

Diffusion Tensor Imaging A Practical Handbook

A new edition of the lavishly illustrated guide to brain structure and function This atlas is an outstanding single-volume resource of information on the structure and function of specific areas of the brain. Updated to reflect the latest technology using 3 Tesla MR images, this edition has been enhanced with new functional MRI studies as well as a new section on diffusion tensor imaging with three-dimensional reconstructions of fiber tracts using color coding to demonstrate neural pathways. Highlights: Glossary of neuroanatomic structures and definitions provides the reader with a foundation in structures, function, and functional relationships High-quality images are divided into five sections, including Sagittal MRI views, Axial MRI views, Coronal MRI views, Fiber-Tracking Diffusion Tensor Imaging, and Three-Dimensional MRI views Icons rapidly orient the reader with the location of each view or the diffusion pathway This book eliminates the need to sift through multiple books for the current information on the structure and function of the brain. It is invaluable for clinicians in radiology, neuroradiology, neurology, neurosurgery, psychiatry, psychology, neuropsychology, and neuroanatomy. The atlas is also ideal for medical students, nursing students, and individuals seeking to gain a firm understanding of human brain anatomy and function.

Quantitative MRI of the Spinal Cord is the first book focused on quantitative MRI techniques with specific application to the human spinal cord. This work includes coverage of diffusion-weighted imaging, magnetization transfer imaging, relaxometry, functional MRI, and spectroscopy. Although these methods have been successfully used in the brain for the past 20 years, their application in the spinal cord remains problematic due to important acquisition challenges (such as small cross-sectional size, motion, and susceptibility artifacts). To date, there is no consensus on how to apply these techniques; this book reviews and synthesizes state-of-the-art methods so users can successfully apply them to the spinal cord. Quantitative MRI of the Spinal Cord introduces the theory behind each quantitative technique, reviews each theory's applications in the human spinal cord and describes its pros and cons, and suggests a simple protocol for applying each quantitative technique to the spinal cord. Chapters authored by international experts in the field of MRI of the spinal cord Contains "cooking recipes"—examples of imaging parameters for each quantitative technique—designed to aid researchers and clinicians in using them in practice Ideal for clinical settings

Ever since the inception of Diffusion Tensor Imaging (DTI), unabated advancements in its capabilities and applications have been spearheaded by a vibrant research effort to devise dedicated acquisition sequences, protocols and hardware. In translational research, however, the transition of these innovations into the arenas of biomedical research, and ultimately clinical practice is frequently hampered by practical considerations. These include the availability of appropriate expertise, time and resources for their implementation, and considerations of compatibility with established techniques and results reported in literature. Such concerns provide the impetus to maximize the utility of existing protocols before attempting the development of novel dedicated techniques. In this thesis, three investigations, each targeting a different DTI application, are presented. The strategy implemented throughout involves assessing the suitability of existing sequences for the intended task, and determining any limiting factors, evaluating whether appropriate modifications of the acquisition protocols used are capable of alleviating limitations, and developing novel, dedicated protocols wherever necessary. The value and, importantly, the wide scope of this approach in answering important research questions is exemplified through the breadth of the studies presented. The first study presents, for the first time, a quantitative evaluation of the effects of cardiac pulsation on prevalent DTI metrics acquired with a specific acquisition protocol used routinely in clinical practice. Findings inform the on-going debate on whether the investment in cardiac gating is merited by improvements in data quality. Effects were observed during only 6 % of the cardiac cycle, and not 20 % as previously reported. The impact of cardiac pulsation on selected diffusion Tensor indices was minimal in group studies, but of potential practical relevance in individual cases. Methods to predict which individuals may benefit from gating have also been suggested. Secondly, the feasibility of post-mortem DTI was established through the successful acquisition, also for the first time, of DTI data on a chemically fixed whole human post-mortem brain using a clinical sequence. Previous failed attempts have been attributed to insufficient SNR. In this study scanner stability and distortion are found to be the main limiting factors, and mitigated using appropriate averaging and co-registration strategies. The third study assessed the potential of ultra-high field strength DTI by identifying and optimizing the potential strengths of DTI at 7T. Subsequent to optimization with respect to SNR, the main sources of artefact were found to be B1 inhomogeneity and inadequate fat suppression. Both were alleviated by modification of the available acquisition protocol, resulting in higher SNR and data quality than previously reported. Finally, in developing appropriate data quality measures, the 'Difference method', commonly used for the quantification of SNR, was found to be unsuitable for in vivo DTI acquisitions at 7 T, leading to the proposal, and successful implementation and validation of an alternative.

