Accelerating Cone Beam Reconstruction Using The Cuda

Nano-bioimaging is a real-time observation method for the study of biological processes in subcellular structures and entire cells. This technique aims to interfere as little as possible with life processes using nanoscale materials and probes. In this method, nanoscale photon source is often used for imaging, and 3D structure of the observed specimen is studied in detail without physical interference. Over the last decade, further boost in bioimaging has led to increase the nano-bioimaging impact that includes many improvements in the data analysis method, image processing, and molecular imaging technology. However, to increase the usage of nano-bioimaging, several developments in the field of diagnosis accuracy, photobleaching prevention, and controlling of the fluorescence resonance energy transfer (FRET) must be achieved. The purpose of this book is to provide a perspective on the current status of nano-bioimaging technologies.

This revised and updated second edition - now with two new chapters - is the only book to give a comprehensive overview of computer algorithms for image reconstruction. It covers the fundamentals of computerized tomography, including all the computational and mathematical procedures underlying data collection, image reconstruction and image display. Among the new topics covered are: spiral CT, fully 3D positron emission tomography, the linogram mode of backprojection, and state of the art 3D imaging results. It also includes two new chapters on comparative statistical evaluation of the 2D reconstruction algorithms and alternative approaches to image reconstruction.

High Performance Computing - HiPC 200815th International Conference, Bangalore, India, December 17-20, 2008, ProceedingsSpringer Science & Business Media

This volume contains the papers presented at the 14th International Conference on Information Processing in Medical Imaging. IPMI meetings have a a strong emphasis on the clinical relevance and validation of medical imaging. This book covers the whole spectrum: acquisition, tomographic reconstruction, registration, segmentation, knowledge-based analysis, display and image quality as well as several important applications. Several papers present significant advances in topics already discussed at previous meetings while others deal with new topics and methodology, opening new horizons in medical imaging. In addition to the 28 full-length papers, 30 short communications are included to sample the most current work in progress. Audience: An up-to-date and complete overview of ongoing research in medical imaging, beneficial to all physicists, computer scientists and physicians who wish to remain informed on state-of-the-art methodology in medical imaging.

5th International Symposium, ISVC 2009, Las Vegas, NV, USA, November 30 - December 2, 2009, Proceedings Volume 2

18th International Conference, Munich, Germany, October 5-9, 2015, Proceedings, Part II

High Performance Computing - HiPC 2008

Compressed Sensing for Magnetic Resonance Image Reconstruction

Technology and Applications

This book constitutes the joint refereed proceedings of five international workshops held in association with the Third International Conference on Grid and Cooperative Computing, GCC 2004, in Wuhan, China in October 2004. The 95 revised workshop papers presented were carefully reviewed and selected from a total of 154 submissions. In accordance with the workshop titles, the papers are organized in topical sections on the information grid and knowledge grid; storage grid and technologies; information security and survivability for the grid; agents, autonomic computing, and grid enabled virtual organization; and visualization and visual steering.

Use the GPU Successfully in Your Radiotherapy Practice With its high processing power, cost-effectiveness, and easy deployment, access, and maintenance, the graphics processing unit (GPU) has increasingly been used to tackle problems in the medical physics field, ranging from computed tomography reconstruction to Monte Carlo radiation transport simulation. Graphics Processing Unit-Based High Performance Computing in Radiation Therapy collects state-of-the-art research on GPU computing and its applications to medical physics problems in radiation therapy. Tackle Problems in Medical Imaging and Radiotherapy The book first offers an introduction to the GPU technology and its current applications in radiotherapy. Most of the remaining chapters discuss a specific application of a GPU in a key radiotherapy problem. These chapters summarize advances and present technical details and insightful discussions on the use of GPU in addressing the problems. The book also examines two real systems developed with GPU as a core component to accomplish important clinical tasks in modern radiotherapy. Translate Research Developments to Clinical Practice Written by a team of international experts in radiation oncology, biomedical imaging, computing, and physics, this book gets clinical and research physicists, graduate students, and other scientists up to date on the latest in GPU computing for radiotherapy. It encourages you to bring this novel technology to routine clinical radiotherapy practice.

