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Piyushimita (Vonu) Thakuriah
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Moira Zellner *Editors*

Seeing Cities Through Big Data

Research, Methods and Applications in
Urban Informatics

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Preface

Big Data is spawning new areas of research, new methods and tools, and new insights into Urban Informatics. This edited volume presents several papers highlighting the opportunities and challenges of using Big Data for understanding urban patterns and dynamics. The volume is intended for researchers, educators, and students who are working in this relatively new area and outlines many of the considerations that are likely to rise in research, applications, and education. The papers tackle a myriad of issues—while some empirical papers showcase insights that Big Data can provide on urban issues, others consider methodological issues or case studies which highlight how Big Data can enrich our understanding of urban systems in a variety of contexts.

The chapters in this book are peer-reviewed papers selected among those originally presented in a 2-day workshop on Big Data and Urban Informatics sponsored by the National Science Foundation and held at the University of Illinois at Chicago in 2014. The workshop brought together researchers, educators, practitioners, and students representing a variety of academic disciplines including Urban Planning, Computer Science, Civil Engineering, Economics, Statistics, and Geography. It was a unique opportunity for urban social scientists and data scientists to exchange ideas in how Big Data can or is being used to address a variety of urban challenges. This edited volume draws from these various disciplines and seeks to address the numerous important issues emerging from these areas.

This volume is intended to introduce and familiarize the reader with how Big Data is being used as well as to highlight different technical and methodological issues that need to be addressed to ensure urban Big Data can answer critical urban questions. The issues explored in this volume cover eight broad categories and span several urban sectors including energy, the environment, transportation, housing, and emergency and crisis management. Authors have also considered the complexities and institutional factors involved in the use of Big Data, from meeting educational needs to changing organizational and social equity perspectives regarding data innovations and entrepreneurship. Others consider the methodological and technical issues that arise in collecting, managing, and analyzing unstructured

user-generated content and other sensed urban data. We have aimed to make the volume comprehensive by incorporating papers that show both the immense potential Big Data holds for Urban Informatics and the challenges it poses.

We would like to acknowledge the support of the National Science Foundation which funded the Big Data and Urban Informatics workshop, without which this volume would not have been possible. We would also like to thank the Department of Urban Planning and Policy at the University of Illinois at Chicago which provided additional support for the workshop. A number of people helped us in preparing this edited volume and in the events that led up to the workshop. A special thank you to Alison Macgregor of the University of Glasgow who helped us organize and manage the review process and to Keith Maynard for providing editing support. We are immensely grateful to Ms. Nina Savar whose efforts ensured a successful workshop. We are also indebted to all of the anonymous reviewers who took their time to provide useful feedback to the authors in this volume.

Glasgow, UK
Chicago, IL

Piyushimita (Vonu) Thakuriah
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Introduction to Seeing Cities Through Big Data: Research, Methods and Applications in Urban Informatics

Piyushimita (Vonu) Thakuriah, Nebiyou Y. Tilahun, and Moira Zellner

1 Scope of Workshop and the Book

The chapters in this book were first presented in a 2-day workshop on Big Data and Urban Informatics held at the University of Illinois at Chicago in 2014. The workshop, sponsored by the National Science Foundation, brought together approximately 150 educators, practitioners and students from 91 different institutions in 11 countries. Participants represented a variety of academic disciplines including Urban Planning, Computer Science, Civil Engineering, Economics, Statistics, and Geography and provided a unique opportunity for discussions by urban social scientists and data scientists interested in the use of Big Data to address urban challenges. The papers in this volume are a selected subset of those presented at the workshop and have gone through a peer-review process.

Our main motivation for the workshop was to convene researchers and professionals working on the emerging interdisciplinary research area around urban Big Data. We sought to organize a community with interests in theoretical developments and applications demonstrating the use of urban Big Data, and the next-generation of Big Data services, tools and technologies for Urban Informatics. We were interested in research results as well as idea pieces and works in progress that highlighted research needs and data limitations. We sought papers that clearly create or use novel, emerging sources of Big Data for urban and regional analysis in transportation, environment, public health, land-use, housing, economic

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development, labor markets, criminal justice, population demographics, urban ecology, energy, community development, and public participation. A background paper titled *Big Data and Urban Informatics: Innovations and Challenges to Urban Planning and Knowledge Discovery* (Thakuria et al. 2016b) documenting the major motivations for the workshop is a chapter in this book.

2 Topics on Big Data and Urban Informatics

The chapters in this book are organized around eight broad categories: (1) Analytics of user-generated content; (2) Challenges and opportunities of urban Big Data; (3) Changing organizational and educational perspectives with urban Big Data; (4) Urban data management; (5) Urban knowledge discovery applied to a variety of urban contexts; (6) Emergencies and Crisis; (7) Health and well-being; and (8) Social equity and data democracy.

2.1 Analytics of User-Generated Content

The first set focuses on how to analyze user-generated content. Understanding urban dynamics or urban environmental problems is challenged by the paucity of public data. The ability to collect and analyze geo-tagged social media is emerging as a way to address this shortage or to supplement existing data, for use by planners, businesses and citizens. New platforms to integrate these forms of data are proposed (Tasse and Hong 2016) but are not without their limitations. In particular, GIS platforms have been evaluated (Tang et al. 2016) that hint at the critical role of committed users in ensuring the successful and reliable use of these tools, and the consequent need for integration of online and off-line activities and for the effective transfer of information to individuals' mobile devices.

Other GIS-enabled frameworks are proposed (Yin et al. 2016a) to support citizen sensing of urban environmental pollution like noise. Such participatory computing architecture supports scalable user participation and data-intensive processing, analysis and visualization.

2.2 Challenges and Opportunities of Urban Big Data

The second set of papers considers the challenges and opportunities of urban Big Data, particularly as an auxiliary data source that can be combined with more traditional survey data, or even as a substitute for large survey-based public datasets. Big Data exists within a broader data economy that has changed in recent