Deep Learning For Undersampled Mri Reconstruction

This book constitutes the refereed joint proceedings of the Third International Workshop on Deep Learning in Medical Image Analysis, DLMIA 2017, and the 6th International Workshop on Multimodal Learning for Clinical Decision Support, ML-CDS 2017, held in conjunction with the 20th International Conference on Medical Imaging and Computer-Assisted Intervention, MICCAI 2017, in Québec City, QC, Canada, in September 2017. The 38 full papers presented at DLMIA 2017 and the 5 full papers presented at ML-CDS 2017 were carefully reviewed and selected. The DLMIA papers focus on the design and use of deep learning methods in medical imaging. The ML-CDS papers discuss new techniques of multimodal mining/retrieval and their use in clinical decision support.

An introduction to a broad range of topics in deep learning, covering mathematical and conceptual background, deep learning techniques used in industry, and research perspectives. “Written by three experts in the field, Deep Learning is the only comprehensive book on the subject.” —Elon Musk, cochair of OpenAI; cofounder and CEO of Tesla and SpaceX Deep learning is a form of machine learning that enables computers to learn from experience and understand the world in terms of a hierarchy of concepts. Because the computer gathers knowledge from experience, there is no need for a human computer operator to formally specify all the knowledge that the computer needs. The hierarchy of concepts allows the computer to learn complicated concepts by building them out of simpler ones; a graph of these hierarchies would be many layers deep. This book introduces a broad range of topics in deep learning. The text offers mathematical and conceptual background, covering relevant concepts in linear algebra, probability theory and information theory, numerical computation, and machine learning. It describes deep learning techniques used by practitioners in industry, including deep feedforward networks, regularization, optimization algorithms, convolutional networks, sequence modeling, and practical methodology; and it surveys such applications as natural language processing, speech recognition, computer vision, online recommendation systems, bioinformatics, and videogames. Finally, the book offers research perspectives, covering such theoretical topics as linear factor models, autoencoders, representation learning, structured probabilistic models, Monte Carlo methods, the partition function, approximate inference, and deep generative models. Deep Learning can be used by undergraduate or graduate students planning careers in either industry or research, and by software engineers who want to begin using deep learning in their products or platforms. A website offers supplementary material for both readers and instructors.

The seven-volume set of LNCS 11301-11307, constitutes the proceedings of the 25th International Conference on Neural Information Processing, ICONIP 2018, held in Siem Reap, Cambodia, in December 2018. The 401 full papers presented were carefully reviewed and selected from 575 submissions. The papers address the emerging topics of theoretical research, empirical studies, and applications of neural information processing techniques across different domains. The first volume, LNCS 11301, is organized in topical sections on deep neural networks, convolutional neural networks, recurrent neural networks, and spiking neural networks.

This is the first book that presents a comprehensive introduction to and overview of electro-magnetic tissue property imaging techniques using MRI, focusing on Magnetic Resonance Electrical Impedance Tomography (MREIT), Electrical Properties Tomography (EPT) and Quantitative Susceptibility Mapping (QSM). The contrast information from these novel imaging modalities is unique since there is currently no other method to reconstruct high-resolution images of the electro-magnetic tissue properties including electrical conductivity, permittivity, and magnetic susceptibility. These three imaging modalities are based on Maxwell's equations and MRI data acquisition techniques. They are expanding MRI's ability to provide new contrast information on tissue structures and functions. To facilitate further technical progress, the book provides in-depth descriptions of the most updated research outcomes, including underlying physics, mathematical theories and models, measurement techniques, computation issues, and other challenging problems.

Contents:IntroductionElectro-magnetism and MRIMagnetic Resonance Electrical Impedance TomographyMR-EPTQuantitative Susceptibility Mapping Readership: Researchers, academics and graduate students in medical imaging, computational mathematics and biomedical imaging. Keywords:Inverse Problem;MREIT;EPT;QSM;Conductivity;Permittivity;Susceptibility

4th International Conference on Trends in Electronics and Informatics (ICOEI 2020) is being organized by SCAD College of Engineering and Technology on 16 18, April 2020 at Tirunelveli, India ICOEI 2020 will provide an outstanding international forum for sharing knowledge and results in all fields of Engineering and Technology The primary goal of the conference is to promote research and developmental activities in Electronics and Informatics Another goal is to promote scientific information interchange between researchers, developers, engineers, students, and practitioners working in India and abroad The conference is organized to make it an ideal platform for people to share views and experiences in Electronics, Informatics and related areas