Magnetic resonance imaging (MRI) is a technique used in biomedical imaging and radiology to visualize internal structures of the body. Because MRI provides excellent contrast between different soft tissues, the technique is especially useful for diagnostic imaging of the brain, muscles, and heart. In the past 20 years, MRI technology has improved significantly with the introduction of systems up to 7 Tesla (7 T) and with the development of numerous post-processing algorithms such as diffusion tensor imaging (DTI), functional MRI (fMRI), and spectroscopic imaging. From these developments, the diagnostic potentialities of MRI have improved impressively with an exceptional spatial resolution and the possibility of analyzing the morphology and function of several kinds of pathology. Given these exciting developments, the Magnetic Resonance Imaging Handbook: Image Principles, Neck, and the Brain is a timely addition to the growing body of literature in the field. Covering MRI from fundamentals to practice, this comprehensive book: Discusses the clinical benefits of diagnosing human pathologies using MRI Explains the physical principles of MRI and how to use the technique correctly Highlights each organ's anatomy and pathological processes with high-quality images Examines the protocols and potentialities of advanced MRI scanners such as 7 T systems Includes extensive references at the end of each chapter to enhance further study Thus, the Magnetic Resonance Imaging Handbook: Image Principles, Neck, and the Brain provides radiologists and imaging specialists with a valuable, state-of-the-art reference on MRI.

Diffusion MRI remains the most comprehensive reference for understanding this rapidly evolving and powerful technology and is an essential handbook for designing, analyzing, and interpreting diffusion MR experiments. Diffusion imaging provides a unique window on human brain anatomy. This non-invasive technique continues to grow in popularity as a way to study brain pathways that could never before be investigated in vivo. This book covers the fundamental theory of diffusion imaging, discusses its most promising applications to basic and clinical

neuroscience, and introduces cutting-edge methodological developments that will shape the field in coming years. Written by leading experts in the field, it places the exciting new results emerging from diffusion imaging in the context of classical anatomical techniques to show where diffusion studies might offer unique insights and where potential limitations lie. Fully revised and updated edition of the first comprehensive reference on a powerful technique in brain imaging Covers all aspects of a diffusion MRI study from acquisition through analysis to interpretation, and from fundamental theory to cutting-edge developments New chapters covering connectomics, advanced diffusion acquisition, artifact removal, and applications to the neonatal brain Provides practical advice on running an experiment Includes discussion of applications in psychiatry, neurology, neurosurgery, and basic neuroscience Full color throughout Imaging in Parkinson's Disease provides up-to-date information concerning new applications of brain imaging to the study of Parkinson's disease. Written by experts in the field, the book focuses on structural and functional imaging methodologies that have recently been applied to study the natural history of Parkinson's disease, with emphasis on the development of the major motor manifestations of the illness as well as cognitive impairment and dementia.

This book provides an overview of the practical aspects of diffusion tensor imaging (DTI), from understanding the basis of the technique through selection of the right protocols, troubleshooting data quality, and analyzing DTI data optimally. DTI is a non-invasive magnetic resonance imaging (MRI) technique for visualizing and quantifying tissue microstructure based on diffusion. The book discusses the theoretical background underlying DTI and advanced techniques based on higher-order models and multi-shell diffusion imaging. It covers the practical implementation of DTI; derivation of information from DTI data; and a range of clinical applications, including neurosurgical planning and the assessment of brain tumors. Its practical utility is enhanced by decision schemes and a fully annotated DTI brain atlas, including color fractional anisotropy maps and 3D tractography reconstructions of major white matter fiber bundles. Featuring contributions from leading specialists in the field of DTI, Diffusion Tensor Imaging: A Practical Handbook is a valuable resource for radiologists, neuroradiologists, MRI technicians and clinicians.

This book explores various state-of-the-art aspects behind the statistical analysis of neuroimaging data. It examines the development of novel statistical approaches to model brain data. Designed for researchers in statistics, biostatistics, computer science, cognitive science, computer engineering, biomedical engineering, applied mathematics, physics, and radiology, the book can also be used as a textbook for graduate-level courses in statistics and biostatistics or as a self-study reference for Ph.D. students in statistics, biostatistics, psychology, neuroscience, and computer science.

The Physics of Clinical MR Taught Through Images Fourth Edition by Val Runge, Wolfgang Nitz, and Johannes Heverhagen presents a unique and highly practical approach to understanding the physics of magnetic resonance imaging. Each physics topic is described in user-friendly language and accompanied by high-quality graphics and/or images. The visually rich format provides a readily accessible tool for learning, leveraging, and mastering the powerful diagnostic capabilities of MRI. Key Features More than 700 images, anatomical drawings, clinical tables, charts, and diagrams, including magnetization curves and pulse sequencing, facilitate acquisition of highly technical content. Eight systematically organized sections cover core topics: hardware and radiologic safety; basic image physics; basic and advanced image acquisition; flow effects; techniques specific to the brain, heart, liver, breast, and cartilage; management and reduction of artifacts; and improvements in MRI diagnostics and technologies. Cutting-edge topics including contrast-enhanced MR angiography, spectroscopy, perfusion, and advanced parallel imaging/data sparsity techniques. Discussion of groundbreaking hardware and software innovations, such as MR-PET, 7 T, interventional MR, 4D flow, CAIPIRINHA, radial acquisition, simultaneous multislice, and compressed sensing. A handy appendix provides a quick reference of acronyms, which often differ from company to company. The breadth of coverage, rich visuals, and succinct text make this manual the perfect reference for radiology residents, practicing radiologists, researchers in MR, and technologists.