This is the first monograph to focus exclusively on coronary radiology. It is particularly timely, given that the emergence of computed tomography and magnetic resonance imaging, coupled with improvements in both hard- and software, has made reproducible non-invasive coronary imaging a practical reality. A wide range of topics is addressed, including: quantitative angiography, intravascular and quantitative ultrasound, multislice and electron beam computed tomography, magnetic resonance coronary angiography and use of the coronary calcium score as an independent risk factor. All of the latest developments, such as non-invasive intracoronary thrombus imaging, are covered. Particular care has been taken to consider the common questions confronted in asymptomatic patients. The text is supported by high-quality color images of the coronary and cardiac anatomy.

This four-volume handbook gives a state-of-the-art overview of porous materials, from synthesis and characterization and simulation all the way to manufacturing and industrial applications. The editors, coming from academia and industry, are known for their didactic skills as well as their technical expertise. Coordinating the efforts of 37 expert authors in 14 chapters, they construct the story of porous carbons, ceramics, zeolites and polymers from varied viewpoints: surface and colloidal science, materials science, chemical engineering, and energy engineering. Volumes 1 and 2 cover the fundamentals of preparation, characterisation, and simulation of porous materials. Working from the fundamentals all the way to the practicalities of industrial production processes, the subjects include hierarchical materials, in situ and operando characterisation using NMR, X-Ray scattering and tomography, state-of-the-art molecular simulations of adsorption and diffusion in crystalline nanoporous materials, as well as the emerging areas of bio-artificing and drug

delivery. Volume 3 focuses on porous materials in industrial separation applications, including adsorption separation, membrane separation, and osmotic distillation. Finally, and highly relevant to tomorrow's energy challenges, Volume 4 explains the energy engineering aspects of applying porous materials in supercapacitors, fuel cells, batteries, electrolysers and sub-surface energy applications.The text contains many high-quality colourful illustrations and examples, as well as thousands of up-to-date references to peer-reviewed articles, reports and websites for further reading. This comprehensive and well-written handbook is a must-have reference for universities, research groups and companies working with porous materials.Related Link(s)

Comparison of Hardware Acceleration Techniques for Cone Beam Reconstruction

Recent Advances in Computer Science and Information Engineering

Image Processing in Radiation Therapy

Molecular Imaging

Medical Image Reconstruction

Parallel Computational Technologies

Biomedical Diagnostics and Clinical Technologies: Applying High-Performance Cluster and Grid Computing disseminates knowledge regarding high performance computing for medical applications and bioinformatics. This critical reference source contains a valuable collection of cutting-edge research chapters for those working in the broad field of medical informatics and bioinformatics.

The three-volume set LNCS 9349, 9350, and 9351 constitutes the refereed proceedings of the 18th International Conference on Medical Image Computing and Computer-Assisted Intervention, MICCAI 2015, held in Munich, Germany, in October 2015. Based on rigorous peer reviews, the program committee carefully selected 263 revised papers from 810 submissions for presentation in three volumes. The papers have been organized in the following topical sections: quantitative image analysis I: segmentation and measurement; computer-aided diagnosis: machine learning; computer-aided diagnosis: automation; quantitative image analysis II: classification, detection, features, and morphology; advanced MRI: diffusion, fMRI, DCE; quantitative image analysis III: motion, deformation, development and degeneration; quantitative image analysis IV: microscopy, fluorescence and histological imagery; registration: method and advanced applications; reconstruction, image formation, advanced acquisition - computational imaging; modelling and simulation for diagnosis and interventional planning; computer-assisted and image-guided interventions.

"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.

Containing chapter contributions from over 130 experts, this unique publication is the first handbook dedicated to the physics and technology of X-ray imaging, offering extensive coverage of the field. This highly comprehensive work is edited by one of the world’s leading experts in X-ray imaging physics and technology and has been created with guidance from a Scientific Board containing respected and renowned scientists from around the world. The book's scope includes 2D and 3D X-ray imaging techniques from soft-X-ray to megavoltage energies, including computed tomography, fluoroscopy, dental imaging and small animal imaging, with several chapters dedicated to breast imaging techniques. 2D and 3D industrial imaging is incorporated, including imaging of artworks. Specific attention is dedicated to techniques of phase contrast X-ray imaging. The approach undertaken is one that illustrates the theory as well as the techniques and the devices routinely used in the various fields. Computational aspects are fully covered, including 3D reconstruction algorithms, hard/software phantoms, and computer-aided diagnosis. Theories of image quality are fully illustrated. Historical, radioprotection, radiation dosimetry, quality assurance and educational aspects are also covered. This handbook will be suitable for a very broad audience, including graduate students in medical physics and biomedical engineering; medical physics residents; radiographers; physicists and engineers in the field of imaging and non-destructive industrial testing using X-rays; and scientists interested in understanding and using X-ray imaging techniques. The handbook's editor, Dr. Paolo Russo, has over 30 years’ experience in the academic teaching of medical physics and X-ray imaging research. He has authored several book chapters in the field of X-ray imaging, is Editor-in-Chief of an international scientific journal in medical physics, and has responsibilities in the publication committees of international scientific organizations in medical physics. Features: Comprehensive coverage of the use of X-rays both in medical radiology and industrial testing The first handbook published to be dedicated to the physics and technology of X-rays Handbook edited by world authority, with contributions from experts in each field