In modern healthcare, various medical modalities play an important role in improving the diagnostic performance in healthcare systems for various applications, such as prosthesis design, surgical implant design, diagnosis and prognosis, and detection of abnormalities in the treatment of various diseases. Analysis of Medical Modalities for Improved Diagnosis in Modern Healthcare discusses the uses of analysis, modeling, and manipulation of modalities, such as EEG, ECG, EMG, PCG, EOG, MRI, and FMRI, for an automatic identification, classification, and diagnosis of different types of disorders and physiological states. The analysis and applications for post-processing and diagnosis are muchneeded topics for researchers and faculty members all across the world in the field of automated and efficient diagnosis using medical modalities. To meet this need, this book emphasizes real-time challenges in medical modalities for a variety of applications for analysis, classification, identification, and diagnostic processes of healthcare systems. Each chapter starts with the introduction, need and motivation of the medical modality, and a number of applications for the identification and improvement of healthcare systems. The chapters can be read independently or consecutively by research scholars, graduate students, faculty members, and practicing scientists who wish to explore various disciplines of healthcare systems, such as computer sciences, medical sciences, and biomedical engineering. This book aims to improve the direction of future research and strengthen research efforts of healthcare systems through analysis of behavior, concepts, principles, and case studies. This book also aims to overcome the gap between usage of medical modalities and healthcare systems. Several novel applications of medical modalities have been unlocked in recent years, therefore new applications, challenges, and solutions for healthcare systems are the focus of this book.

The four-volume set LNCS 11070, 11071, 11072, and 11073 constitutes the refereed proceedings of the 21st International Conference on Medical Image Computing and Computer-Assisted Intervention, MICCAI 2018, held in Granada, Spain, in September 2018. The 373 revised full papers presented were carefully reviewed and selected from 1068 submissions in a double-blind review process. The papers have been organized in the following topical sections: Part I: Image Quality and Artefacts; Image Reconstruction Methods; Machine Learning in Medical Imaging; Statistical Analysis for Medical Imaging; Image Registration Methods. Part II: Optical and Histology Applications: Optical Imaging Applications; Histology Applications; Microscopy Applications; Optical Coherence Tomography and Other Optical Imaging Applications. Cardiac, Chest and Abdominal Applications: Cardiac Imaging Applications: Colorectal, Kidney and Liver Imaging Applications; Lung Imaging Applications; Breast Imaging Applications; Other Abdominal Applications. Part III: Diffusion Tensor Imaging and Functional MRI: Diffusion Tensor Imaging; Diffusion Weighted Imaging; Functional MRI; Human Connectome. Neuroimaging and Brain Segmentation Methods: Neuroimaging; Brain Segmentation Methods. Part IV: Computer Assisted Intervention: Image Guided Interventions and Surgery; Surgical Planning, Simulation and Work Flow Analysis; Visualization and Augmented Reality. Image Segmentation Methods: General Image Segmentation Methods, Measures and Applications; Multi-Organ Segmentation; Abdominal Segmentation Methods; Cardiac Segmentation Methods; Chest, Lung and Spine Segmentation; Other Segmentation Applications.

This book provides, for the first time, a unified approach to the application of MRI in radiotherapy that incorporates both a physics and a clinical perspective. Readers will find detailed information and guidance on the role of MRI in all aspects of treatment, from dose planning, with or without CT, through to response assessment. Extensive coverage is devoted to the latest technological developments and emerging options. These include hybrid MRI treatment systems, such as MRI-Linac and proton-guided systems, which are ushering in an era of real-time MRI guidance. The past decade has witnessed an unprecedented rise in the use of MRI in the radiation treatment of cancer. The development of highly conformal dose delivery techniques has led to a growing need to harness advanced imaging for patient treatment. With its flexible soft tissue contrast and ability to acquire functional information, MRI offers advantages at all stages of treatment. In documenting the state of the art in the field, this book will be of value to a wide range of professionals. The authors are international experts drawn from the scientific committee of the 2017 MR in RT symposium and the faculty of the ESTRO teaching course on imaging for physicists.