Editor Hersh Chandarana, MD and authors review Advanced MR Imaging in Clinical Practice. Articles will include: Current Status of Diffusion Weighted Imaging; Current Status of Perfusion Weighted Imaging; Non-gadolinium Enhanced MR Angiography; Pearls and Pitfalls of 3 T imaging; Implementing MR Neurography in Clinical Practice; Imaging around Hardware and Metal; Recent Advances in T1- and T2-Weighted Imaging of the Abdomen and Pelvis; Recent Advances in Neuro and Spine Imaging; Advances in MR Hardware and Software, and more!

The concepts behind diffusion tensor imaging (DTI) are commonly difficult to grasp, even for magnetic resonance physicists. To make matters worse, a many more complex higher-order methods have been proposed over the last few years to overcome the now well-known deficiencies of DTI. In Introduction to Diffusion Tensor Imaging: And Higher Order Models, these concepts are explained through extensive use of illustrations rather than equations to help readers gain a more intuitive understanding of the inner workings of these techniques. Emphasis is placed on the interpretation of DTI images and tractography results, the design of experiments, and the types of application studies that can be undertaken. Diffusion MRI is a very active field of research, and theories and techniques are constantly evolving. To make sense of this constantly shifting landscape, there is a need for a textbook that explains the concepts behind how these techniques work in a way that is easy and intuitive to understand—Introduction to Diffusion Tensor Imaging fills this gap. Extensive use of illustrations to explain the concepts of diffusion tensor imaging and related methods Easy to understand, even without a background in physics Includes sections on image interpretation, experimental design, and applications Up-to-date information on more recent higher-order models, which are increasingly being used for clinical applications

Diffusion-weighted imaging (DWI) is an integral part of routine neuroimaging, used nearly universally in brain MRIs, and more recently for the spine, spinal cord, and head and neck. DWI provides clinically relevant information on conditions including stroke, infection, and neoplasms. Diffusion tensor imaging (DTI) is a powerful, newer technique with the potential for multiple protocols, including the diagnosis of mild traumatic brain injury and psychiatric disorders. Written by leading authorities in neuroradiology and radiology, Diffusion Weighted and Diffusion Tensor Imaging: A Clinical Guide provides key points and summaries on the concepts and applications required for proper implementation and

interpretation of DWI and DTI. Key Features: More than 600 high-quality illustrations Protocols and applications from early childhood to older adulthood Methods to differentiate normal versus pathological states Brain edema pathophysiology and use of DWI to distinguish between cytotoxic and vasogenic edema Utilization of DWI and DTI to diagnose trauma, white matter disease, tumors, cerebrovascular disease, and head, neck, and spine disorders This concise handbook is an invaluable resource for neuroradiologists and radiologists, as well as fellows and residents in these disciplines. With the expanding use of these procedures, neuroscientists, neurologists, neurosurgeons, and psychiatrists will also find it indispensable.

Diffusion Tensor Imaging A Practical Handbook Springer

Modern neuroimaging offers tremendous opportunities for gaining insights into normative development and a wide array of developmental neuropsychiatric disorders. Focusing on ontogeny, this text covers basic processes involved in both healthy and atypical maturation, and also addresses the range of neuroimaging techniques most widely used for studying children. This book will enable you to understand normative structural and functional brain maturation and the mechanisms underlying basic developmental processes; become familiar with current knowledge and hypotheses concerning the neural bases of developmental neuropsychiatric disorders; and learn about neuroimaging techniques, including their unique strengths and limitations. Coverage includes normal developmental processes, atypical processing in developmental neuropsychiatric disorders, ethical issues, neuroimaging techniques and their integration with psychopharmacologic and molecular genetic research approaches, and future directions. This comprehensive volume is an essential resource for neurologists, neuropsychologists, psychiatrists, pediatricians, and radiologists concerned with normal development and developmental neuropsychiatric disorders.

This book summarizes the current state of movement disorder management and the role of surgical therapies as an alternative to medication. Following a chapter on the history of movement disorder surgery, leaders in their fields describe the pathophysiology, functional neuroanatomy, clinical presentation, and medical management of Parkinson's disease, dystonia, and essential tremor. This is followed by chapters on the spectrum of movement disorder surgery itself, from the lesioning procedures of radiofrequency ablation, stereotactic radiosurgery, and high-frequency ultrasound to the modulatory procedures of "asleep", image-guided deep brain stimulation (DBS) and "awake", microelectrode-guided DBS. The final chapters focus on closed-loop DBS, drug-delivery, gene therapy, and other emerging neurosurgical therapies, highlighting long-standing experimental strategies that are reaching exciting phases of clinical translation. This volume is a valuable tool for accessing the wide spectrum of concepts that currently define this dynamic field.

