

Fundamentals of Medical Imaging

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I would highly recommend this book for medical imaging scientists and for anyone who is interested in learning the basic building blocks of medical image reconstruction and formation. This book is intended to be used as a textbook on medical imaging for senior-year undergraduate or first-year graduate students; as such, it has a strong emphasis on the fundamentals of reconstructing and computing medical images, in addition to the basic principles of image processing. As medical imaging technologies have continuously advanced over the past several decades, demand for qualified imaging scientists and physicists has grown. Gaining certification in diagnostic imaging from the American Board of Radiology has become important in the United States. Learning the physics of medical imaging and the operation of imaging devices, performing quality assurance and quality control, and understanding radiation safety and patient safety requirements have become the main interests for many biomedical engineering and medical physics students and faculty. This book may not be ideal for those seeking certification; however, it will be helpful in the training of imaging scientists who are interested in the development and research of medical imaging devices. Unlike some textbooks covering only 1 subject in depth in the field of radiography, this book covers CT, MRI, nuclear medicine, ultrasonography, and image analysis or visualization at a level suitable for teaching, making it a useful resource for researchers, teachers, and students. The information on each modality was written by 1 or 2 experts in the field along with the author, Paul Suetens; thus, the presentation is coherent throughout the book. The experts who contributed are Hilde Bosmans (radiography), Bruno De Man (CT), Stefan Sunaert (MRI), Johan Nuyts (nuclear medicine), Jan D'hooge (ultrasonography), and Frederik Maes and Dirk Vandermeulen (image analysis and visualization). One aspect of the book that I particularly like is that the reference citations are included as footnotes, allowing the reader to avoid unnecessary back-and-forth flipping through the book. I also appreciate the high-quality, full-color images and illustrations, which are important in a textbook on medical imaging.

Chapter 1 introduces the basic principles of digital image processing, including common terminology and the components that define image quality. Chapters 2 through 6 explain how medical images are obtained. Each chapter includes a short history of the imaging modality, the theory of the physics of the signal and its interaction with tissue, the image formation or reconstruction process, a discussion of image quality, the different types of equipment currently used, examples of the clinical use of the modality, a brief description of biologic effects and safety issues, and some future expectations. Chapters 7 and 8 cover image analysis and visualization for the purposes of diagnosis, therapy, and surgery. Advanced mathematic derivations are shown in separate text boxes to help the reader understand the subject matter without becoming overly occupied with the step-by-step derivation of the equations. An appendix for linear system theory and an appendix with exercises are included. The linear system theory has been moved to the appendix in this second edition to avoid a formal teaching of the subject, as it should be a prerequisite for understanding the topic of image reconstruction. The exercises are useful and can be expanded in the future to include more practice problems. The bibliography provides a list of references to newly developed topics for research and more advanced reading. There is also a companion Web site (www.cambridge.org/suetens), which provides corrections to the text, some 3-dimensional animations, solutions to the exercises, and an introduction to the book and the author.

This book fills a void in the teaching of medical imaging, particularly in how the images are formed and computed across all modalities. Once a solid foundation of imaging principles is established, practitioners in medical imaging can build clinical emphasis and applications onto that foundation. Thanks to the author for providing a textbook that will not only help teach medical imaging but also serve as a reference book for experienced medical physicists and scientists.

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