



POLITÉCNICA



Seminario de investigación  
Matemática Aplicada  
<http://dma.upm.es>

## SENSING COMPLEX SYSTEMS: TIME SERIES, NETWORKS AND THEIR INTERFACES

*Complex systems, composed by many elements whose interaction results in the display of collective emergent behaviour, pervade science and technology, with examples as diverse as the climate, the financial system, or the brain. Sensing complex systems is traditionally done either by (i) tracking the time evolution of some observable via a time series representation or (ii) by reconstructing the architecture of the interactions between the elements of the system in terms of a network (mathematical graph) representation. Thus time series and networks are indeed two different ways of representing data, and their subsequent analysis is developed in the respective areas of time series analysis (broadly construed) and network science/graph theory.*

*In this talk I first present examples where both time series and network theory, together with data mining and machine learning, can provide innovative solutions for relevant societal questions: can*

*we predict the future outcome of a startup? Can we predict the success of movie actors?*

*Then, we argue that one can extract novel information from the data by exploiting the interface between networks and time series: one can map the information stored in a time series into a graph (and then use graph theory and network science to describe the structure of the time series and its underlying dynamics), and similarly one can extract time series from a given network (and then use the tools of signal processing and time series analysis to describe the network structure). I will provide concrete examples of how one can do this and what new interesting mathematics arise. Coupling this approach with Machine Learning, I will present several case studies, from the prediction of artistic styles in painting or the diagnosis of mental disorders to the prediction of how customers browse and buy in e-commerce websites*

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**JUEVES 7 DE OCTUBRE DE 2021, 12:00 h**  
**PRESENCIAL** (*en español*):  
ETSIAAB, Salón de Actos (edificio agrícolas)  
**ONLINE ZOOM:**  
ID de reunión: 833 5607 0241  
Código de acceso: 689448