CUDA Accelerated Cone-beam Reconstruction

Applying High-Performance Cluster and Grid Computing

State of the Art in Nano-bioimaging

Handbook Of Porous Materials: Synthesis, Properties, Modeling And Key Applications (In 4 Volumes)

Cone Beam Computed Tomography

Image Reconstruction from Projections

The first book of its kind to highlight the unique capabilities of laser-driven acceleration and its diverse potential, Applications of Laser-Driven Particle Acceleration presents the basic understanding of acceleration concepts and envisioned prospects for selected applications. As the main focus, this new book explores exciting and diverse application possibilities, with emphasis on those uniquely enabled by the laser driver that can also be meaningful and realistic for potential users. It also emphasises distinction, in the accelerator context, between laser-driven accelerated particle sources and the integrated laser-driven particle accelerator system (all-optical and hybrid versions). A key aim of the book is to inform multiple, interdisciplinary research communities of the new possibilities available and to inspire them to engage with laser-driven acceleration, further motivating and advancing this developing field. Material is presented in a thorough yet accessible manner, making it a valuable reference text for general scientific and engineering researchers who are not necessarily subject matter experts. Applications of Laser-Driven Particle Acceleration is edited by Professors Paul R. Bolton, Katia Parodi, and Jörg Schreiber from the Department of Medical Physics at the Ludwig-Maximilians-Universität München in München, Germany. Features: Reviews the current understanding and state-of-the-art capabilities of laser-driven particle acceleration and associated energetic photon and neutron generation Presents the intrinsically unique features of laser-driven acceleration and particle bunch yields Edited by internationally renowned researchers, with chapter contributions from global experts

Similar to the way in which computer vision and computer graphics act as the dual fields that connect image processing in modern computer science, the field of image processing can be considered a crucial middle road between the vision and graphics fields. Research Developments in Computer Vision and Image Processing: Methodologies and Applications brings together various research methodologies and trends in emerging areas of application of computer vision and image processing. This book is useful for students, researchers, scientists, and engineers interested in the research developments of this rapidly growing field.

Conventional computed tomography (CT) techniques employ a narrow array of x-ray detectors and a fan-shaped x-ray beam to rotate around the patient to produce images of thin sections of the patient. Large sections of the body are covered by moving the patient into the rotating x-ray detector and x-ray source gantry. Cone beam CT is an alternative technique using a large area detector and cone-shaped x-ray beam to produce 3D images of a thick section of the body with one full angle (360 degree or 180 degree plus detector coverage) rotation. It finds applications in situations where bulky, conventional CT systems would interfere with clinical procedures or cannot be integrated with the primary treatments or imaging systems. Cone Beam Computed Tomography explores the past, present, and future state of medical x-ray imaging while explaining how cone beam CT, with its superior spatial resolution and compact configuration, is used in clinical applications and animal research. The book: Supplies a detailed introduction to cone beam CT, covering basic principles and applications as well as advanced techniques Explores state-of-the-art research and future developments while examining the fundamental limitations of the technology Addresses issues related to implementation and system characteristics, including image quality, artifacts, radiation dose, and perception Reviews the historical development of medical x-ray imaging, from conventional CT techniques to volumetric 3D imaging Discusses the major components of cone beam CT: image acquisition, reconstruction, processing, and display A reference work for scientists, engineers, students, and imaging professionals, Cone Beam Computed Tomography provides a solid understanding of the theory and implementation of this revolutionary technology.