Magnetic resonance imaging (MRI) is now considered the imaging modality of choice for the majority of disorders affecting the central nervous system. This is particularly true for gray and white matter disorders, thanks to the superb soft tissue contrast in MRI which allows gray matter, unmyelinated, and myelinated white matter to be distinguished and their respective disorders identified. The present book is devoted to the disorders of myelin and myelination. A growing amount of detailed in vivo information about myelin, myelination, and myelin disorders has been derived both from MRI and from MR spectroscopy (MRS). This prompted us to review the clinical, laboratory, biochemical, and pathological data on this subject in order to integrate all available information and to provide improved insights into normal and disordered myelin and myelination. We will show how the synthesis of all available information contributes to the interpretation of MR images. After a brief historical review about the increasing knowledge on myelin and myelin disorders, we propose a new classification of myelin disorders based on the subcellular localization of the enzymatic defects as far as the inborn errors of metabolism are concerned. This classification serves as a guide throughout the book. All items of the classification will be discussed and, whenever relevant and possible, be illustrated by MR images.

This book provides a comprehensive and practical guide for the safe and efficient management of patients with intrinsic brain tumors and medically intractable epilepsy. It presents in an easily understandable way the preoperative evaluation of these patients, starting from the clinical interpretation of conventional anatomical MR imaging and analyses the clinical significance of newer MR based imaging techniques such as diffusion and perfusion imaging. It demonstrates with clarity the role of MR spectroscopy and fractional anisotropy and diffusion tensor imaging in the preoperative assessment of these patients and how this data can be incorporated into the surgical planning. This book is aimed at neurosurgeons, neuroradiologists, neurologists, and epileptologists, and may also be of interest to neuropsychologists, neurophysiologists, radiation oncologists, and medical physicists.

Brain Tumor Imaging is a practical, comprehensive reference that covers all the methods of imaging used in the diagnosis and assessment of brain tumors. It includes key information on the use of advanced imaging technologies in the clinical setting for the successful treatment of patients with brain tumors. Key Features: Includes more than 500 high-quality images (color as well as black and white) that help illustrate the latest imaging modalities used in neuro-oncology Covers advanced, functional imaging techniques, giving readers the latest information on clinically advanced imaging tools for brain tumor assessment Provides details on how to accurately evaluate treatment effects and differentiate from tumor progression This book is an essential guide to advanced imaging modalities for all radiologists, neuroradiologists, neuro-oncologists, and neurosurgeons involved in the treatment and evaluation of patients with brain tumors.

Explains the difficult concepts behind diffusion tensor imaging (DTI) through extensive use of illustrations rather than equations to help readers gain a more intuitive understanding of the inner workings of

these techniques. Emphasis is placed on the interpretation of DTI images and tractography results, the design of experiments, and the types of application studies that can be undertaken.

New Techniques for Management of 'Inoperable' Gliomas radically challenges the assumption that certain gliomas cannot be removed with modern techniques, contesting stereotypical thinking and establishing new paradigms in the field. Gliomas are primary brain tumors which are often fatal. Recent data has demonstrated that despite the fact that surgery cannot cure gliomas, patient survival is substantially improved by removing as much of the tumor as possible. This fact has raised the imperative that neurologists try to improve techniques to bring surgical resection to as many patients as possible. This book brings new insights and technologies to the forefront, giving hope to patients. Provides the first comprehensive book to discuss techniques for removing gliomas that are traditionally deemed 'inoperable' Presents a great reference tool that challenges stereotypical thinking by offering techniques by innovative surgeons Includes chapters that are organized by different glioma types and surgery/techniques

The concept of Diffusion Tensor Imaging (DTI) is often difficult to grasp, even for Magnetic Resonance physicists. Introduction to Diffusion Tensor Imaging uses extensive illustrations (not equations) to help readers to understand how DTI works. Emphasis is placed on the interpretation of DTI images, the design of DTI experiments, and the forms of application studies. The theory of DTI is constantly evolving and so there is a need for a textbook that explains how the technique works in a way that is easy to understand - Introduction to Diffusion Tensor Imaging fills this gap. * Uses extensive illustrations to explain the concept of Diffusion Tensor Imaging * Easy to understand, even without a background in physics * Includes sections on image interpretation, experimental design and applications

The synucleinopathy sporadic Parkinson's disease (sPD) is the second most frequent degenerative disorder of the human nervous system after Alzheimer's disease. The propensity for developing sPD exists in all ethnic groups worldwide, and the prevalence of the disorder increases considerably with age, thereby imposing an enormous social and economic burden on societies with increased life expectancy. The sPD-associated pathological process is progressive, does not go into remission, and can take decades to reach its culmination if it is not be terminated prematurely by death owing to other causes. Against the background of the normal morphology and anatomy, the authors analyze the pathoanatomy of sPD in the nervous system at various neuropathological stages and summarize the potential functional consequences of the lesions.