Magnetic Resonance Imaging (MRI) is a powerful medical imaging modality used as a diagnostic tool. There is a steady rise in the imagining examination. Trends from 2000 - 2016 showed that nearly 16 million to 21 million patients had enrolled annually in various US health care systems. The number of MRIs per 1000 increased from 62 per 1000 to 139 per 1000 patients from 2000 to 2016. MR images are usually stored in Picture Archiving and Communication Systems (PACS) in Digital Imaging and Communication in Medicine (DICOM). DICOM format includes a header and imaging data. MRI k-space is the raw data obtained during the MR signal acquisition. The file size of complex MR data is huge. It is generally transformed into the anatomical imaging data, and raw data is discarded and not transferred to the PACS. The abundant DICOM data has the potential to be used for training neural networks. Deep Neural Network models depend on the extensive training datasets. DICOM images are magnitude images without the image phase. It is essential to understand the effect of missing image phase information to use the DICOM data for this training task effectively.My thesis attempts to compare a deep neural network's performance for accelerated MRI reconstruction using the k-space to DICOM only data. MR imaging offers a great deal of control to the user to acquire the data and reconstruct the clinical images. All this comes at the cost of an increase in the acquisition time. Typical scan times are between 30 to 40 mins. Scan times go up to 60 mins if a contrast agent needs to be administered. Such long acquisition times are not only expensive but a cause of inconvenience to the subject as it is impossible to stay motionless in the bore during the whole duration. Two areas are of interest to reduce the scan time, (i) accelerated acquisition and (ii) fast and efficient reconstruction.Methods like compressed sensing and parallel imaging are used to accelerate MRI acquisition. Compressed sensing achieves scan acceleration by overcoming the requirement of Nyquist sampling criteria. An undersampling pattern like the Poisson Disk undersampling pattern is used to acquire an incoherent random sparse signal instead of the full k-space. The "sigpy.mri" python library's "Poisson" API was used to simulate this undersampling. This Python API generates a variable-density Poisson-disc sampling pattern. Compressed Sensing theory mentions that image reconstruction would be possible using signals less than the number indicated by Nyquist as long as the k-space undersampling is done incoherently, which does not lead to structural aliasing when the anatomical image is constructed. This algorithm combines the undersampling with partial Fourier imaging. This API uses a fully sampled calibration region at the center of the k-space in addition to the acceleration factor. The acceleration factor is used for undersampling the region outside the fully sampled center region. Poisson disk undersampling does random sampling while constraining the maximum and minimum distance. This scheme leads to incoherent sampling and avoids structural artifacts.After the image acquisition comes, the reconstruction of the fully sampled k-space or the anatomical image with good SNR. A deep-learning neural network was trained to perform the reconstruction of the retrospectively undersampled data. The undersampled raw k-space data's training performance is compared with that of the undersampled k-space data obtained from the

DICOM data.Our experiments have shown that the magnitude obtained from raw k-space data has consistently shown better initial training performance and faster convergence when compared to the magnitude image obtained from the DICOM image. It is also observed that after training enough epochs, the performance of the model trained using raw data is comparable to that of the DICOM images. The significance of this finding is in the fact that the abundantly available DICOM data can be used to train a deep neural network to perform reconstruction of the undersampled k-space.FastMRI is a research project from Facebook AI(FAIR) and NYU Langone Health. The dataset for this project is publicly available. This dataset has two types of scans, knee MRI and brain MRI. For this work, we have used single coil knee MRI data. For performing the training, 2D slices from these images are used from the training dataset's single-coil knee MRI volumes. The training dataset has 973 volumes and a total of 34,742 slices.

This book constitutes the proceedings of the 26th International Conference on Information Processing in Medical Imaging, IPMI 2019, held at the Hong Kong University of Science and Technology, Hong Kong, China, in June 2019. The 69 full papers presented in this volume were carefully reviewed and selected from 229 submissions. They were organized in topical sections on deep learning and segmentation; classification and inference; reconstruction; disease modeling; shape, registration; learning motion; functional imaging; and white matter imaging. The book also includes a number of post papers.

This book provides a thorough overview of the ongoing evolution in the application of artificial intelligence (AI) within healthcare and radiology, enabling readers to gain a deeper insight into the technological background of AI and the impacts of new and emerging technologies on medical imaging. After an introduction on game changers in radiology, such as deep learning technology, the technological evolution of AI in computing science and medical image computing is described, with explanation of basic principles and the types and subtypes of AI. Subsequent sections address the use of imaging biomarkers, the development and validation of AI applications, and various aspects and issues relating to the growing role of big data in radiology. Diverse real-life clinical applications of AI are then outlined for different body parts, demonstrating their ability to add value to daily radiology practices. The concluding section focuses on the impact of AI on radiology and the implications for radiologists, for example with respect to training. Written by radiologists and IT professionals, the book will be of high value for radiologists, medical/clinical physicists, IT specialists, and imaging informatics professionals.

