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Medical Imaging Systems

An Introductory Guide

Springer Open

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Preface

The present book is the result of four years of work that started in Winter 2014/15 and was finally concluded in Summer 2018. As such, numerous hours of work went into this manuscript by several authors, who were all affiliated with the Pattern Recognition Lab of the Friedrich-Alexander-University Erlangen-Nuremberg. I truly appreciate the dedication and the hard work of my colleagues that led to this final manuscript and, although many already left the lab to take positions in academia and industry, they still supported the finalization of this book.

While major parts of the book were already completed in Winter 2016/17, Springer gave us the opportunity to rework the book with new concepts like the *geek boxes* and new figures in order to adapt the book to a broader audience. With the present concepts, we hope that the book is suited to early-stage undergraduate students as well as students who already completed fundamental math classes and want to deepen their knowledge on medical imaging. We believe, the time to improve the manuscript was well spent and the final polish gave rise to a textbook with a coherent story line. In particular, we break with the historical development of the described imaging devices and present, e. g., magnetic resonance imaging before computed tomography, although they were developed in opposite order. A closer look reveals that this change of order is reasonable for didactical purposes: magnetic resonance imaging relies mainly on the Fourier transform, while computed tomography requires understanding of the Fourier slice theorem discovered by Johann Radon. These observations then also mend the apparent historical disorder, as we celebrate Joseph Fourier's 250^{th} birthday this year and celebrated the 100^{th} birthday of the Radon transform last year.

We also tried to find many graphical explanations for many of the mathematical operations such that the book does not require complete understanding of all mathematical details. Yet, we also offer details and references to further literature in the previously mentioned *geek boxes* as students in the later semesters also need to be familiar with these concepts. In conclusion, we hope that we created a useful textbook that will be accessible to many readers. In order to improve this ease of access further, we chose to publish the entire manuscript as open access book under Creative Commons Attribution 4.0 International License. Thus, any information in this book can shared, copied, adapted, or remixed even for commercial purposes as long as the original source is appropriately referenced and a link to the license is provided.

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Contents