This volume provides a deeper understanding of the diagnosis of brain tumors by correlating radiographic imaging features with the underlying pathological abnormalities. All modern imaging modalities are used to complete a diagnostic overview of brain tumors with emphasis on recent advances in diagnostic neuroradiology. High-quality illustrations depicting common and uncommon imaging characteristics of a wide range of brain tumors are presented and analysed, drawing attention to the ways in which these characteristics reflect different aspects of pathology. Important theoretical considerations are also discussed. Since the first edition, chapters have been revised and updated and new material has been added, including detailed information on the clinical application of functional MRI and diffusion tensor imaging. Radiologists and other clinicians interested in the current diagnostic approach to brain tumors will find this book to be an invaluable and enlightening clinical tool.

The second, revised edition of this successful textbook provides an up-to-date description of the use of preoperative fMRI in patients with brain tumors and epilepsies. State of the art fMRI procedures are presented, with detailed consideration of practical aspects, imaging and data processing, normal and pathological findings, and diagnostic possibilities and limitations. Relevant information on brain physiology, functional neuroanatomy, imaging technique, and methodology is provided by recognized experts in these fields. Compared with the first edition, chapters have been updated to reflect the latest developments and in particular the current use of diffusion tensor imaging (DTI) and resting-state fMRI. Entirely new chapters are included on resting-state presurgical fMRI and the role of DTI and tractography in brain tumor surgery. Further chapters address multimodality functional neuroimaging, brain plasticity, and pitfalls, tips, and tricks.

Functional Neuroradiology: Principles and Clinical Applications, is a follow-up to Faro and Mohamed's groundbreaking work, Functional (BOLD)MRI: Basic Principles and Clinical Applications. This new 49 chapter textbook is comprehensive and offers a complete introduction to the state-of-the-art functional imaging in Neuroradiology, including the physical principles and clinical applications of Diffusion, Perfusion, Permeability, MR spectroscopy, Positron Emission Tomography, BOLD fMRI and Diffusion Tensor Imaging. With chapters written by internationally distinguished neuroradiologists, neurologists, psychiatrists, cognitive neuroscientists, and physicists, Functional Neuroradiology is divided into 9 major sections, including: Physical principles of all key functional techniques, Lesion characterization using Diffusion, Perfusion, Permeability, MR spectroscopy, and Positron Emission Tomography, an overview of BOLD fMRI physical principles and key concepts, including scanning methodologies, experimental research design, data analysis, and functional connectivity, Eloquent Cortex and White matter localization using BOLD fMRI and Diffusion Tensor Imaging, Clinical applications of BOLD fMRI in Neurosurgery, Neurology, Psychiatry, Neuropsychology, and Neuropharmacology, Multi-modality functional Neuroradiology, Beyond Proton Imaging, Functional spine and CSF imaging, a full-color Neuroanatomical Brain atlas of eloquent cortex and key white matter tracts and BOLD fMRI paradigms. By offering readers a complete overview of functional imaging modalities and techniques currently used in patient diagnosis and management, as well as emerging technology, Functional Neuroradiology is a vital information source for physicians and cognitive neuroscientists involved in daily practice and research.

The renowned Principles and Practice of Geriatric Psychiatry, now in its third edition, addresses the social and biological concepts of geriatric mental health from an international perspective. Featuring contributions by distinguished authors from around the world, the book offers a distinctive angle on issues in this continually developing discipline. Principles and Practice of Geriatric Psychiatry provides a comprehensive review of: geriatric psychiatry spanning both psychiatric and non-psychiatric disorders scientific advances in service development specific clinical dilemmas New chapters on: genetics of aging somatoform disorders epidemiology of substance abuse somatoform disorders care of the dying patient Continuing the practice of earlier editions, the major sections of the book address aging, diagnosis and assessment and clinical conditions, incorporating an engaging discussion on substance abuse and schizophrenic disorders. Shorter sections include the presentation of mental illness in elderly people from different cultures—one of the most popular sections in previous editions. Learning and behavioural studies, as well as models of geriatric psychiatry practice, are covered extensively. This book provides a detailed overview of the entire range of mental illness in old age, presented within an accessible format. Principles and Practice of Geriatric Psychiatry is an essential read for psychiatrists, geriatricians, neurologists and psychologists. It is of particular use for instructors of general psychiatry programs and their residents.

