistic transformations, such as converting a landscape photo into a Van Gogh-style painting. These breakthroughs, which often make headlines, capture widespread interest but remain challenging to simulate using traditional Monte Carlo techniques. GANs operate by training two networks in a competitive framework, yielding impressive results in high-dimensional sampling. Diffusion models offer a compelling alternative to Monte Carlo sampling by iteratively refining samples, reversing a noise-adding process, and producing smooth transitions critical for many applications. Normalizing flows map simple, tractable distributions (e.g., Gaussians) to complex target distributions through a sequence of invertible transformations, enabling efficient density estimation and sample generation. These advancements significantly expand the scope of Monte Carlo simulations, allowing statisticians and researchers to model more complex and non-standard distributions with greater accuracy and computational efficiency. This talk will explore these transformative methods, highlighting their principles, applications, and potential to redefine simulation in modern statistics and data science.



14:00

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Ciências
ULisboa C6,
Floor 4, SASLab
(room 6.4.29)



SPEAKER

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Renato Assunção received his Ph.D. in Statistics from the University of Washington in 1994. He is a researcher at ESRI Inc., Redlands, USA since 2021, and a full professor in the Computer Science Department, at Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brazil, where he is affiliated since 1988. His research focuses mainly on the development of algorithms and statistical methods for the analysis of spatial data, specially areal and point processes data. It is primarily concerned with the spatial analysis of risk appearing in many fields such as epidemiological surveillance, sensor networks, and demographic problems.

Google Scholar: <https://scholar.google.com/citations?user=rjVMpKoAAAAJ&hl=pt-BR&oi=ao>