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Minrui Zheng
School of Public Administration and Policy
Renmin University of China
Beijing, China

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To my parents and my advisor (Dr. Wenwu Tang). Their endless support has been encouraging to continue my research.

Preface

Neural networks as a commonly used machine learning algorithms (e.g., artificial neural networks and convolutional neural networks) have been extensively used in GIScience domain to explore the nonlinear or/and complex geographic phenomena. However, how to automatically adjust the parameters of neural networks is still an open question in GIScience. Moreover, the model performance of neural networks often depends on the parameter setting for a given dataset. Meanwhile, adjusting the parameter configuration of neural networks will increase the overall running time. In this book, the author proposed an automated spatially explicit hyperparameter optimization approach to identify optimal or near-optimal parameter settings for neural networks and accelerate the search process through both model and computing levels. The author used two spatial prediction models in this book to examine the utilities of spatially explicit hyperparameter optimization. The results demonstrate that the approach proposed in this book improves the computing performance at model and computing levels and addresses the challenge of finding optimal parameter settings for neural networks in the GIScience field.

In the remainder of this book, Chap. 2 focuses on a literature review of artificial neural networks, hyperparameter optimization, cyberinfrastructure and high-performance and parallel computing, and evolutionary algorithms. Chapter 3 describes the framework of spatially explicit hyperparameter optimization. Chapter 4, which connects to objective 1, focuses on introducing the basic framework of spatially explicit hyperparameter optimization that incorporates spatial statistics and high-performance and parallel computing. Chapter 5 demonstrates the utilities of the automated spatially explicit hyperparameter optimization (objective 2). Chapter 6 examines the practicability of spatially explicit hyperparameter optimization, which links to objective 3. Chapter 7 concludes this book.

Beijing, China — Minrui Zheng

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