This is the most comprehensive book to be written on the subject of fetal MRI. It provides a practical hands-on approach to the use of state-of-the-art MRI techniques and the optimization of sequences. Fetal pathological conditions and methods of prenatal MRI diagnosis are discussed by organ system, and the available literature is reviewed. Interpretation of findings and potential artifacts are thoroughly considered with the aid of numerous high-quality illustrations. In addition, the implications of fetal MRI are explored from the medico-legal and ethical points of view. This book will serve as a detailed resource for radiologists, obstetricians, neonatologists, geneticists, and any practitioner wanting to gain an in-depth understanding of fetal MRI technology and applications. In addition, it will provide a reference source for technologists, researchers, students, and those who are implementing a fetal MRI service in their own facility.

Professor Derek Jones, a world authority on diffusion MRI, has assembled most of the world's leading scientists and clinicians developing and applying diffusion MRI to produce an authorship list that reads like a "Who's Who" of the field and an essential resource for those working with diffusion MRI. Destined to be a modern classic, this definitive and

richly illustrated work covers all aspects of diffusion MRI from basic theory to clinical application. Oxford Clinical Neuroscience is a comprehensive, cross-searchable collection of resources offering quick and easy access to eleven of Oxford University Press's prestigious neuroscience texts. Joining Oxford Medicine Online these resources offer students, specialists and clinical researchers the best quality content in an easy-to-access format.

MRI from Picture to Proton presents the basics of MR practice and theory in a unique way: backwards! The subject is approached just as a new MR practitioner would encounter MRI: starting from the images, equipment and scanning protocols, rather than pages of physics theory. The reader is brought face-to-face with issues pertinent to practice immediately, filling in the theoretical background as their experience of scanning grows. Key ideas are introduced in an intuitive manner which is faithful to the underlying physics but avoids the need for difficult or distracting mathematics. Additional explanations for the more technically inquisitive are given in optional secondary text boxes. The new edition is fully up-dated to reflect the most recent advances, and includes a new chapter on parallel imaging. Informal in style and informed in content, written by recognized effective communicators of MR, this is an essential text for the student of MR.

This book constitutes the refereed proceedings of the Second International Workshop on Multimodal Brain Image Analysis, held in conjunction with MICCAI 2012, in Nice, France, in October 2012. The 19 revised full papers presented were carefully reviewed and selected from numerous submissions. The objective of this workshop is to forward the state of the art in analysis methodologies, algorithms, software systems, validation approaches, benchmark datasets, neuroscience, and clinical applications.

The Mouse Brain in Stereotaxic Coordinates, Second Edition has been the acknowledged reference in this field since the publication of the first edition, and is now available in a Compact Edition. This will provide a more affordable option for students, as well as researchers needing an additional lab atlas. This version includes the coronal diagrams delineating the entire brain as well as the introductory text from the Deluxe edition. It is an essential reference for anyone studying the mouse brain or related species. * Includes 100 detailed diagrams of the coronal set delineating the entire mouse brain * Compact edition of the most comprehensive and accurate mouse brain atlas available * Contains minor updates and revisions from the full edition

MRI Atlas of Human White Matter presents an atlas to the human brain on the basis of T 1-weighted imaging and diffusion tensor imaging. A general background on magnetic resonance imaging is provided, as well as the basics of diffusion tensor imaging. An overview of the principles and limitations in using this methodology in fiber tracking is included. This book describes the core white-matter structures, as well as the superficial white matter, the deep gray matter, and the cortex. It also presents a three-dimensional reconstruction and atlas of the brain white-matter tracts. The Montreal Neurological Institute coordinates, which are the most widely used, are adopted in this book as the primary coordinate system. The Talairach coordinate system is used as the secondary coordinate system. Based on magnetic resonance imaging and diffusion tensor imaging, the book offers a full segmentation of 220 white-matter and gray-matter structures with boundaries. Visualization of brain white matter anatomy via 3D diffusion tensor imaging (DTI) contrasts and enhances relationship of anatomy to function Full segmentation of 170+ brain regions more clearly defines structure boundaries than previous point-and-annotate anatomical labeling, and connectivity is mapped in a way not provided by traditional atlases

This book gathers papers presented at the Workshop on Computational Diffusion MRI, CDMRI 2020, held under the auspices of the International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), which took place virtually on October 8th, 2020, having originally been planned to take place in Lima, Peru. This book presents the latest developments in the highly active and rapidly growing field of diffusion MRI. While offering new perspectives on the most recent research challenges in the field, the selected articles also provide a valuable starting point for anyone interested in learning computational techniques for diffusion MRI. The book includes rigorous mathematical derivations, a large number of rich, full-colour visualizations, and clinically relevant results. As such, it is of interest to researchers and practitioners in the fields of computer science, MRI physics, and applied mathematics. The reader will find numerous contributions covering a broad range of topics, from the mathematical foundations of the diffusion process and signal generation to new computational methods and estimation techniques for the in-vivo recovery of microstructural and connectivity features, as well as diffusion-relaxometry and frontline applications in research and clinical practice.

