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UC3M–ICMAT Seminar – 2014/2015

Applied Probability and Statistics

Completing the circle: a tale of computational vs. analytical results from statistics, applied probability and epidemiology

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10h30, *ICMAT, Aula Gris I*

The advent of cheap computer power promises to continue to catalyze empirical findings of scientific interest. Such findings sometimes come from data analyses based on models for which analytical results may not be readily available. However, these analytical results complete the circle: empirical findings are more likely to be valued by other scientists once they understand the model used to obtain them and, for such understanding, deriving model analytical properties has proved fundamental. I will present an example of such a loop, focusing on "plug-and-play" computational statistical algorithms applied to the analysis of infectious disease real data based on continuous-time Markov chains of the SIR family, commonplace in ecology and epidemiology. Plug-and-play approaches allow the modeler to analyze data by simply writing computer code to simulate models. I will present empirical results both from historical cholera death data and from more recent multi-strain cholera cases, based on novel models where transition rates are subject to continuous-time white noise. These empirical findings led us to studying the properties of those novel Markov chains in random environments. I will conclude by presenting some of these properties, which reveal a change in the fundamental nature of the initial Markov chains. Such fundamental change shows that with great computational power comes great analytical responsibility. I will illustrate this same idea with another example involving non-linear modeling of financial leverage in S&P500 data.

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