The field of molecular imaging of living subjects have evolved considerably and have seen spectacular advances in chemistry, engineering and biomedical applications. This textbook was designed to fill the need for an authoritative source for this multi-disciplinary field. We have been fortunate to recruit over 80 leading authors contributing 75 individual chapters. Given the multidisciplinary nature of the field, the book is broken into six different sections: "Molecular Imaging technologies", "Chemistry", "Molecular Imaging in Cell and Molecular Biology", "Applications of Molecular Imaging", "Molecular Imaging in Drug Evaluation" with the final section comprised of chapters on computation, bioinformatics and modeling. The organization of this large amount of information is logical and strives to avoid redundancies among chapters. It encourages the use of figures to illustrate concepts and to provide numerous molecular imaging examples.

Research Developments in Computer Vision and Image Processing: Methodologies and Applications
Semiconductor Radiation Detectors
Applications of Laser-Driven Particle Acceleration
Grid and Cooperative Computing - GCC 2004
Basic Science of PET Imaging
Applications in Medical Sciences

This book contains a selection of communications presented at the Third International Meeting on Fully Three-Dimensional Image Reconstruction in Radiology and Nuclear Medicine, held 4-6 July 1995 at Domaine d' Aix-Marlioz, Aix-les-Bains, France. This nice resort provided an inspiring environment to hold discussions and presentations on new and developing issues. Roentgen discovered X-ray radiation in 1895 and Becquerel found natural radioactivity in 1896 : a hundred years later, this conference was focused on the applications of such radiations to explore the human body. If the physics is now fully understood, 3D imaging techniques based on ionising radiations are still progressing. These techniques include 3D Radiology, 3D X-ray Computed Tomography (3D-CT), Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET). Radiology is dedicated to morphological imaging, using transmitted radiations from an external X-ray source, and nuclear medicine to functional imaging, using radiations emitted from an internal radioactive tracer. In both cases, new 3D tomographic systems will tend to use 2D detectors in order to improve the radiation detection efficiency. Taking a set of 2D acquisitions around the patient, 3D acquisitions are obtained. Then, fully 3D image reconstruction algorithms are required to recover the 3D image of the body from these projection measurements.

Since the publication of the best-selling, highly acclaimed first edition, the technology and clinical applications of medical imaging have changed significantly. Gathering these developments into one volume, Webb's Physics of Medical Imaging, Second Edition presents a thorough update of the basic physics, modern technology and many examples of clinical application across all the modalities of medical imaging. New to the Second Edition Extensive updates to all original chapters Coverage of state-of-the-art detector technology and computer processing used in medical imaging 11 new contributors in addition to the original team of authors Two new chapters on medical image processing and multimodality imaging More than 50 percent new examples and over 80 percent new figures Glossary of abbreviations, color insert and contents lists at the beginning of each chapter Keeping the material accessible to graduate students, this well-illustrated book reviews the basic physics underpinning imaging in medicine. It covers the major techniques of x-radiology, computerised tomography, nuclear medicine, ultrasound and magnetic resonance imaging, in addition to infrared, electrical impedance and optical imaging. The text also describes the mathematics of medical imaging, image processing, image perception, computational requirements and multimodality imaging.

X-ray examination techniques based on cone beam geometry are gaining more and more importance in clinical and pre-clinical use. These techniques include cone-beam computed tomography, rotation angiography, digital volume tomography,micro-CT, and others. The reconstruction of axial slices from stacks of individual projections remains a challenge since it is computationally very expensive. There is a number of reconstruction algorithms described, the most popular one is the so-called Feldkamp-Davis-Kress (FDK) algorithm.The aim of this thesis is to show if the usage of GPU power will improve the different hardware based parameters such as speed and memory consumption between MATLAB scripts and C++ codes. By doing this the efficiency of different hardware acceleration techniques is being compared. As examples rotation angiography and micro-CT data sets will be used.**X-ray examination techniques based on cone***

beam geometry are gaining more and more importance in clinical and pre-clinical use. These techniques include cone-beam computed tomography, rotation angiography, digital volume tomography,micro-CT, and others. The reconstruction of axial slices from stacks of individual projections remains a challenge since it is computationally very expensive. There is a number of reconstruction algorithms described, the most popular one is the so-called Feldkamp-Davis-Kress (FDK) algorithm.The aim of this thesis is to show if the usage of GPU power will improve the different hardware based parameters such as speed and memory consumption between MATLAB scripts and C++ codes. By doing this the efficiency of different hardware acceleration techniques is being compared. As examples rotation angiography and micro-CT data sets will be used.

The congress's unique structure represents the two dimensions of technology and medicine: 13 themes on science and medical technologies intersect with five challenging main topics of medicine to create a maximum of synergy and integration of aspects on research, development and application. Each of the congress themes was chaired by two leading experts. The themes address specific topics of medicine and technology that provide multiple and excellent opportunities for exchanges.

