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Target Detection and Tracking by Bionanosensor Networks

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Preface

Bionanosensor networks consist of spatially distributed bionanosensors that are engineered with recent advances in bionanotechnology. As such, bionanosensor 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 bionanosensors as well as developing innovative applications of such networks.

Research into bionanosensor networks has evolved from the study of molecular communication, which was proposed in 2005 as a communication paradigm for bionanosensors or bionanomachines. Molecular communication allows bionanosensors to communicate using chemical signals, providing a mechanism for bionanosensors 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 bionanosensors, termed 'bionanosensor 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 bionanosensor networks.

This book summarizes our initial research efforts with bionanosensor 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.

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