



Departamento de
Estadística e
Investigación Operativa

CICLO DE CONFERENCIAS ESTADÍSTICA Y CIENCIA DE DATOS PATRICIA ROMÁN

28/02/2024

Título: Stochastic processes to model growth phenomena.

Fecha y hora: 15 de marzo de 2024 (12.30 horas)

Lugar: Aula A-23 Facultad de Ciencias, UGR

Conferenciante: Paola Paraggio (Dipartimento di Matematica, Università di Salerno, 84084 Fisciano (SA), Italy). Email: pparaggio@unisa.it

Resumen del trabajo:

Sigmoidal growth curves, such as the Gompertz, logistic, and Korf models, describe the characteristic S-shaped pattern observed in various biological and ecological processes (cf. Di Crescenzo and Spina [1], Román-Román et al. [2], Di Crescenzo and Paraggio [3]). These models depict initial slow growth, followed by rapid expansion, and eventually reaching a plateau as the system approaches its carrying capacity. Although each model offers unique insights into population dynamics, making them valuable tools in fields like epidemiology, ecology, and agriculture, such growth curves overlook random fluctuations typical of realworld dynamics. To address this limitation many efforts have been realized to introduce random models related to these curves. Among them, stochastic processes, such as birth-death processes or diffusion processes, stand out. Most of the times, such stochastic processes are constructed in such a way that their expected values coincide with the corresponding growth curves (cf. Román-Román et al. [4], Di Crescenzo et al. [5] and [6]). This contribution presents a survey of prominent sigmoidal curves and their stochastic counterparts, alongside real-world applications and simulation studies aimed at



bridging theory with practice. The aforementioned topics constitute a research area in which the late lamented colleague Professor Román-Román made a notable and significant contribution.

References

- [1] A. Di Crescenzo, S. Spina (2016) Analysis of a growth model inspired by gompertz and korf laws, and an analogous birth-death process, *Math. Biosci.* 282, 121–134, doi:10.1016/j.mbs.2016.10.005.
- [2] P. Román-Román, J.J. Serrano-Pérez, F. Torres-Ruiz (2019) A note on estimation of multi-sigmoidal gompertz functions with random noise, *Mathematics* 7 (541) 1–18, doi:10.3390/math7060541.
- [3] A. Di Crescenzo, P. Paraggio (2019) Logistic growth described by birth-death and diffusion processes, *Mathematics* 7 (6) 1–28, doi:10.3390/math7060489. 489 1
- [4] P. Román-Román, J.J. Serrano-Pérez, F. Torres-Ruiz (2019) A note on estimation of multi-sigmoidal gompertz functions with random noise, *Mathematics* 7 (541), 1–18, doi:10.3390/math7060541.
- [5] A. Di Crescenzo, P. Paraggio, P. Román-Román, F. Torres-Ruiz (2021) Applications of the multi-sigmoidal deterministic and stochastic logistic models for plant dynamics, *Applied Mathematical Modelling* 92, pp. 884-904. doi: 10.1016/j.apm.2020.11.046
- [6] A. Di Crescenzo, P. Paraggio, P. Román-Román, F. Torres-Ruiz (2023) Statistical analysis and first-passage-time applications of a lognormal diffusion process with multisigmoidal logistic mean. *Statistical Papers*, vol. 64, p. 1391-1438, ISSN: 1613-9798, doi: 10.1007/s00362-022-01349-1

Reseña de la autora:

Paola Paraggio es postdoctorada en Probabilidad y Estadística adscrita al Departamento de Matemáticas de la Universidad de Salerno, donde trabaja en el seno de un consolidado grupo de investigación en procesos estocásticos con gran reconocimiento internacional. Las líneas en las que desarrolla su investigación incluyen los siguientes tópicos: procesos de nacimiento y muerte (incluyendo el caso multidimensional), procesos de difusión aplicados a la modelización de fenómenos de crecimiento reales, procesos telegráficos con sus generalizaciones, procesos de tipo Poisson modulados por cadenas de Markov ocultas, así como tiempos de primer paso asociados a estos tipos de procesos.

La conferencia se **emitirá en directo** por el canal del departamento: <https://www.youtube.com/@ugrestadistica>