Methodologies and Applications

Cardiovascular and Neurovascular Imaging

Graphics Processing Unit-Based High Performance Computing in Radiation Therapy

Quantitative Analysis in Nuclear Medicine Imaging

Information Processing in Medical Imaging

Advances in Visual Computing

This book constitutes refereed proceedings of the 14th International Conference on Parallel Computational Technologies, PCT 2020, held in May 2020. Due to the COVID-19 pandemic the conference was held online. The 22 revised full papers and 2 short papers presented were carefully reviewed and selected from 124 submissions. The papers are organized in topical sections on high performance architectures, tools and technologies; parallel numerical algorithms; supercomputer simulation.

This book presents the proceedings of the IUPESM World Biomedical Engineering and Medical Physics, a tri-annual high-level policy meeting dedicated exclusively to furthering the role of biomedical engineering and medical physics in medicine. The book offers papers about emerging issues related to the development and sustainability of the role and impact of medical physicists and biomedical engineers in medicine and healthcare. It provides a unique and important forum to secure a coordinated, multileveled global response to the need, demand and importance of creating and supporting strong academic and clinical teams of biomedical engineers and medical physicists for the benefit of human health.

- Summarizes the state of the art in the most relevant areas of medical physics and engineering applied to radiation oncology - Covers all relevant areas of the subject in detail, including 3D imaging and image processing, 3D treatment planning, modern treatment techniques, patient positioning, and aspects of verification and quality assurance - Conveys information in a readily understandable way that will appeal to professionals and students with a medical background as well as to newcomers to radiation oncology from the field of physics

Expecting the reader to have some basic training in liner algebra and optimization, the book begins with a general discussion on CS techniques and algorithms. It moves on to discussing single channel static MRI, the most common modality in clinical studies. It then takes up multi-channel MRI and the interesting challenges consequently thrown up in signal reconstruction. Off-line and on-line techniques in dynamic MRI reconstruction are visited. Towards the end the book broadens the subject by discussing how CS is being applied to other areas of biomedical signal processing like X-ray, CT and EEG acquisition. The emphasis throughout is on qualitative understanding of the subject rather than on quantitative aspects of mathematical forms. The book is intended for MRI engineers interested in the brass tacks of image formation; medical physicists interested in advanced techniques in image reconstruction; and mathematicians or signal processing engineers.

A Conceptual Tutorial

Fundamentals of Computerized Tomography

15th International Conference, Bangalore, India, December 17-20, 2008, Proceedings

Inherently Parallel Algorithms in Feasibility and Optimization and their Applications

Physics and Technology

Evaluation of State-of-the-Art Hardware Architectures for Fast Cone-Beam CT Reconstruction

GPU Computing Gems Emerald Edition offers practical techniques in parallel computing using graphics processing units (GPUs) to enhance scientific research. The first volume in Morgan Kaufmann's Applications of GPU Computing Series, this book offers the latest insights and research in computer vision, electronic design automation, and emerging data-intensive applications. It also covers life sciences, medical imaging, ray tracing and rendering, scientific simulation, signal and audio processing, statistical modeling, video and image processing. This book is intended to help those who are facing the challenge of programming systems to effectively use GPUs to achieve efficiency and performance goals. It offers developers a window into diverse application areas, and the opportunity to gain insights from others' algorithm work that they may apply to their own projects. Readers will learn from the leading researchers in parallel programming, who have gathered their solutions and experience in one volume under the guidance of expert area editors. Each chapter is written to be accessible to researchers from other domains, allowing knowledge to cross-pollinate across the GPU spectrum. Many examples leverage NVIDIA's CUDA parallel computing architecture, the most widely-adopted massively parallel programming solution. The insights and ideas as well as practical hands-on skills in the book can be immediately put to use. Computer programmers, software engineers, hardware engineers, and computer science students will find this volume a helpful resource. For useful source codes discussed throughout the book, the editors invite readers to the following website: ..." Covers the breadth of industry from scientific simulation and electronic design automation to audio / video processing, medical imaging, computer vision, and more Many examples leverage NVIDIA's CUDA parallel computing architecture, the most widely-adopted massively parallel programming solution Offers insights and ideas as well as practical "hands-on" skills you can immediately put to use