This book is a practical guide on image-guided robotic (CyberKnife®) radiosurgery of the brain and the spine. The volume introduces the radiosurgical community to the potential of image-guidance in the treatment of neurosurgical diseases including neuro-oncological, vascular and functional disorders. Principles of image-guided radiosurgery, including physics and radiobiology are considered. Each chapter provides a critical review of the literature and analyses of several aspects to offer an assessment of single and hypofractionated treatments. Based on the authors experience, tables or summaries presenting the treatment approaches and associated risks are included as well. Providing a practical guide to define the selection of dose, fractionation schemes, isodose line, margins, imaging, constraints to the structures at risk will support safe practice of neuroradiosurgery. This book aims to shed new light on the treatment of neoplastic and non-neoplastic diseases of the central nervous system using the CyberKnife® image-guided robotic radiosurgery system. It will be adopted by neurosurgery residents and neurosurgery consultants as well as residents in radiation oncology and radiation oncologists; medical physicists involved in radiosurgery procedures may also benefit from this book.

An Atlas for the 21st Century The most precise, cutting-edge images of normal cerebral anatomy available today are the centerpiece of this spectacular atlas for clinicians, trainees, and students in the neurologically-based medical and non-medical specialties. Truly an "atlas for the 21st century," this comprehensive visual reference presents a

detailed overview of cerebral anatomy acquired through the use of multiple imaging modalities including advanced techniques that allow visualization of structures not possible with conventional MRI or CT. Beautiful color illustrations using 3-D modeling techniques based upon 3D MR volume data sets further enhances understanding of cerebral anatomy and spatial relationships. The anatomy in these color illustrations mirror the black and white anatomic MR images presented in this atlas. Written by two neuroradiologists and an anatomist who are also prominent educators, along with more than a dozen contributors, the atlas begins with a brief introduction to the development, organization, and function of the human brain. What follows is more than 1,000 meticulously presented and labelled images acquired with the full complement of standard and advanced modalities currently used to visualize the human brain and adjacent structures, including MRI, CT, diffusion tensor imaging (DTI) with tractography, functional MRI, CTA, CTV, MRA, MRV, conventional 2-D catheter angiography, 3-D rotational catheter angiography, MR spectroscopy, and ultrasound of the neonatal brain. The vast array of data that these modes of imaging provide offers a wider window into the brain and allows the reader a unique way to integrate the complex anatomy presented. Ultimately the improved understanding you can acquire using this atlas can enhance clinical understanding and have a positive impact on patient care. Additionally, various anatomic structures can be viewed from modality to modality and from multiple planes. This state-of-the-art atlas provides a single source reference, which allows the interested reader ease of use, cross-referencing, and the ability to visualize high-resolution images with detailed labeling. It will serve as an authoritative learning tool in the classroom, and as an invaluable practical resource at the workstation or in the office or clinic. Key Features: Provides detailed views of anatomic structures within and around the human brain utilizing over 1,000 high quality images across a broad range of imaging modalities Contains extensively labeled images of all regions of the brain and adjacent areas that can be compared and contrasted across modalities Includes specially created color illustrations using computer 3-D modeling techniques to aid in identifying structures and understanding relationships Goes beyond a typical brain atlas with detailed imaging of skull base, calvaria, facial skeleton, temporal bones, paranasal sinuses, and orbits Serves as an authoritative learning tool for students and trainees and practical reference for clinicians in multiple specialties

Part of the Neurosurgery by Example series, this volume on surgical neuro-oncology presents exemplary cases in which renowned authors guide readers through the assessment and planning, decision making, surgical procedure, after care, and complication management of common and uncommon disorders. The cases explore a number of different types of nervous systems tumors, including glioblastoma, medulloblastoma, skull tumors, and more. Each chapter also contains 'pivot points' that illuminate changes required to manage patients in alternate or atypical situations, and pearls for accurate diagnosis, successful treatment, and effective complication management. Containing a focused review of medical evidence and expected outcomes, Surgical Neuro-Oncology is appropriate for neurosurgeons who wish to learn more about this subspecialty, and those preparing for the American Board of Neurological Surgery oral examination.

Established as the leading textbook on imaging diagnosis of brain and spine disorders, Magnetic Resonance Imaging of the Brain and Spine is now in its Fourth Edition. This thoroughly updated two-volume reference delivers cutting-edge information on nearly every aspect of clinical neuroradiology. Expert neuroradiologists, innovative renowned MRI physicists, and experienced leading clinical neurospecialists from all over the world show how to generate state-of-the-art images and define diagnoses from crucial clinical/pathologic MR imaging correlations for neurologic, neurosurgical, and psychiatric diseases spanning fetal CNS anomalies to disorders of the aging brain. Highlights of this edition include over 6,800 images of remarkable quality, more color images, and new information using advanced techniques, including perfusion and diffusion MRI and functional MRI. A companion Website will offer the fully searchable text and an image bank.