This book constitutes the refereed proceedings of the 10th International Conference on Functional Imaging and Modeling of the Heart, held in Bordeaux, France, in June 2019. The 46 revised full papers were carefully reviewed and selected from 50 submissions. The focus of the papers is on following topics: Electrophysiology: mapping and biophysical modelling; Novel imaging tools and analysis methods for myocardial tissue characterization and remodeling; Biomechanics: modeling and tissue property measurements; Advanced cardiac image analysis tools for diagnostic and interventions.

Quantitative Magnetic Resonance Imaging is a ‘go-to’ reference for methods and applications of quantitative magnetic resonance imaging, with specific sections on Relaxometry, Perfusion, and Diffusion. Each section will start with an explanation of the basic techniques for mapping the tissue property in question, including a description of the challenges that arise when using these basic approaches. For properties which can be measured in multiple ways, each of these basic methods will be described in separate chapters. Following the basics, a chapter in each section presents more advanced and recently proposed techniques for quantitative tissue property mapping, with a concluding chapter on clinical applications. The reader will learn: The basic physics behind tissue property mapping How to implement basic pulse sequences for the quantitative measurement of tissue properties The strengths and limitations to the basic and more rapid methods for mapping the magnetic relaxation properties T1, T2, and T2* The pros and cons for different approaches to mapping perfusion The methods of Diffusion-weighted imaging and how this approach can be used to generate diffusion tensor maps and more complex representations of diffusion How flow, magneto-electric tissue property, fat fraction, exchange, elastography, and temperature mapping are performed How fast imaging approaches including parallel imaging, compressed sensing, and Magnetic Resonance Fingerprinting can be used to accelerate or improve tissue property mapping schemes How tissue property mapping is used clinically in different organs Structured to cater for MRI researchers and graduate students with a wide variety of backgrounds Explains basic methods for quantitatively measuring tissue properties with MRI - including T1, T2, perfusion, diffusion, fat and iron fraction, elastography, flow, susceptibility - enabling the implementation of pulse sequences to perform measurements Shows the limitations of the techniques and explains the challenges to the clinical adoption of these traditional methods, presenting the latest research in rapid quantitative imaging which has the possibility to tackle these challenges Each section contains a chapter explaining the basics of novel ideas for quantitative mapping, such as compressed sensing and Magnetic Resonance Fingerprinting-based approaches

Image registration is the process of systematically placing separate images in a common frame of reference so that the information they contain can be optimally integrated or compared. This is becoming the central tool for image analysis, understanding, and visualization in both medical and scientific applications. Medical Image Registration provid

This IBM® Redpaper publication provides an update to the original description of IBM Reference Architecture for Genomics. This paper expands the reference architecture to cover all of the major vertical areas of healthcare and life sciences industries, such as genomics, imaging, and clinical and translational research. The architecture was renamed IBM Reference Architecture for High Performance Data and AI in Healthcare and Life Sciences to reflect the fact that it incorporates key building blocks for high-performance computing (HPC) and software-defined storage, and that it supports an expanding infrastructure of leading industry partners, platforms, and frameworks. The reference architecture defines a highly flexible, scalable, and cost-effective platform for accessing, managing, storing, sharing, integrating, and analyzing big data, which can be deployed on-premises, in the cloud, or as a hybrid of the two. IT organizations can use the reference architecture as a high-level guide for overcoming data management challenges and processing bottlenecks that are frequently encountered in personalized healthcare initiatives, and in compute-intensive and data-intensive biomedical workloads. This reference architecture also provides a framework and context for modern healthcare and life sciences institutions to adopt cutting-edge technologies, such as cognitive life sciences solutions, machine learning and deep learning, Spark for analytics, and cloud computing. To illustrate these points, this paper includes case studies describing how clients and IBM Business Partners alike used the reference architecture in the deployments of demanding infrastructures for precision medicine. This publication targets technical professionals (consultants, technical support staff, IT Architects, and IT Specialists) who are responsible for providing life sciences solutions and support.

