Preface

The constantly changing landscape of Geographic Information Systems makes it challenging for experts and practitioners to stay informed of the field’s most up-to-date research. That is why Information Science Reference is pleased to offer this three-volume reference collection that will empower students, researchers, and academicians with a strong understanding of critical issues within Geographic Information Systems by providing both broad and detailed perspectives on cutting-edge theories and developments. This reference is designed to act as a single reference source on conceptual, methodological, technical, and managerial issues, as well as provide insight into emerging trends and future opportunities within the discipline.

*Geographic Information Systems: Concepts, Methodologies, Tools, and Applications* is organized into eight distinct sections that provide comprehensive coverage of important topics. The sections are: (1) Fundamental Concepts and Theories, (2) Development and Design Methodologies, (3) Tools and Technologies, (4) Utilization and Application, (5) Organizational and Social Implications, (6) Managerial Impact, (7) Critical Issues, and (8) Emerging Trends. The following paragraphs provide a summary of what to expect from this invaluable reference tool.

Section 1, **Fundamental Concepts and Theories**, serves as a foundation for this extensive reference tool by addressing crucial theories essential to the understanding of Geographic Information Systems. Introducing the book is “Showing the Past” by Willington Siabato, Alberto Fernández-Wyttenbach, and Miguel-Ángel Bernabé-Poveda, a great foundation laying the groundwork for the basic concepts and theories that will be discussed throughout the rest of the book. Another chapter of note in Section 1 is titled “GIS, Grid Computing and RFID in Healthcare Information Supply Chain” by Yenming J. Chen, which discusses the growing use of GIS and distributed computing in the health informatics and clinical technologies industry. Section 1 concludes, and leads into the following portion of the book with a nice segue chapter, “Virtual Environments for Geospatial Applications,” by Magesh Chandramouli and Bo Huang. Where Section 1 leaves off with fundamental concepts, Section 2 discusses architectures and frameworks in place for Geographic Information Systems.

Section 2, **Development and Design Methodologies**, presents in-depth coverage of the conceptual design and architecture of Geographic Information Systems, focusing on aspects including territorial analysis, spatial database design, augmented discovery, semantic interoperability, location privacy, semantic annotation, and many more topics. Opening the section is “GIS Technique for Territorial Analysis” by Francesco Riccioli and Toufic El Asmar. This section is vital for developers and practitioners who want to measure and track the progress of Geographic Information Systems on a local, national, or international level. Through case studies, this section lays excellent groundwork for later sections that will get into present and future applications for Geographic Information Systems, including, of note: “Methodologies for Augmented Discovery of Geospatial Resources” by Mattia Santoro, Paolo Mazzetti, Stefano
Section 3, **Tools and Technologies**, presents extensive coverage of the various tools and technologies used in the implementation of Geographic Information Systems. Section 3 begins where Section 2 left off, though this section describes more concrete tools at place in the modeling, planning, and applications of Geographic Information Systems. The first chapter, “*Algorithms for 3D Map Segment Registration*,” by Hao Men and Kishore Pochiraju, contains a great example of the types of works that can be found in this section, a perfect resource for practitioners looking into new technologies within the field. Section 3 is full of excellent chapters like this one, including such titles as “*A New Image Distortion Measure Based on Natural Scene Statistics Modeling*,” “*Map Matching Algorithms for Intelligent Transport Systems*,” and “*Multi-Criteria Decision Analysis for Identifying a Suitable Location for Groundwater Pumping Wells*” to name a few. Where Section 3 described specific tools and technologies at the disposal of practitioners, Section 4 describes successes, failures, best practices, and different applications of the tools and frameworks discussed in previous sections.

Section 4, **Utilization and Application**, describes how the broad range of Geographic Information Systems efforts has been utilized and offers insight on and important lessons for their applications and impact. Section 4 includes the widest range of topics because it describes case studies, research, methodologies, frameworks, architectures, theory, analysis, and guides for implementation. Topics range from landscape biodiversity characterization, geographic visual query languages, and estimating biomass, to open source deployment, topographical capture, and geospatial analysis. The first chapter in the section is titled “*Children’s Maps in GIS*,” which was written by Kerstin Nordin and Ulla Berglund. The breadth of topics covered in the chapter is also reflected in the diversity of its authors, from countries all over the globe, including Malaysia, Thailand, Sweden, Italy, Nigeria, Uganda, Zimbabwe, South Africa, the United States and more. Section 4 concludes with an excellent view of a case study in technology implementation and use, “*A Geospatial Analysis of Convective Rainfall Regions within Tropical Cyclones after Landfall*” by Corene J. Matyas.

