

Preface

According to the *World Urbanization Prospects* by United Nations, about 68% of the global population will live in urban areas by 2050. Cities have become the hot spots of production, consumption and waste generation. However, continued urbanization brings many global problems related to waste disposal and air and water pollution. Therefore, it is critical to understand the natural environments of urban areas to improve and foster environmental and human sustainability of cities around the world.

Taking cities as observing objects, urban remote sensing is an important branch of remote sensing. Under the context of global urbanization, urban remote sensing technology has been playing a significant role in urban monitoring, planning, construction and urban management. To meet the growing demand for urban remote sensing observation, we detail advanced remote sensing technologies and methodologies for complicated urban areas in this book, consisting of ten chapters that describe the principles of urban remote sensing and multi-source remote sensing big data acquisition, urban remote sensing image processing methods, urban remote sensing image-specific application in related industries and the prospect of urban remote sensing development. To facilitate readers' understanding, we use a large number of algorithm studies as intuitive materials and provide typical industry solutions or case studies in specific applied research areas. The main contents are as follows:

Chapter 1 introduces an urban spatio-temporal-spectral-angular observation model that applies multi-platform, multi-sensor collaborative observation from space, sky and ground to acquire abundant 3D spatial data. The data obtained by different remote sensing observation platforms serve as a complementary data source.

Chapter 2 describes big data characteristics of urban remote sensing, including urban scene visible light remote sensing images, multi-spectral remote sensing images, hyperspectral remote sensing images, thermal

infrared images, microwave remote sensing images, LiDAR data and luminous remote sensing images, providing a decision-making basis for data selection of specific urban remote sensing applications in subsequent chapters.

Chapter 3 focuses on tasks, objects and mechanisms of urban remote sensing interpretation and interpretation methods by taking visual interpretation, semi-automatic interpretation, full-automatic interpretation and big data interpretation as examples.

Chapter 4 presents selected mainstream methods of cloud detection and shadow detection of urban remote sensing images, mainstream methods of tone adjustment of urban remote sensing images, mainstream methods of super-resolution reconstruction of urban remote sensing images and mainstream methods of image fusion.

Chapter 5 introduces the classification and information extraction methods for urban remote sensing imagery from seven perspectives that include the classification and information extraction demands, unsupervised classification methods, supervised classification methods, new classification methods, urban road extraction, urban buildings extraction and urban lakes extraction.

Chapter 6 describes urban 3D reconstruction methods based on multi-source high-resolution remote sensing imagery.

Chapter 7 presents the change detection methods and applications of urban remote sensing. Change detection is an important means of recognizing and analyzing the changes of targets from different time periods. By comparing remote sensing images from two different phases, the change detection methods own notable advantages in urban land cover change monitoring, urbanization dynamic monitoring, environmental change dynamic monitoring, natural disaster monitoring and crop yield estimation.

Chapter 8 introduces the demands of dynamic urban monitoring, the urban dynamic monitoring process, the urban dynamic monitoring methods and the remote sensing monitoring of urban geological hazards, planning, conditions and geological hazards, providing a comprehensive understanding of remote sensing monitoring.

Chapter 9 focuses on the remote sensing monitoring technologies and practices of the urban ecological environment. This chapter contains three topics: (i) remote sensing monitoring of urban thermal environment, (ii) remote sensing inversion of urban aboveground biomass and (iii) remote sensing quantitative monitoring of cyanobacteria in urban lakes.

Chapter 10 summarizes and envisions the developing directions of urban remote sensing technologies and applications.

This book can serve as a textbook for undergraduate and graduate students and as a reference book for anyone interested in urban remote sensing.