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# Target Detection and Tracking by Bionanosensor Networks

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ISSN 2191-5768 ISSN 2191-5776 (electronic)  
SpringerBriefs in Computer Science  
ISBN 978-981-10-2467-2 ISBN 978-981-10-2468-9 (eBook)  
DOI 10.1007/978-981-10-2468-9

Library of Congress Control Number: 2016949094

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Printed on acid-free paper

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The registered company is Springer Nature Singapore Pte Ltd.  
The registered company address is: 152 Beach Road, #22-06/08 Gateway East, Singapore 189721, Singapore

# Preface

Biosensor networks consist of spatially distributed biosensors that are engineered with recent advances in bionanotechnology. As such, biosensor networks represent a new interdisciplinary research area that expands the traditional area of network engineering. Research into this field is aimed at designing robust networks from spatially distributed biosensors as well as developing innovative applications of such networks.

Research into biosensor networks has evolved from the study of molecular communication, which was proposed in 2005 as a communication paradigm for biosensors or bionanomachines. Molecular communication allows biosensors to communicate using chemical signals, providing a mechanism for biosensors to form a network. Remarkable progress has been made in recent years, with physical layer issues such as channel modeling and capacity analysis having been addressed. However, we raised a question as to how such bottom-up research efforts will lead to the creation of practical applications.

The objective to writing this book has been to initiate application-oriented studies of molecular communication; that is, to investigate how a collection of biosensors, termed ‘biosensor networks’ in this book, can be used for practical purposes, such as in nanomedical sensing. In particular, this book focuses on two key functionalities for nanomedical applications: target detection and target tracking. Target detection involves detecting a target in the environment, while target tracking is to detect and track targets as they move. In nanomedical applications, targets can be disease sites or infectious microorganisms that appear in the environment. The timely detection of targets and the tracking of them to provide immediate treatment or further analysis of the environment are important roles that can be accomplished by biosensor networks.

This book summarizes our initial research efforts with biosensor networks. It describes the main ideas, methods, results and resources relevant to their study. We hope that the materials provided in this book are useful and serve as a basis for further studies.

Finally, we wish to thank the following people who helped us in a variety of ways with the writing of the book: Dr. Armita Afsharinejad (Waterford Institute of

Technology, Ireland), Mr. Chen-Hao Chan (National Taiwan University, Taiwan), Prof. Yifan Chen (South University of Science and Technology of China, China), Prof. Andrew W. Eckford (York University, Canada), Dr. Nariman Farsad (Stanford University, USA), Prof. Tokuko Haraguchi (National Institute of Information and Communications Technology, Japan), Mr. Peng He (University of Electronic Science and Technology of China, China), Prof. Yasushi Hiraoka (Osaka University, Japan), Prof. Yu-Hsiang Hsu (National Taiwan University, Taiwan), Dr. Shouhei Kobayashi (National Institute of Information and Communications Technology, Japan), Ms. Takako Kojin (National Institute of Information and Communications Technology, Japan), Prof. Qiang Liu (University of Electronic Science and Technology of China, China), Dr. Jian Qin Liu (National Institute of Information and Communications Technology, Japan), Prof. Mohammad U. Mahfuz (University of Wisconsin-Green Bay, USA), Dr. Michael J. Moore (Google Inc., USA), Prof. Tatsuya Suda (University Netgroup Inc., USA), and Prof. Jun Suzuki (University of Massachusetts, Boston, USA).

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