Section 5, **Organizational and Social Implications**, includes chapters discussing the organizational and social impact of Geographic Information Systems. The section opens with “*The Digital Geography Lab at Salem State University*” by Stephen S. Young and Kym Pappathanasi. Where Section 4 focused on the broad, many applications of Geographic Information Systems technology, Section 5 focuses exclusively on how these technologies affect human lives, either through the way they interact with each other, or through how they affect behavioral/workplace situations. Other interesting chapters of note in Section 5 include “*Using Volunteered Geographic Information to Assess the Spatial Distribution of West Nile Virus in Detroit, Michigan*” by Kevin P. McKnight, Joseph P. Messina, Ashton M. Shortridge, Meghan D. Burns, and Bruce W. Pigozzi, and “*Cartography and Stability to Enhance and Self Regulate Proactive Routing in MANETs*” by Mohamed Amine Abid and Abdelfettah Belghith. Section 5 concludes with a fascinating study of a new development in Geographic Information Systems, in “*A Reflection on the Ph.D. Program in Spatially Integrated Social Science at the University of Toledo*,” written by Bhuiyan Monwar Alam, Jeanette Eckert, and Peter S. Lindquist.

Section 6, **Managerial Impact**, presents focused coverage of Geographic Information Systems as it relates to effective uses of urban geospatial management, location management, city competitiveness, e-planning, environmental quality monitoring, disaster management, and much more. This section serves as a vital resource for developers who want to utilize the latest research to bolster the capabilities and
functionalities of their processes. The section begins with “Urban Geospatial Management System,” a great look into how city planners and civil engineers can use the latest geospatial technologies to more effectively practice their work. The 15 chapters in this section offer unmistakable value to managers looking to implement new strategies that work at larger bureaucratic levels. The section concludes with “Formalizing Cross-Parameter Conditions for Geoprocessing Service Chain Validation” by Daniel Fitzner. Where Section 6 leaves off, section seven picks up with a focus on some of the more content-theoretical material of this compendium.

Section 7, Critical Issues, presents coverage of academic and research perspectives on Geographic Information Systems tools and applications. The section begins with “Qualitative Spatial Reasoning for Applications,” by Diedrich Wolter and Jan Oliver Wallgrün. Other issues covered in detail in Section 7 include geography education, taxonomies of volunteered information, community and GIS, complex processes in GIS, and much more. The section concludes with “Geo-Informatics for Land Use and Biodiversity Studies” by P. K. Joshi and Neena Priyanka, a great transitional chapter between Sections 7 and 8 because it examines an important question going into the future of the field. The last chapter manages to show a theoretical look into future and potential technologies, a topic covered in more detail in Section 8.

Section 8, Emerging Trends, highlights areas for future research within the field of Geographic Information Systems, opening with “Neogeography” by Judith Gelernter. Section 8 contains chapters that look at what might happen in the coming years that can extend the already staggering amount of applications for Geographic Information Systems. Other chapters of note include “Data Mining Location-Based Social Networks for Geospatial Discovery” and “3D Camera Tracking for Mixed Reality using Multi-Sensors Technology.” The final chapter of the book looks at an emerging field within Geographic Information Systems, in the excellent contribution, “Semantic Enrichment for Geospatial Information in a Tourism Recommender System” by David Isern, Antonio Moreno, Joan de la Flor, Joan Borràs, Aida Valls, Antonio Russo, Yolanda Pérez, and Salvador Anton-Clavé.

Although the primary organization of the contents in this multi-volume work is based on its eight sections, offering a progression of coverage of the important concepts, methodologies, technologies, applications, social issues, and emerging trends, the reader can also identify specific contents by utilizing the extensive indexing system listed at the end of each volume. Furthermore to ensure that the scholar, researcher, and educator have access to the entire contents of this multi volume set as well as additional coverage that could not be included in the print version of this publication, the publisher will provide unlimited multi-user electronic access to the online aggregated database of this collection for the life of the edition, free of charge when a library purchases a print copy. This aggregated database provides far more contents than what can be included in the print version, in addition to continual updates. This unlimited access, coupled with the continuous updates to the database ensures that the most current research is accessible to knowledge seekers.

As a comprehensive collection of research on the latest findings related to using technology to providing various services, Geographic Information Systems: Concepts, Methodologies, Tools, and Applications, provides researchers, administrators and all audiences with a complete understanding of the development of applications and concepts in Geographic Information Systems. Given the vast number of issues concerning usage, failure, success, policies, strategies, and applications of Geographic Information Systems in countries around the world, Geographic Information Systems: Concepts, Methodologies, Tools, and Applications addresses the demand for a resource that encompasses the most pertinent research in technologies being employed to globally bolster the knowledge and applications of Geographic Information Systems.