This book introduces the classical and modern image reconstruction technologies. It covers 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 discussed. Contemporary research results in exact region-of-interest (ROI) reconstruction with truncated projections, Katsevich's cone-beam filtered backprojection algorithm, and reconstruction with highly under-sampled data are included. The last chapter of the book is devoted to the techniques of using a fast analytical algorithm to reconstruct an image that is equivalent to an iterative reconstruction. These techniques are the author's most recent research results. This book is intended for students, engineers, and researchers who are interested in medical image reconstruction. Written in a non-mathematical way, this book provides an easy access to modern mathematical methods in medical imaging. Table of Content: Chapter 1 Basic Principles of Tomography 1.1 Tomography 1.2 Projection 1.3 Image Reconstruction 1.4 Backprojection 1.5 Mathematical Expressions Problems References Chapter 2 Parallel-Beam Image Reconstruction 2.1 Fourier Transform 2.2 Central Slice Theorem 2.3 Reconstruction Algorithms 2.4 A Computer Simulation 2.5 ROI Reconstruction with Truncated Projections 2.6 Mathematical Expressions (The Fourier Transform and Convolution , The Hilbert Transform and the Finite Hilbert Transform , Proof of the Central Slice Theorem, Derivation of the Filtered Backprojection Algorithm , Expression of the Convolution Backprojection Algorithm, Expression of the Radon Inversion Formula ,Derivation of the Backprojection-then-Filtering Algorithm Problems References Chapter 3 Fan-Beam Image Reconstruction 3.1 Fan-Beam Geometry and Point Spread Function 3.2 Parallel-Beam to Fan-Beam Algorithm Conversion 3.3 Short Scan 3.4 Mathematical Expressions (Derivation of a Filtered Backprojection Fan-Beam Algorithm, A Fan-Beam Algorithm Using the Derivative and the Hilbert Transform) Problems References Chapter 4 Transmission and Emission Tomography 4.1 X-Ray Computed Tomography 4.2 Positron Emission Tomography and Single Photon Emission Computed Tomography 4.3 Attenuation Correction for Emission Tomography 4.4 Mathematical Expressions Problems References Chapter 5 3D Image Reconstruction 5.1 Parallel Line-Integral Data 5.2 Parallel Plane-Integral Data 5.3 Cone-Beam Data (Feldkamp's Algorithm, Grangeat's Algorithm, Katsevich's Algorithm) 5.4 Mathematical Expressions (Backprojection-then-Filtering for Parallel Line-Integral Data, Filtered Backprojection Algorithm for Parallel Line-Integral Data, 3D Radon Inversion Formula, 3D Backprojection-then-Filtering Algorithm for Radon Data, Feldkamp's Algorithm, Tuy's Relationship, Grangeat's Relationship, Katsevich's Algorithm) Problems References Chapter 6 Iterative Reconstruction 6.1 Solving a System of Linear Equations 6.2 Algebraic Reconstruction Technique 6.3 Gradient Descent Algorithms 6.4 Maximum-Likelihood Expectation-Maximization Algorithms 6.5 Ordered-Subset Expectation-Maximization Algorithm 6.6 Noise Handling

(Analytical Methods, Iterative Methods, Iterative Methods) 6.7 Noise Modeling as a Likelihood Function 6.8 Including Prior Knowledge 6.9 Mathematical Expressions (ART, Conjugate Gradient Algorithm, ML-EM, OS-EM, Green's One-Step Late Algorithm, Matched and Unmatched Projector/Backprojector Pairs) 6.10 Reconstruction Using Highly Undersampled Data with l0 Minimization Problems References Chapter 7 MRI Reconstruction 7.1 The 'M' 7.2 The 'R' 7.3 The 'I'; (To Obtain z-Information, x-Information, y-Information) 7.4 Mathematical Expressions Problems References Indexing

This book provides researchers and engineers in the imaging field with the skills they need to effectively deal with nonlinear inverse problems associated with different imaging modalities, including impedance imaging, optical tomography, elastography, and electrical source imaging. Focusing on numerically implementable methods, the book bridges the gap between theory and applications, helping readers tackle problems in applied mathematics and engineering. Complete, self-contained coverage includes basic concepts, models, computational methods, numerical simulations, examples, and case studies. Provides a step-by-step progressive treatment of topics for ease of understanding. Discusses the underlying physical phenomena as well as implementation details of image reconstruction algorithms as prerequisites for finding solutions to non linear inverse problems with practical significance and value. Includes end of chapter problems, case studies and examples with solutions throughout the book. Companion website will provide further examples and solutions, experimental data sets, open problems, teaching material such as PowerPoint slides and software including MATLAB m files. Essential reading for Graduate students and researchers in imaging science working across the areas of applied mathematics, biomedical engineering, and electrical engineering and specifically those involved in nonlinear imaging techniques, impedance imaging, optical tomography, elastography, and electrical source imaging

