Modelación Sistemas Sociales Complejos

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En este curso se pretende introducir a los estudiantes con los métodos utilizados en la modelación de sistemas sociales complejos. Entre otros: análisis de redes (networrk analysis), teoría de juegos (game theory), simulaciones basadas en agentes (agent-based simulations). Asimismo, se presentará el modo en que distintos fenómenos sociales han sido modelados. Evolución de la cooperación social, emergencia y estabilidad de estructuras jerárquicas/igualitarias, segregación espacial y condiciones sociales de la generación de conocimiento. Interesa no sólo familiarizar a los estudiantes con el modo en que estos fenómenos ya han sido aproximados sino además identificar puzles que no han sido resueltos para de este modo motivar a los estudiantes a desarrollar contribuciones en el área.

Lecturas:
Benabou, E. (2002) Agent-based modeling: Methods and techniques for simulating human systems, PNAS 99(3): 7280-7287.

Abstract

Agent-based modeling is a powerful simulation modeling technique that has seen a number of applications in the last few years, including applications to real-world business problems. After the basic principles of agent-based simulation are briefly introduced, its four areas of application are discussed by using real-world applications: flow simulation, organizational simulation, market simulation, and diffusion simulation. For each category, one or several business applications are described and analyzed.

In agent-based modeling (ABM), a system is modeled as a collection of autonomous decision-making entities called agents. Each agent individually assesses its situation and makes decisions on the basis of a set of rules. Agents may execute various behaviors appropriate for the system they represent—for example, producing, consuming, or selling. Repetitive competitive interactions between agents are a feature of agent-based modeling, which relies on the power of computers to explore dynamics out of the reach of pure mathematical methods (1, 2). At the simplest level, an agent-based model consists of a system of agents and the relationships between them. Even a simple agent-based model can exhibit complex behavior patterns (3) and provide valuable information about the dynamics of the real-world system that it emulates. In addition, agents may be capable of evolving, allowing unanticipated behaviors to emerge. Sophisticated ABM sometimes incorporates neural networks, evolutionary algorithms, or other learning techniques to allow realistic learning and adaptation.

ABM is a mindset more than a technology. The ABM mindset consists of describing a system from the perspective of its constituent units. A number of researchers think that the alternative to ABM is traditional differential equation modeling; this is wrong, as a set of differential equations, each describing the dynamics of one of the system's constituent units, is an agent-based model. A synonym of ABM would be microscopic modeling, and an alternative would be macroscopic modeling. As the ABM mindset is starting to enjoy significant popularity, it is a good time to redefine why it is useful and when ABM should be used. These are the questions this paper addresses, first by reviewing and classifying the benefits of ABM and then by providing a variety of examples in which the benefits will be clearly described. What the reader will be able to take home is a clear view of when and how to use ABM. One of the reasons underlying ABM's popularity is its ease of implementation: indeed, once one has heard about ABM, it is easy to program an agent-based model. Because the technique is easy to use, one may wrongly think the concepts are easy to master. But although ABM is technically simple, it is also conceptually deep. This unusual combination often leads to improper use of ABM.

The Economics of Social Networks, Chapter 1 in Volume I of Advances in Economics and Econometrics, Theory and Applications: Ninth World Congress of the Econometric Society, edited by Richard Blundell, Whitney Newey, and Torsten Persson, Cambridge University Press, 2006.

Abstract

Networks of relationships help determine the careers that people choose, the jobs they obtain, the products they buy, and how they vote. The many aspects of our lives that are governed by social networks make it critical to understand how they impact behavior, which network structures are likely to emerge in a society, and why we organize ourselves as we do. Matthew Jackson offers a comprehensive introduction to social and economic networks, drawing on the latest findings in economics, sociology, computer science, physics, and mathematics. He provides empirical background on networks and the regularities that they exhibit, and discusses random graph-based models and strategic models of network formation. He helps readers to understand behavior in networked societies, with a detailed analysis of learning and diffusion in networks, decision making by individuals who are influenced by their social neighbors, game theory and markets on networks, and a host of related subjects. Jackson also describes the varied statistical and modeling techniques used to analyze social networks.

Para aquellos estudiantes que quieran familiarizarse con las técnicas computacionales utilizadas en esta área, se les recomienda visitar la página de recursos de NETLOGO: http://ccl.northwestern.edu/netlogo/resources.shtml.

Para aquellos estudiantes que quieran familiarizarse con el lenguaje de la teoría de juegos, se recomienda visitar el siguiente sitio: http://www.gametheory.net/