

<<医学图像重建>>

图书基本信息

书名：<<医学图像重建>>

13位ISBN编号：9787040204377

10位ISBN编号：7040204371

出版时间：2009-11

出版时间：高等教育出版社

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页数：198

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前言

The first time I heard about image reconstruction was twenty years ago I came to the University of Utah as a post-doctoral fellow in the Department of Radiology. Dr. Grant Gullberg and Dr. Rolf Clackdoyle gave many lectures on image reconstruction and I took notes. Even today I still go back to those notes from time to time. I benefit from those notes significantly. This book is compiled together with parts of those notes and some current research papers with most mathematical proofs removed. I am grateful to Dr. Gullberg and Dr. Clackdoyle for introducing me to the wonderful world of image reconstruction. I appreciate Dr. Michel Defrise, Dr. Ge Wang, and Dr. Guang-Hong Chen for their helpful suggestions. I also like to thank my colleagues in the department and in other institutions. I would especially like to thank Kathy Gullberg and Jacob Piatt for proof-reading the drafts. This tutorial text introduces the classical and modern image reconstruction technologies to the general audience. It covers the topics in two-dimensional (2D) parallel-beam and fan-beam imaging, three-dimensional (3D) parallel ray, parallel plane, and cone-beam imaging. Both analytical and iterative methods are presented. The applications in X-ray CT, SPECT (single photon emission computed tomography) , PET (positron emission tomography) , and MRI (magnetic resonance imaging) are also discussed. Contemporary research results in exact ROI (region-of-interest) reconstruction with truncated projections, Katsevich's cone-beam filtered backprojection algorithm, and reconstruction with highly undersampled data with ℓ_0 -minimization are also included in this book. This book is written in an easy-to-read style, which lets the diagrams do the most talking. The readers who intend to get into medical image reconstruction will gain the general knowledge of the field in a painless way. I hope you enjoy reading it as much as I enjoy writing (and drawing) it. The first time reader can skip the more challenging materials marked by the "*" sign without interrupting the flow of this book.

内容概要

Medical Image Reconstruction A Conceptual Tutorial introduces the classical and modern image reconstruction technologies, such as two-dimensional (2D) parallel-beam and fan-beam imaging, three-dimensional (3D) parallel ray, parallel plane, and cone-beam imaging. This book presents both analytical and iterative methods of these technologies and their applications in X-ray CT (computed tomography), SPECT (single photon emission computed tomography), PET (positron emission tomography), and MRI (magnetic resonance imaging). Contemporary research results in exact region-of-interest (ROI) reconstruction with truncated projections, Katsevich's cone-beam filtered backprojection algorithm, and reconstruction with highly undersampled data with/without minimization are also included. This book is written for engineers and researchers in the field of biomedical engineering specializing in medical imaging and image processing with image reconstruction.

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章节摘录

插图：What you have just done is a standard mathematical procedure called backprojection. If you backproject from all angles from You will produce an image similar to the one shown in Figure 1.9 (d) .After backprojection, the image is still not quite the same as the original image but rather is a blurred version of it. To eliminate the blurring, we introduce negative "wings" around the spike in the projections before backprojection [see Figure 1.9 (e)]. The procedure of adding negative wings around the spike is called filtering. The use of the negative wings results in a clear image [see Figure 1.9 (f)]. This image reconstruction algorithm is very common and is referred to as a Filtered Backprojection (FBP) algorithm. In this section, we use a point source to illustrate the usefulness of filtering and backprojection with many views in image reconstruction. We must point out that if the object is a point source, we only need two views to reconstruct the image, just like the map making example in Section 1.1.

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