Magnetic Resonance Imaging, MRI, is a powerful imaging modality that is frequently used in both clinical and academic settings. With its advantages of flexibility in signal encoding, we can use MRI to non-invasively visualize various soft-tissue contrasts, showing not only anatomical but also metabolic and functional information. In addition, MRI is a radiation-free modality which makes it favorable in numbers of clinical applications because of the reduced radiation-risk compared with other radiology modalities such as X-ray, Computed Tomography (CT), Positron Emission Tomography (PET) etc. Despite the advantages of MRI techniques, there are still several challenges preventing MRI from becoming more efficient and accessible. First, the scan time for MRI is usually longer than other modalities such as X-ray and CT, since it requires enough measurements to resolve high-quality images for diagnostic tasks. In order to accelerate MRI, various fast-imaging techniques, such as Parallel Imaging (PI) and Compressed Sensing (CS) have been proposed to speed up MRI acquisition using under-sampling. However, it is still unclear what is the best approach to conduct the under-sampling as different under-sampling patterns may result in different reconstruction quality. Second, the reconstruction methods for under-sampled MRI need further improvement. The reconstruction algorithms are formed as nonlinear optimization problems using iterative optimization that can be time-consuming. Fixed and handcrafted penalty terms are usually used to regularize the optimization, which are hard to tune. There are often trade-offs between the speed of the algorithm and the quality of resulting images. In many cases, the imperfect artifact suppression or over-smoothing slows down the clinical adoption of these fast-imaging techniques. Third, MR images are typically not quantitative. Most clinical MRI protocols used nowadays are contrast-weighted sequences, which incorporate the tissue contrasts in qualitative ways. Therefore, the resulting MR images may vary a lot between different protocols and scanners, which makes it very difficult for radiologists to conduct quantitative analysis or longitudinal comparison. In this work, we propose to resolve these remaining challenges to further improve MRI technologies. We utilized state-of-the-art Machine Learning and Deep Learning algorithms to significantly improve these three essential components in MRI: faster acquisition, better reconstruction, and more accurate qualification. Specifically, we firstly propose a machine learning based method to optimize the undersampling pattern for accelerated acquisition. The results, validated on in-vivo multi-contrast brain and prostate MRI datasets, demonstrate that the proposed method can generalize well for different anatomy. It enables efficient (5sec-10sec) and adaptive under-sampling pattern optimization at per-subject/per-scan level, and achieves 30%-50% lower PI+CS reconstruction error at the same acceleration factor. To improve MRI acquisition with a safer protocol and lower contrast dose, a deep learning model is developed to enhance the MRI. The proposed Deep Learning method yielded significant (N=50, p 0.001) improvements over the low-dose (10%) images (5dB PSNR gains and > 11.0% SSIM). Ratings on image quality and contrast enhancement are significantly (N=20, p

Magnetic Resonance Image Reconstruction: Theory, Methods and Applications presents the fundamental concepts of MR image reconstruction, including its formulation as an inverse problem, as well as the most common models and optimization methods for reconstructing MR images. It discusses approaches for specific applications such as non-Cartesian imaging, under sampled reconstruction, motion correction, dynamic imaging and quantitative MRI. Magnetic Resonance Image Reconstruction: Theory, Methods and Applications is a unique resource suitable for physicists, engineers, technologists and clinicians with an interest in medical image reconstruction and MRI. Explains the underlying principles of MRI reconstruction as well as the latest research Gives example code of some of the methods presented Includes the latest developments such as compressed sensing, tensor-based reconstruction and machine learning based reconstruction

The seven-volume set LNCS 12261, 12262, 12263, 12264, 12265, 12266, and

12267 constitutes the refereed proceedings of the 23rd International Conference on Medical Image Computing and Computer-Assisted Intervention, MICCAI 2020, held in Lima, Peru, in October 2020. The conference was held virtually due to the COVID-19 pandemic. The 542 revised full papers presented were carefully reviewed and selected from 1809 submissions in a double-blind review process. The papers are organized in the following topical sections: Part I: machine learning methodologies Part II: image reconstruction; prediction and diagnosis; cross-domain methods and reconstruction; domain adaptation; machine learning applications; generative adversarial networks Part III: CAI applications; image registration; instrumentation and surgical phase detection; navigation and visualization; ultrasound imaging; video image analysis Part IV: segmentation; shape models and landmark detection Part V: biological, optical, microscopic imaging; cell segmentation and stain normalization; histopathology image analysis; opthalmology Part VI: angiography and vessel analysis; breast imaging; colonoscopy; dermatology; fetal imaging; heart and lung imaging; musculoskeletal imaging Part VI: brain development and atlases; DWI and tractography; functional brain networks; neuroimaging; positron emission tomography.