The Haifa 2000 Workshop on "Inherently Parallel Algorithms for Feasibility and Optimization and their Applications" brought together top scientists in this area. The objective of the Workshop was to discuss, analyze and compare the latest developments in this fast growing field of applied mathematics and to identify topics of research which are of special interest for industrial applications and for further theoretical study. Inherently parallel algorithms, that is, computational methods which are, by their mathematical nature,

parallel, have been studied in various contexts for more than fifty years. However, it was only during the last decade that they have mostly proved their practical usefulness because new generations of computers made their implementation possible in order to solve complex feasibility and optimization problems involving huge amounts of data via parallel processing. These led to an accumulation of computational experience and theoretical information and opened new and challenging questions concerning the behavior of inherently parallel algorithms for feasibility and optimization, their convergence in new environments and in circumstances in which they were not considered before their stability and reliability. Several research groups all over the world focused on these questions and it was the general feeling among scientists involved in this effort that the time has come to survey the latest progress and convey a perspective for further development and concerted scientific investigations. Thus, the editors of this volume, with the support of the Israeli Academy for Sciences and Humanities, took the initiative of organizing a Workshop intended to bring together the leading scientists in the field. The current volume is the Proceedings of the Workshop representing the discussions, debates and communications that took place. Having all that information collected in a single book will provide mathematicians and engineers interested in the theoretical and practical aspects of the inherently parallel algorithms for feasibility and optimization with a tool for determining when, where and which algorithms in this class are fit for solving specific problems, how reliable they are, how they behave and how efficient they were in previous applications. Such a tool will allow software creators to choose ways of better implementing these methods by learning from existing experience.

This volume presents the 5th European Conference of the International Federation for Medical and Biological Engineering (EMBEC), held in Budapest, 14-18 September, 2011. The scientific discussion on the conference and in this conference proceedings include the following issues: - Signal & Image Processing - ICT - Clinical Engineering and Applications - Biomechanics and Fluid Biomechanics - Biomaterials and Tissue Repair - Innovations and Nanotechnology - Modeling and Simulation - Education and Professional

Images from CT, MRI, PET, and other medical instrumentation have become central to the radiotherapy process in the past two decades, thus requiring medical physicists, clinicians, dosimetrists, radiation therapists, and trainees to integrate and segment these images efficiently and accurately in a clinical environment. Image Processing in Radiation Therapy presents an up-to-date, detailed treatment of techniques and algorithms for the registration, segmentation, reconstruction, and evaluation of imaging data. It describes how these tools are used in radiation planning, treatment delivery, and outcomes assessment. The book spans deformable registration, segmentation, and image reconstruction and shows how to incorporate these practices in radiation therapy. The first section explores image processing in adaptive radiotherapy, online monitoring and tracking, dose accumulation, and accuracy assessment. The second section describes the mathematical approach to deformable registration. The book presents similarity metrics used for registration techniques, discussing their effectiveness and applicability in radiation therapy. It also evaluates parametric and nonparametric image registration techniques and their applications in radiation therapy processes. The third section assesses the efficiency, robustness, and breadth of application of image segmentation approaches, including atlas-based, level set, and registration-based techniques. The fourth section focuses on advanced imaging techniques for radiotherapy, such as 3D image reconstruction and image registration using a graphics processor unit. With contributions from an international group of renowned authors, this book provides a comprehensive description of image segmentation and registration, in-room imaging, and advanced reconstruction techniques. Through many practical examples, it illustrates the clinical rationale and implementation of the techniques.

Principles and Practice

International Conferences, SIP 2011, Held as Part of the Future Generation Information Technology Conference, FGIT 2011, in Conjunction with GDC 2011, Jeju Island, Korea, December 8-10, 2011. Proceedings

Webb's Physics of Medical Imaging, Second Edition

Proceedings of the First International Workshop on New Frontiers in High-performance and Hardware-aware Computing (HipHaC '08), Lake Como, Italy, November 2008 (in Conjunction with MICRO-41)

