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# Object Detection in Aerial and Satellite Images

To our families and friends...

# Preface

Very high resolution satellite and aerial images provide valuable information to researchers. With their availability, there has been much interest to extract man-made objects from such imageries. Among these, detection of objects such as buildings, road segments, and urban area boundaries play crucial roles especially for municipalities, government agencies, rescue teams, military, and other civil agencies. For a human expert, manually extracting this valuable information is tedious and prone to errors. One possible solution to extract this information is developing automated techniques. Unfortunately, the solution is not straightforward if standard image processing and pattern recognition techniques are used.

In this book, we provide some new approaches using several local and semi-local invariant features (such as SIFT, Gabor features, gradient features, and color invariants) to automatically detect man-made objects in remotely sensed images. These invariant features are very powerful in detecting objects under various imaging conditions (like illumination, viewing angle, etc). However, extraction of invariant features is not sufficient for detecting objects. Therefore, we further formalize the problem by developing graph theoretical, probabilistic, and region based methods, to extract structural information to verify object appearance.

The book consists of five parts. In the first part, we give a brief information about aerial and satellite images. We also introduce object detection problems in these images. Using mathematical techniques, in the second part we first develop methods to detect urban area boundaries. We also formulate some measures to estimate the degree of urbanization in detected urban areas. Having detected urban area boundaries, we develop our algorithms to detect separate buildings and road segments in urban area. We present these approaches in the third and fourth part respectively. We tested the robustness of the proposed algorithms using a diverse data set including very high resolution panchromatic Ikonos satellite and aerial images. Experimental results indicate the high performance and usefulness of our object detection approaches on

such a diverse image dataset. Finally, in the fifth part we summarize and discuss all object detection methods presented in this book.

Readers of this book can inform the authors about errors, suggestions, and other comments using following e-mail addresses,

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Best Regards,
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