Preceded by Magnetic resonance imaging: physical principles and sequence design / E. Mark Haacke ... [et al.]. c1999.

Handbook of Medical Image Computing and Computer Assisted Intervention presents important advanced methods and state-of-the art research in medical image computing and computer assisted intervention, providing a comprehensive reference on current technical approaches and solutions, while also offering proven algorithms for a variety of essential medical imaging applications. This book is written primarily for university researchers, graduate students and professional practitioners (assuming an elementary level of linear algebra, probability and statistics, and signal processing) working on medical image computing and computer assisted intervention. Presents the key research challenges in medical image computing and computer-assisted intervention Written by leading authorities of the Medical Image Computing and Computer Assisted Intervention (MICCAI) Society Contains state-of-the-art technical approaches to key challenges Demonstrates proven algorithms for a whole range of essential medical imaging applications Includes source codes for use in a plug-and-play manner Embraces future directions in the fields of medical image computing and computer-assisted intervention

In 1971 Dr. Paul C. Lauterbur pioneered spatial information encoding principles that made image formation possible by using magnetic resonance signals. Now Lauterbur, "father of the MRI", and Dr. Zhi-Pei Liang have co-authored the first engineering textbook on magnetic resonance imaging. This long-awaited, definitive text will help undergraduate and graduate students of biomedical engineering, biomedical imaging scientists, radiologists, and electrical engineers gain an in-depth understanding of MRI principles. The authors use a signal processing approach to describe the fundamentals of magnetic resonance imaging. You will find a clear and rigorous discussion of these carefully selected essential topics: Mathematical fundamentals Signal generation and detection principles Signal characteristics Signal localization principles Image reconstruction techniques Image contrast mechanisms Image resolution, noise, and artifacts Fast-scan imaging Constrained reconstruction Complete with a comprehensive set of examples and homework problems, Principles of Magnetic Resonance Imaging is the must-read book to improve your knowledge of this revolutionary technique.

Machine Learning for Tomographic ImagingProgramme: Iop Expanding Physi
"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 l0-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. Gengsheng Lawrence Zeng is an expert in the development of medical image reconstruction algorithms and is a professor at the Department of Radiology, University of Utah, Salt Lake City, Utah, USA.
Machine learning represents a paradigm shift in tomographic imaging, and image reconstruction is a new frontier of machine learning. This book will meet the needs of those who want to catch the wave of smart imaging. The book targets graduate students and researchers in the imaging community. Open network software, working datasets, and multimedia will be included. The first of its kind in the emerging field of deep reconstruction and deep imaging, Machine Learning for Tomographic Imaging presents the most essential elements, latest progresses and an in-depth perspective on this important topic.
The six-volume set LNCS 11764, 11765, 11766, 11767, 11768, and 11769 constitutes the refereed proceedings of the 22nd International Conference on Medical Image Computing and Computer-Assisted Intervention, MICCAI 2019, held in Shenzhen, China, in October 2019. The 539 revised full papers presented were carefully reviewed and selected from 1730 submissions in a double-blind review process. The papers are organized in the following topical sections: Part I: optical imaging; endoscopy; microscopy. Part II: image segmentation; image registration; cardiovascular imaging; growth, development, atrophy and progression. Part III: neuroimage reconstruction and synthesis; neuroimage segmentation; diffusion weighted magnetic resonance imaging; functional neuroimaging (fMRI); miscellaneous neuroimaging. Part IV: shape; prediction; detection and localization; machine learning; computer-aided diagnosis; image reconstruction and synthesis. Part V: computer assisted interventions; MIC meets CAI. Part VI: computed tomography; X-ray imaging.
Discover New Methods for Dealing with High-Dimensional Data A sparse statistical model has only a small number of nonzero parameters or weights; therefore, it is much easier to estimate and interpret than a dense model. Statistical Learning with Sparsity: The Lasso and Generalizations presents methods that exploit sparsity to help recover the underlying signal in a set of data. Top experts in this rapidly evolving field, the authors describe the lasso for linear regression and a simple coordinate descent algorithm for its computation. They discuss the application of l1 penalties to generalized linear models and support vector machines, cover generalized penalties such as the elastic net and group lasso, and review numerical methods for optimization. They also present statistical inference methods for fitted (lasso) models, including the bootstrap, Bayesian methods, and recently developed approaches. In addition, the book examines matrix decomposition, sparse multivariate analysis, graphical models, and compressed sensing. It concludes with a survey of theoretical results for the lasso. In this age of big data, the number of features measured on a person or object can be large and might be larger than the number of observations. This book shows how the sparsity assumption allows us to tackle these problems and extract useful and reproducible patterns from big datasets. Data analysts, computer scientists, and theorists will appreciate this thorough and up-to-date treatment of sparse statistical modeling.

