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Guanrong Chen · Yang Lou

Naming Game

Models, Simulations and Analysis

 Springer

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Preface

Language is a unique hallmark of human beings among all species in nature, which is emerged and developed by creation, acquisition, and maintenance. Humans use language to communicate with each other, to exchange information, and to express ideas, which in many ways have significantly changed our world and ourselves.

In the study of language evolution and development, one important scientific method is based on social or computer game simulations. In a typical language game, a simple mathematical model is designed and used to simulate the process of linguistic pattern formation and recognition, where a population of humans is involved in the play and they follow some pre-set game rules leading to consensus of the whole population on a new word, a new phrase, or a new sentence.

A representative computer game model for studying language creation and development is the so-called *naming game* model which, along with several variants, is a simulation-based numerical study exploring the emergence and evolution of shared information in a population of communicating agents. The shared information could be, for example, a set of emerging names for an object observed by the agents, or some social conventions, ideas, knowledge, etc. The population of agents is connected in a certain communication topology, and thus each agent can be considered as a node in the underlying communication network, with the mutual interaction or acquaintance between two connected nodes represented by an edge. As a result, naming game is formulated as a reaction–diffusion process on a graph, which can be studied using tools from the graph theory in mathematics.

This monograph presents an introduction to the naming game in various versions, specifically the minimal naming game with agents having infinite or finite sizes of memories (Chaps. 2 and 3), naming game with group discussions (Chap. 4), naming game with learning errors in communications (Chap. 5), naming game on multi-community networks (Chap. 6), naming game with multiple words or sentences (Chap. 7), and naming game with multiple languages (Chap. 8). It is the authors' hope that, after reading, the readers could have some fundamental knowledge with a comprehensive understanding of the naming game and its applications to future social and language studies.

The book is designed for self-studies by researchers and practitioners, graduate and also undergraduate students, as well as social and linguistic scientists. The main contents of the text are collected from the authors' own research work, in a natural combination with many others' contributions, all being edited into a logical presentation of the notion as a self-contained technical book. In so doing, all simulations have been re-checked with all simulation figures redrawn in a unified format. A rather comprehensive list of main references is provided for the reader's verification and future studies.

During the preparation of the manuscript, the authors received some helpful assistance from several individuals, especially Dr. Zhengping Fan who shared the source code of the multi-local network model and Mr. Jianfeng Zhou who shared the source code of the multi-language naming game model. All of them are acknowledged here with great appreciation.

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