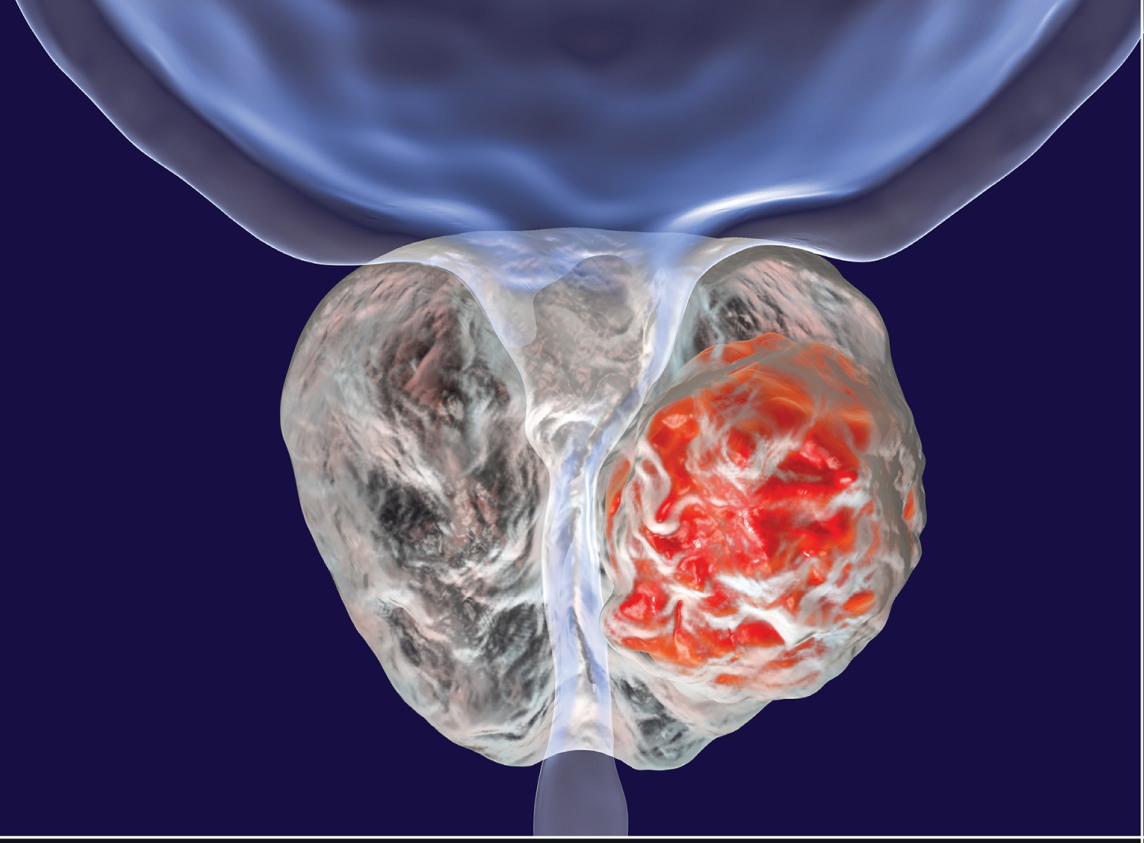

PROSTATE CANCER IMAGING

AN ENGINEERING AND CLINICAL PERSPECTIVE

edited by
Ayman El-Baz
Gyan Pareek
Jasjit S. Suri

CRC Press
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Dedication

This book is dedicated with love and affection to my mother and father, whose loving spirit sustains me still.

Ayman El-Baz

This book is dedicated to my late parents, whose love will always be in my heart.

Jasjit S. Suri

This book is dedicated to Natwar Kumar Pareek—a great urologist, father and mentor, and to my loving wife Gina and two children Niki and Sonya.

Gyan Pareek

Contents

Preface

This book covers novel strategies of the state-of-the-art approaches for automated noninvasive systems for early prostate cancer diagnostics. Prostate cancer is the most frequently diagnosed malignancy after skin cancer and the second leading cause of male cancer-related deaths in the United States after lung cancer. However, early detection of prostate cancer increases chances of patients' survival. Generally, CAD systems analyze the prostate images in three steps: (i) prostate segmentation; (ii) prostate description or feature extraction, and (iii) classification of the prostate status.

Current diagnosing of prostate carcinoma combines digital rectal examination (DRE), prostate-specific antigen (PSA) blood test, and needle biopsy. Each of these techniques have their own shortcomings. The biopsy is the most precise, but is a highly invasive, expensive, and painful method for detecting prostate cancer and determining its aggressiveness. Therefore accurate, highly sensitive and specific, but noninvasive diagnostic techniques are in significant demand. Today's CAD systems analyze images from various modalities, such as ultrasound, computed tomography (CT), and MRI, to detect and localize prostate cancer, as well as evaluate its size and extent.

The main aim of this book is to help advance scientific research within the broad field of early detection of prostate cancer. This book focuses on major trends and challenges in this area, and it presents work aimed at identifying new techniques and their use in biomedical image analysis.

Ayman El-Baz
Gyan Pareek
Jasjit S. Suri

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The completion of this book could not have been possible without the participation and assistance of so many people whose names may not all be enumerated. Their contributions are sincerely appreciated and gratefully acknowledged. However, the editors would like to express their deep appreciation and indebtedness particularly to Dr. Ali H. Mahmoud and Dr. Ahmed M. Shalaby for their endless support. We would like to further thank all the collaborators, which include engineers, scientists, and physicians from industries and academics all around the globe for their friendship and support. Lastly, we would like to thank our families for their constant love, support and understanding.

Ayman El-Baz
Gyan Pareek
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Editors

Ayman El-Baz is a Professor, University Scholar, and Chair of the Bioengineering Department at the University of Louisville, Kentucky. Dr. El-Baz earned his bachelor's and master's degrees in Electrical Engineering in 1997 and 2001, respectively. He earned his doctoral degree in electrical engineering from the University of Louisville in 2006. In 2009, Dr. El-Baz was named a Coulter Fellow for his contributions to the field of biomedical translational research. Dr. El-Baz has 15 years of hands-on experience in the fields of bio-imaging modeling and noninvasive computer-assisted diagnosis systems. He has authored or coauthored more than 450 technical articles (105 journals, 15 books, 50 book chapters, 175 refereed-conference papers, 100 abstracts, and 15 US patents).

Gyan Pareek is the Director of Minimally Invasive Urologic Surgery, and Assistant Professor of Surgery (Urology) at the Alpert Medical School of Brown University. Dr. Pareek has been a full-time faculty member since completing his Minimally Invasive and Endourology fellowship at the University of Wisconsin in 2005. Dr. Pareek is the director of the Brown medical student urology course (URO-415). He is particularly passionate about resident teaching and is actively involved with the residents as a clinical and research mentor through the Brown Medical Student Mentoring Program. Dr. Pareek is a member of the urology staff at Rhode Island Hospital, Miriam Hospital, Providence VA Medical Center, and Memorial Hospital of Rhode Island.

Jasjit S. Suri is an innovator, scientist, visionary, industrialist, and internationally known leader in biomedical engineering. Dr. Suri has spent over 24 years in the field of biomedical engineering/devices and its management. He received his doctorate from the University of Washington, Seattle, and his MBA from Weatherhead, Case Western Reserve University, Cleveland, Ohio. Dr. Suri was awarded the President's Gold medal in 1980 and the Fellow of American Institute of Medical and Biological Engineering for his outstanding contributions.

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