IUMPA
Institut Universitari de Matemàtica Pura i Aplicada

Networks and Data Science

We are interested in the mathematical modeling and data analysis of problems from any discipline, from physics or engineering, as well as from the social and life sciences. We find especially attractive those problems that allow them to be studied from the point of view of complex networks, graph theory, and applied mathematical analysis.

In particular, we are currently interested in the following research subjects, where we can offer

(1) **Biomedical data science**. We are currently collaborating with the BDSLab (ITACA) in the following topics: Glioblastoma Modelling, Design of apps for collecting patient information to feed predictive models, and data quality of medical records repositories.

(2) **Diffusion Processes and Fractional Calculus**. We are interested in studying anomalous diffusion processes via machine learning. We are currently working on the regime change point detection of the process that involves. We are also interested in studying Fractional Calculus Modelling of such processes. We are collaborating with C. Lizama (GAFEVOL), M. Murillo-Arcila, and M.A. García March.

(3) **Mathematical Modeling in Synthetic Biology**. We are working in plants with Diego Orzáez Lab (IBMCP) and at the cellular level with Guillermo Rodrigo (I2SysBio).

(4) **Mathematical Foundations of Quantum Computing**. We are analyzing the structure and behavior of optimization algorithms that, in their configuration, use tensor products and their connections with Quantum Computing. We collaborate with Antonio Falcó (ESI Chair at Universidad Cardenal Herrera).

(5) **Data Science for Common and Social Good**. We are proud members of the Data Science against COVID-19 Task Force, led by Nuria Oliver (Ellis Alicante). We have specialized in outbreak modeling and predicting of the evolution of COVID-19 pandemics via Recurrent Neural Networks.

(6) **Complex Networks Modelling**. We are interested in applications to any discipline in network communications, image processing, linguistics, and many more. We are also working in data visualization of Science Maps in collaboration with E. Orduña and M. Rebollo.

(7) **Modelling in Industrial Engineering**. We work in signal processing for the detection of failures in electrical machines & Energy efficiency problems with Jose A. Antonino (Instituto Tecnología Energética).

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