The 30-volume set, comprising the LNCS books 12346 until 12375, constitutes the refereed proceedings of the 16th European Conference on Computer Vision, ECCV 2020, which was planned to be held in Glasgow, UK, during August 23-28, 2020. The conference was held virtually due to the COVID-19 pandemic. The 1360 revised papers presented in these proceedings were carefully reviewed and selected from a total of 5025 submissions. The papers deal with topics such as computer vision; machine learning; deep neural networks; reinforcement learning; object recognition; image classification; image processing; object detection; semantic segmentation; human pose estimation; 3d reconstruction; stereo vision; computational photography; neural networks; image coding; image reconstruction; object recognition; motion estimation. .

This issue of Neuroimaging Clinics of North America focuses on State of the Art Evaluation of the Head and Neck and is edited by Dr. Ashok Srinivasan. Articles will include: Diffusion MR in the head and neck: Principles and applications; Perfusion imaging in the head and neck: Go with the flow; MR spectroscopy of the head and neck: Principles, applications and challenges; Technological improvements in head and neck MR: At the cutting edge; Dual Energy CT in head and neck imaging: Pushing the envelope; Role of Ultrasound in head and neck evaluation; PET imaging in the head and neck: Current state and future directions; Patient centric head and neck cancer radiation therapy: Role of advanced imaging; AI in head and neck imaging: Glimpse into the future; NIRADS: Principles and implementation; Common data elements in head and neck reporting; and more!

This book constitutes the refereed proceedings of the First International Workshop on Machine Learning for Medical Reconstruction, MLMIR 2018, held in conjunction with MICCAI 2018, in Granada, Spain, in September 2018. The 17 full papers presented were carefully reviewed and selected from 21 submissions. The papers are organized in the following topical sections: deep learning for magnetic resonance imaging; deep learning for computed tomography, and deep learning for general image reconstruction.

MRI: Essentials for Innovative Technologies describes novel methods to improve magnetic resonance imaging (MRI) beyond its current limitations. It proposes smart encoding methods and acquisition sequences to deal with frequency displacement due to residual static magnetic field inhomogeneity, motion, and undersampling. Requiring few or no hardware modifications, these speculative methods offer building blocks that can be combined and refined to overcome barriers to more advanced MRI applications, such as real-time imaging and open systems. After a concise review of basic mathematical tools and the physics of MRI, the book describes the severe artifacts produced by conventional MRI techniques. It first tackles magnetic field inhomogeneities, outlining conventional solutions as well as a completely different approach based on time-varying gradients and temporal frequency variation coding (acceleration). The book then proposes two innovative acquisition methods for reducing acquisition time, motion, and undersampling artifacts: adaptive acquisition and compressed sensing. The concluding chapter lays out the author’s predictions for the future of MRI. For some of the proposed solutions, this is the first time the reported results have been published. Where experimental data is preliminary or unavailable, the book presents only numerical solutions. Offering insight into emerging MRI techniques, this book provides readers with specialized knowledge to help them design better acquisition sequences and select appropriate correction methods. The author’s proceeds from the sale of this book will be entirely donated to Bambin Gesù Children's Hospital in Rome.

The sixteen-volume set comprising the LNCS volumes 11205-11220 constitutes the refereed proceedings of the 15th European Conference on Computer Vision, ECCV 2018, held in Munich, Germany, in September 2018.The 776 revised papers presented were carefully reviewed and selected from 2439 submissions. The papers are organized in topical sections on learning for vision; computational photography; human analysis; human sensing; stereo and reconstruction; optimization; matching and recognition; video attention; and poster sessions.

In recent years, there has been increasing interest in the clinical applications of coronary angiography techniques. Coronary MRA can be instrumental in the evaluation of congenital coronary artery anomalies, however, the complexity of advanced MR pulse sequences and strategies may be overwhelming to many. Coronary MR Angiography demystifies the art of coronary MRA by providing a text in plain language with clearly illustrated imaging steps and protocols. Designed to bridge the gap between radiology and cardiology, it is written for physicians and scientists planning to incorporate this technique into their research or practice.