Coronary Radiology

New Technologies in Radiation Oncology

This book offers a wide-ranging and up-to-date overview of the basic science underlying PET and its preclinical and clinical applications in modern medicine. In addition, it provides the reader with a sound understanding of the scientific principles and use of PET in routine practice and biomedical imaging research. The opening sections address the fundamental physics, radiation safety, CT scanning dosimetry, and dosimetry of PET radiotracers, chemistry and regulation of PET radiopharmaceuticals, with information on labeling strategies, tracer quality control, and regulation of radiopharmaceutical production in Europe and the United States. PET physics and instrumentation are then discussed, covering the basic principles of PET and PET scanning systems, hybrid PET/CT and PET/MR imaging, system calibration, acceptance testing, and quality control. Subsequent sections focus on image reconstruction, processing, and quantitation in PET and hybrid PET and on imaging artifacts and correction techniques, with particular attention to partial volume correction and motion artifacts. The book closes by examining clinical applications of PET and hybrid PET and their physiological and/or molecular basis in conjunction with technical foundations in the disciplines of oncology, cardiology and neurology, PET in pediatric malignancy and its role in radiotherapy treatment planning. Basic Science of PET Imaging will meet the needs of nuclear medicine practitioners, other radiology specialists, and trainees in these fields.

at the distributed virtual Program Committee meeting. Each paper's review recomm- dationswere carefully checkedfor consistency; in many instances, the Vice Chairs read the papers themselves when the reviews did not seem suf?cient to make a decision. Throughout the reviewing process, I received a tremendous amount of help and advice from General Co-chair Manish Parashar, Steering Chair Viktor Prasanna, and last year's Program Chair Srinivas Aluru; I am very grateful to them. My thanks also go to the Publications Chair Sushil Prasad for his outstanding efforts in putting the proceedings together. Finally, I thank all the authors for their contributions to a hi- quality technical program. I wish all the attendees a very enjoyable and informative meeting. December 2008 P. Sadayappan Message from the General Co-chairs and the Vice General Co-chairs On behalf of the organizers of the 15th International Conference on High-Performance Computing(HiPC), it is our

pleasureto present these proceedingsand we hopeyou will ?nd them exciting and rewarding. TheHiPCcallforpapers,onceagain,receivedanoverwhelmingresponse,attracting 317submissionsfrom27countries.P.Sadayappan,theProgramChair,andthe Program Committee worked with remarkablededication to put together an outstandingtechnical program consisting of the 46 papers that appear in these proceedings.

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

CSIE 2011 is an international scientific Congress for distinguished scholars engaged in scientific, engineering and technological research, dedicated to build a platform for exploring and discussing the future of Computer Science and Information Engineering with existing and potential application scenarios. The congress has been held twice, in Los Angeles, USA for the first and in Changchun, China for the second time, each of which attracted a large number of researchers from all over the world. The congress turns out to develop a spirit of cooperation that leads to new friendship for addressing a wide variety of ongoing problems in this vibrant area of technology and fostering more collaboration over the world. The congress, CSIE 2011, received 2483 full paper and abstract submissions from 27 countries and regions over the world. Through a rigorous peer review process, all submissions were refereed based on their quality of content, level of innovation, significance, originality and legibility. 688 papers have been accepted for the international congress proceedings ultimately.

Nuclear Science Symposium, Medical Imaging Conference : 16-22 October 2004, Rome, Italy

Biomedical Diagnostics and Clinical Technologies: Applying High-Performance Cluster and Grid Computing

Medical Image Computing and Computer-Assisted Intervention -- MICCAI 2015

World Congress on Medical Physics and Biomedical Engineering May 26-31, 2012, Beijing, China

High Performance and Hardware Aware Computing

14th International Conference, PCT 2020, Perm, Russia, May 27–29, 2020, Revised Selected Papers

Holger Scherl introduces the reader to the reconstruction problem in computed tomography and its major scientific challenges that range from computational efficiency to the fulfillment of Tuy's sufficiency condition. The assessed hardware architectures include multi- and many-core systems, cell broadband engine architecture, graphics processing units, and field programmable gate arrays.

This book provides a review of image analysis techniques as they are applied in the field of diagnostic and therapeutic nuclear medicine.

Driven in part by the remarkable sophistication of nuclear medicine instrumentation and - crease in computing power and its ready and inexpensive availability, this is a relatively new yet rapidly expanding field. Likewise, although the use of nuclear imaging for diagnosis and therapy has origins dating back almost to the pioneering work of Dr G. de Hevesy, quantitative imaging has only recently emerged as a promising approach for diagnosis and therapy of many diseases. An effort has, therefore, been made to place the reviews provided in this book in a broader context. The effort to do this is reflected by the inclusion of introductory chapters that address basic principles of nuclear medicine instrumentation and dual-modality imaging, followed by overview of issues that are closely related to quantitative nuclear imaging and its potential role in diagnostic and therapeutic applications. A brief overview of each chapter is provided below. Chapter 1 presents a general overview of nuclear medicine imaging physics and instrumentation including planar scintigraphy, single-photon emission computed tomography (SPECT) and positron emission tomography (PET). Nowadays, patients' diagnosis and therapy is rarely done without the use of imaging technology. As such, imaging considerations are incorporated in almost every chapter of the book. The development of dual-modality - aging systems is an emerging research field, which is addressed in chapter 2.

