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# Spatial Similarity Relations in Multi-scale Map Spaces

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ISBN 978-3-319-09742-8      ISBN 978-3-319-09743-5 (eBook)  
DOI 10.1007/978-3-319-09743-5  
Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014947360

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# Preface

Automated map generalization is a necessary technique for the construction of multi-scale vector map databases that are crucial components in spatial data infrastructure of cities, provinces, and countries. Nevertheless, this is still a dream because many algorithms for map feature generalization are not truly automatic and therefore need human's interference. One of the major reasons is that map generalization is a process of spatial similarity transformation in multi-scale map spaces; however, existing theory is not capable to support such transformation.

This book focuses on the theory of spatial similarity relations in multi-scale map spaces, proposing a series of approaches and models that can be used to automate relevant algorithms in map generalization, and achieves the following innovative contributions.

First, the fundamental issues of spatial similarity relations are explored, i.e. (1) a classification system is proposed that classifies the objects processed by map generalization algorithms into ten categories; (2) the Set Theory-based definitions of similarity, spatial similarity, and spatial similarity relation in multi-scale map spaces are given; (3) mathematical language-based descriptions of the features of spatial similarity relations in multi-scale map spaces are addressed; (4) the factors that affect human's judgments of spatial similarity relations are proposed, and their weights are also obtained by psychological experiments; and (5) a classification system for spatial similarity relations in multi-scale map spaces is proposed.

Second, the models that can calculate spatial similarity degrees for the ten types of objects in multi-scale map spaces are proposed, and their validity is tested by psychological experiments. If a map (or an individual object, or an object group) and its generalized counterpart are given, the models can be used to calculate the spatial similarity degrees between them.

Third, the proposed models are used to solve problems in map generalization: (1) ten formulae are constructed that can calculate spatial similarity degrees by map scale changes in map generalization; (2) an approach based on spatial similarity degree is proposed that can determine when to terminate a map generalization system or an algorithm when it is used to generalize objects on maps; and (3) an

approach is proposed to calculate the distance tolerance of the Douglas–Peucker Algorithm so that the Douglas–Peucker Algorithm may become fully automatic.

The authors would like to express their appreciations to many people who made the completion of this book possible. Above all, the first author is grateful to Dr. Robert Weibel in the Department of Geography, University of Zurich, Switzerland, Dr. Zhilin Li in the Department of Land Surveying & GeoInformatics, Hongkong Polytechnical University, Hongkong, and Professor Jiayao Wang in the PLA Information Engineering University, China, who discussed the theory of spatial similarity relations with the first author 10 years ago at the early stage of preparing this book. Second, the authors would like to thank Dr. Wanhong Yang in the Department of Geography, University of Guelph, Canada, and Dr. Peter Deadman, Dr. Jane Law, and Dr. Su-Yin Tan in the Department of Geography and Environmental Management, University of Waterloo, Canada, for their constructive and insightful advice. Third, the authors feel so indebted to Dr. Tao Liu and Dr. Zhonghui Wang who helped to collect various maps, did psychological experiments, and analyzed statistical data. Last but not least, the authors appreciate the Natural Sciences and Engineering Research Council of Canada, the Natural Science Foundation Committee of China (Project No. 41371435), and the National Key Technologies R&D Program of China (Project No. 2013BAB05B01) for their financial support to the work described in the book.

The book can be a reference to the graduates and researchers who are interested in cartography and geographic information science/systems, especially those in automated map generalization and/or spatial databases construction. Any comments and suggestions regarding this book are greatly welcomed and appreciated.

Lanzhou, China  
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April 28, 2014

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