Complexity

Special Issue on
Handling Complexity in Large-Scale Data and Multiscale Models

WILEY | Hindawi

CALL FOR PAPERS

echnological and theoretical advances in scientific disciplines ranging from engineering and applied mathematics to natural and physical sciences, including biology and health sciences, are often dealing with detailed microscopic models such as Molecular Dynamics, Brownian Dynamics, and Monte Carlo and Agent-Based models, but also with very-large scale data sets (e.g., fMRI recordings) containing information over a wide range of scales, from the atomic, molecular, and cellular to the observable macroscopic levels. A fundamental question that then arises is how one can identify low-dimensional descriptions (manifolds) of the high-dimensional space and construct and analyse low dimensional models that will reflect, in an efficient manner, the most important features of the dynamics of the system under study.

Thus, to tackle such problems we are confronted with two challenges: (a) the problem of data mining and embedding, that is, how to develop and implement methodologies to extract the most important features that are able to efficiently describe the underlying complex behaviour, and (b) the development of multiscale-modelling and analysis methodologies that allow the conduction of system-level tasks such as numerical analysis, optimization, and control of the emergent behaviour.

The aim of this special issue is to attract high-quality submissions focusing on the development and implementation of new modelling and computational-assisted analysis algorithms that have the potential to facilitate our understanding of complex phenomena with important impact on science and society such as catastrophic shifts in ecosystems, epileptic seizures in neuroscience, and outbreaks of (re)emerging infectious diseases in epidemiology, for example.

According to the above, this Special Issue relates to the modelling and analysis of complex phenomena and their spatiotemporal dynamics in the following potential topics.

Potential topics include but are not limited to the following:

- ▶ Computational neuroscience
- ▶ Molecular and antigenic evolution
- ▶ Mathematical epidemiology and population biology
- ▶ Environmental and ecological dynamics
- ▶ Medical and biological image analysis
- ▶ Multiscale mathematical modelling and numerical analysis
- ▶ Manifold and machine learning algorithms to for data reduction
- ▶ Forecasting of tipping points and/or catastrophic phase transitions
- ▶ Optimization algorithms
- ▶ Graph-embedding analysis and algorithms

Authors can submit their manuscripts through the Manuscript Tracking System at https://mts.hindawi.com/submit/journals/complexity/hclam/.

Papers are published upon acceptance, regardless of the Special Issue publication date.

Lead Guest Editor
Constantinos Siettos, National Technical University of Athens, Athens, Greece
ksiet@mail.ntua.gr

Guest Editors
Jens Starke, University of Rostock, Rostock, Germany
jens.starke@uni-rostock.de

Maíra Aguiar, Centro de Matemática e Aplicações Fundamentais (CMAF), Lisbon, Portugal
mafsantos@fc.ul.pt