Comprehensive resource features state-of-the-art brain mapping techniques and pearls from international recognized neurosurgeons Alfredo Quinones-Hinojosa and Kaisorn Chaichana and coeditor Deependra Mahato Despite advances in imaging techniques to identify eloquent cortical brain regions and subcortical white matter, brain mapping is the only method for obtaining real-time information with high sensitivity and specificity. This groundbreaking technology greatly enhances the neurosurgeon's ability to safely resect challenging lesions located in eloquent areas of the brain. Brain Mapping: Indications and Techniques by esteemed neurosurgeons Alfredo Quinones-Hinojosa, Kaisorn Chaichana, and Deependra Mahato, is a comprehensive overview of the most critical aspects of brain mapping from leaders in the field. The book starts with discussion of preoperative aspects, including the history of brain mapping and anatomy of eloquent cortical and eloquent white matter tracts. Subsequent chapters cover perioperative aspects of brain mapping including indirect and direct functional mapping, the role of neurophysiology, awake craniotomy operating room set-up and surgical instruments, and anesthetic considerations. Diverse awake and asleep brain mapping techniques are described for various intracranial pathologies, as well as advances in postoperative recovery of neurological function including physical and speech therapy. Key Features Dedicated chapters focused on essential sensory functions cover speech mapping, asleep motor mapping, awake subcortical language mapping, and visual cortex and visual tract mapping Disease- and region-specific techniques that encompass extra-operative brain mapping for epilepsy, surgery mapping for insular tumors, seizure mapping, and brainstem and spinal cord mapping Clinical pearls on postoperative issues such as rehabilitation, emergence of DBS-evoked functional connectomics, brain neuroplasticity, and radiating eloquent areas High-quality illustrations and videos enhance understanding of brain regions targeted in different mapping techniques This is the most comprehensive resource available to date on brain mapping and surgery in eloquent regions. As such, it is a must-have for neurosurgical residents, fellows, practicing neurosurgeons, and allied healthcare practitioners who treat patients with brain conditions.

This book provides a concise overview of emerging technologies in the field of modern neuroimaging. Fundamental principles of the main imaging modalities are described as

well as advanced imaging techniques including diffusion weighted imaging, perfusion imaging, arterial spin labeling, diffusion tensor imaging, intravoxel incoherent motion, MR spectroscopy, functional MRI, and artificial intelligence. The physical concepts underlying each imaging technique are carefully and clearly explained in a way suited to a medical audience without prior technical knowledge. In addition, the clinical applications of the various techniques are described with the aid of illustrative clinical examples. Helpful background information is also presented on the core principles of MRI and the evolution of neuroimaging, and important references to current medical research are highlighted. The book will meet the needs of a range of non-technological professionals with an interest in advanced neuroimaging, including radiology researchers and clinicians in the fields of neurology, neurosurgery, and psychiatry.

This tutorial reference serves as a coherent overview of various statistical and mathematical approaches used in brain network analysis, where modeling the complex structures and functions of the human brain often poses many unique computational and statistical challenges. This book fills a gap as a textbook for graduate students while simultaneously articulating important and technically challenging topics. Whereas most available books are graph theory-centric, this text introduces techniques arising from graph theory and expands to include other different models in its discussion on network science, regression, and algebraic topology. Links are included to the sample data and codes used in generating the book's results and figures, helping to empower methodological understanding in a manner immediately usable to both researchers and students. MRI has emerged as a powerful way of studying in-vivo brain structure and function in both healthy and disease states. Whilst new researchers may be able to call upon advice and support for acquisition from operators, radiologists and technicians, it is more challenging to obtain an understanding of the principles of analysing neuroimaging data. This is crucial for choosing acquisition parameters, designing and performing appropriate experiments, and correctly interpreting the results. This primer gives a general and accessible introduction to the wide array of MRI-based neuroimaging methods that are used in research. Supplemented with online datasets and examples to enable the reader to obtain hands-on experience working with real data, it provides a practical and approachable introduction for those new to the neuroimaging field. The text also covers the fundamentals of what different MRI modalities measure, what artifacts commonly occur, the essentials of the analysis, and common "pipelines" including brain extraction, registration and segmentation. As it does not require any background knowledge beyond high-school mathematics and physics, this primer is essential reading for anyone wanting to work in neuroimaging or grasp the results coming from this rapidly expanding field. The Oxford Neuroimaging Primers are short texts aimed at new researchers or advanced undergraduates from the biological, medical or physical sciences. They are intended to provide a broad understanding of the ways in which neuroimaging data can be analyzed and how that relates to acquisition and interpretation. Each primer has been written so that it is a stand-alone introduction to a particular area of neuroimaging, and the primers also work together to provide a comprehensive foundation for this increasingly influential field.

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