This book comprises selected papers of the International Conference on Signal Processing, Image Processing and Pattern Recognition, SIP 2011, held as Part of the Future Generation Information Technology Conference, FGIT 2011, in Conjunction with GDC 2011, in Conjunction with GDC 2011, Jeju Island, Korea, in December 2011. The papers presented were carefully reviewed and selected from numerous submissions and focus on the various aspects of signal processing, image processing and pattern recognition.

The aim of this book is to educate the reader on radiation detectors, from sensor to read-out electronics to application. Relatively new detector materials, such as CdZTe and Cr compensated GaAs, are introduced, along with emerging applications of radiation detectors. This X-ray technology has practical applications in medical, industrial, and security applications. It identifies materials based on their molecular composition, not densities as the traditional transmission equipment does. With chapters written by an international selection of authors from both academia and industry, the book covers a wide range of topics on radiation detectors, which will satisfy the needs of both beginners and experts in the field.

Signal Processing, Image Processing and Pattern Recognition

GPU Computing Gems Emerald Edition

World Congress on Medical Physics and Biomedical Engineering, June 7-12, 2015, Toronto, Canada

Third International Conference, Wuhan, China, October 21-24, 2004. Proceedings

2004 IEEE Nuclear Science Symposium Conference Record

Cardiovascular and Neurovascular Imaging: Physics and Technology explains the underlying physical and technical principles behind a range of cardiovascular and neurovascular imaging modalities, including radiography, nuclear medicine, ultrasound, and magnetic resonance imaging (MRI). Examining this interdisciplinary branch of medical imaging from a

"Cone-Beam Computed Tomography (CBCT) is an imaging method that reconstructs a 3D representation of the object from its 2D X-ray images. It is an important diagnostic tool in the medical field, especially dentistry. However, most 3D reconstruction algorithms are computationally intensive and time consuming; this limitation constrains the use of CBCT. In recent years, high-end graphics cards, such as the ones powered by NVIDIA graphics processing units (GPUs), are able to perform general purpose computation. Due to the highly parallel nature of the 3D reconstruction algorithms, it is possible to implement these algorithms on the GPU to reduce the processing time to the level that is practical. Two of the most popular 3D Cone-Beam reconstruction algorithms are the Feldkamp-Davis-Kress algorithm (FDK) and the Algebraic Reconstruction Technique (ART). FDK is fast to construct 3D images, but the quality of its images is lower than the quality of ART images. However, ART requires significantly more computation. Material ART is a recently developed algorithm that uses beam-hardening correction to eliminate artifacts. In this thesis, these three algorithms were implemented on the NVIDIA's CUDA platform. These CUDA based algorithms were tested on three different graphics cards, using phantom and real data. The test results show significant speedup when compared to the CPU software implementation. The speedup is sufficient to allow a moderate cost personal computer with NVIDIA graphics card to process CBCT images in real-time."--Abstract.

The two volume set LNCS 5875 and LNCS 5876 constitutes the refereed proceedings of the 5th International Symposium on Visual Computing, ISVC 2009, held in Las Vegas, NV, USA, in November/December 2009. The 97 revised full papers and 63 poster papers presented together with 40 full and 15 poster papers of 7 special tracks were carefully reviewed and selected from more than 320 submissions. The papers are organized in topical sections on computer graphics; visualization; feature extraction and matching; medical imaging; motion; virtual reality; face processing; reconstruction; detection and tracking; applications; and video analysis and event recognition. The 7 additional special tracks address issues such as object recognition; visual computing for robotics; computational bioimaging; 3D mapping, modeling and surface reconstruction; deformable models: theory and applications; visualization enhanced data analysis for health applications; and optimization for vision, graphics and medical imaging: theory and applications.

Image Reconstruction

Handbook of X-ray Imaging

5th European Conference of the International Federation for Medical and Biological Engineering 14 - 18 September 2011, Budapest, Hungary

Three-Dimensional Image Reconstruction in Radiology and Nuclear Medicine