Lecture Notes in Computer Science

Edited by G. Goos and J. Hartmanis

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Design and Implementation of Large Spatial Databases

First Symposium SSD '89
Santa Barbara, California, July 17/18, 1989
Proceedings

Springer-Verlag
Berlin Heidelberg New York London Paris Tokyo Hong Kong

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CR Subject Classification (1987): A.0, E.1–2, E.5, F.2.2, H.2.1–2, H.2.8, I.2.1, I.3.5

ISBN 3-540-52208-5 Springer-Verlag Berlin Heidelberg New York
ISBN 0-387-52208-5 Springer-Verlag New York Berlin Heidelberg

Printing and binding: Druckhaus Beltz, Hemsbach/Bergstr.
2145/3140-543210 – Printed on acid-free paper

Dedicated to the Memory of

Markku Tamminen

1945 - 1989

Preface

This book contains the proceedings of the First Symposium on the Design and Implementation of Large Spatial Databases (SSD '89), which was held with about 175 participants at Santa Barbara, California, on July 17 and 18, 1989.

The great interest in this symposium seems to be representative of the growing interest in spatial data management in general. There are numerous spatial applications in geography, computer vision, robotics, computer-aided manufacturing, and environmental information systems, and these applications require more powerful data management tools than the ones available today.

Research in spatial data management requires expertise in these application areas *and* in various fields within computer science, such as database management, data structures and algorithms, computational geometry, solid modeling, and computer vision. Experts from the application areas have to cooperate with computer scientists in a highly interdisciplinary field to obtain systems that are both practical and at the cutting edge of today's computer science.

It is our hope that this symposium also served as an opportunity to bring together people from these various disciplines and to establish closer connections between these fields.

We would like to thank NASA, the Environmental Protection Agency, the Oak Ridge National Laboratory, and the U.S. Geological Survey for their generous support. Thanks also to ACM, the IEEE Computer Society, and to Springer-Verlag for their cooperation. The National Center for Geographic Information and Analysis here at Santa Barbara has been supportive of this project from the beginning. Thanks to the members of the program committee for returning their reviews promptly under great time pressure. And thanks to Sandi Glendinning for taking care of our local arrangements.

Santa Barbara, November 1989 The Editors

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7 ± 2 criteria for assessing and comparing spatial data structures

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Abstract

Spatial data structures have evolved under the influence of several forces: 1) Database technology, with its emphasis on modeling and logical organization; 2) the long history of data structures developed in response to requirements from other applications; and 3) the recent rapid progress in computational geometry, which has identified typical queries and access patterns to spatial data. Rather than attempting a comprehensive survey of many spatial data structures recently developed, we aim to identify the key issues that have created them, their common characteristics, the requirements they have to meet, and the criteria for assessing how well these requirements are met. As a guideline for tackling these general goals, we begin with a brief history and recall how past requirements from other applications have shaped the development of data structures. Starting from the very early days, five major types of applications generated most of the known data structures. But the requirements of these applications do not include one that is basic to spatial data: That objects are embedded in Euclidian space, and access is mostly determined by location in space.

We present six specifically geometric requirements spatial data structures must address. Sections 3, 4, 5 discuss the mostly static aspects of how space is organized, and how objects are represented and embedded in space. Sections 6, 7, 8 consider the dynamic aspects of how objects are processed. We differentiate three types of processing, of increasing complexity, that call for different solutions: common geometric transformations such as translation and rotation; proximity search, and traversal of the object by different types of algorithms. Together with the general requirement of effective implementability, we propose these seven criteria as a profile for assessing spatial data structures. This survey leads us to two main conclusions: 1) That the current emphasis on comparative search trees is perhaps unduly influenced by the great success balanced trees enjoyed as a solution to the requirements of older applications that rely on single-key access, and 2) that spatial data structures are increasingly of the 'metric' type based on radix partitions of space.

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