Table of Contents

Data-driven Segmentation

Segmentation of Meningiomas and Low Grade Gliomas in MRI 1
M. R. Kaus, S. K. Warfield, A. Nabavi, E. Chatzidakis, P. M. Black, F. A. Jolesz and R. Kikinis

Automated Segmentation of MS Lesions from Multi-channel MR Images .. 11
Koen Van Leemput, Frederik Maes, Fernando Bello, Dirk Vandermeulen, Alan Colchester and Paul Suetens

Measurement of Infarct Volume in Stroke Patients Using Adaptive Segmentation of Diffusion Weighted MR Images 22
A. L. Martel, S. J. Allder, G. S. Delay, P. S. Morgan and A. R. Moody

Quantitative Modelling of Microcalcification Detection in Digital Mammography 32
Andreas Rick, Serge Muller, Sylvie Bothorel, Michel Grimaud

Interactive Direct Volume Rendering of Dural Arteriovenous Fistulae in MR–CISS Data 42
C. Rezk–Salama, P. Hastreiter, K. Eberhardt, B. Tomandl, T. Ertl

Segmentation of White Matter Lesions from Volumetric MR Images 52
S. A. Hojjatoleslami, F. Kruggel and D. Y. von Cramon

Fractional Segmentation of White Matter 62
S.K. Warfield, C-F. Westin, C.R.G. Guttmann, M. Albert, F.A. Jolesz and R. Kikinis

A Modified Fuzzy C-Means Algorithm for MRI Bias Field Estimation and Adaptive Segmentation 72
M. N. Ahmed, S. M. Yamany, N. A. Mohamed and A. A. Farag

Statistical 3D Vessel Segmentation Using a Rician Distribution 82
Albert C. S. Chung and J. Alison Noble

Retinal Blood Vessel Segmentation by Means of Scale-Space Analysis and Region Growing 90
M. Elena Martinez-Perez, Alun D. Hughes, Alice V. Stanton, Simon A. Thom, Anil A. Bharath and Kim H. Parker

Liver Blood Vessels Extraction by a 3-D Topological Approach 98
Petr Dokládal, Christophe Lohou, Laurent Perroton, Gilles Bertrand

Segmentation using Structural Models

Tamed Snake: A Particle System for Robust Semi-Automatic Segmentation 106
Johannes Hug, Christian Brechbühler, and Gábor Székely

Interactive Medical Image Segmentation with United Snakes 116
Jianming Liang, Tim McInerney and Demetri Terzopoulos

Active Shape Model-based Segmentation of Digital X-ray Images 128
G. Behiels, D. Vandermeulen, F. Maes, P. Suetens and P. Dewaele

Nonrigid 3-D/2-D Registration of Images Using Statistical Models 138
M. Fleute and S. Lavallée

A New Approach to 3D Sulcal Ribbon Finding from MR Images 148
X. Zeng, L.H. Staib, R.T. Schultz, H. Tagare, L. Win and J.S. Duncan

Automated Segmentation of Sulcal Regions 158
Maryam E. Rettmann, Chenyang Xu, Dzung Pham, and Jerry L. Prince

Cylindrical Echocardiographic Image Segmentation Based on 3D Deformable Models 168
J. Montagnat, H. Delingette and G. Malandain

Active Model Based Carotid Ultrasonic Data Segmentation 176
A. Moreau-Gaudry, J.P. Baguet and P. Cinquin

Automatic Segmentation of Lung Fields in Chest Radiographs 184
Bram van Ginneken, Bart M. ter Haar Romeny

Automatic Reconstruction of 3D Geometry Using Projections and a Geometric Prior Model 192
J. Lötjönen, I. E. Magnin, L. Reinhardt, J. Nenonen and T. Katila

3D Image Matching Using a Finite Element Based Elastic Deformation Model 202
M. Ferrant, S.K. Warfield, C.R.G. Guttmann, R.V. Mulkern, F.A. Jolesz, and R. Kikinis

Image Processing and Feature Detection

Quantitative Comparison of Sinc-Approximating Kernels for Medical Image Interpolation 210
E. H. W. Meijering, W. J. Niessen, J. P. W. Pluim and M. A. Viergever

A Post Processing Technique to Suppress Fluid Signal and Increase Contrast in Multispectral MR Exams of MS Patients 218
J. R. Mitchell, P. Gareau, S. Karlik and B. Rutt

De-noising h_{int} Surfaces: a Physics-based Approach 227
M. Yam, R. Highnam and M. Brady

ERS Transform for the Detection of Bronchi on CT of the Lungs 235
F. Chabat, D. M. Hansell and G. Z. Yang

Detection of Pulmonary Nodules on CT and Volumetric Assessment of Change over Time 245
Margrit Betke and Jane P. Ko

Improving the Detection Performance in Semi-automatic Landmark Extraction 253
S. Frantz, K. Rohr, and H.S. Stiehl

Automatic Classification of Linear Structures in Mammographic Images .. 263
R. Zwiggelaar, C. J. Taylor and C. R. M. Boggis

Surfaces and Shape

Conformal Geometry and Brain Flattening 271
S. Angenent, S. Haker, A. Tannenbaum and R. Kikinis

Quasi-Conformally Flat Mapping the Human Cerebellum 279
M. K. Hurdal, P. L. Bowers, K. Stephenson, D. W. L. Sumners, K. Rehm, K. Schaper and D. A. Rottenberg

Rendering the Unfolded Cerebral Cortex 287
Junfeng Guo, Alexandru Salomie, Rudi Deklerck and Jan Cornelis

Tessellated Surface Reconstruction from 2D Contours 297
C. F. Chan, C. K. Kwoh, M. Y. Teo and W. S. Ng

Accurate Robust Symmetry Estimation 308
Stephen Smith, Mark Jenkinson

Global Shape from Shading for an Endoscope Image 318
S.Y.Yeung, H.T.Tsui and A.Yim

Measurement and Interpretation

The Measurement of Focal Diurnal Variation in the Femoral Articular Cartilage of the Knee 328
A. D. Brett, J. C. Waterton, S. Solloway, J. E. Foster, M. C. Keen, S. Gandy, B. J. Middleton, R. A. Maciewicz, I. Watt, P. A. Dieppe and C. J. Taylor

Three-Dimensional Reconstruction and Quantification of Hip Joint Cartilages from Magnetic Resonance Images 338
Y. Sato, T. Kubota, K. Nakanishi, H. Tanaka, N. Sugano, T. Nishii, K. Ohzono, H. Nakamura, T. Ochi, and S. Tamura

Quantification of Cerebral Grey and White Matter Asymmetry from MRI . 348
F. Maes, K. Van Leemput, L. E. DeLisi, Dirk Vandermeulen and Paul Suetens

Quantitation of Vessel Morphology from 3D MRA 358
A.F. Frangi, W. J. Niessen, R. M. Hoogeveen, Th. van Walsum and M. A. Viergever

A Patient-Specific Computer Model for Prediction of Clinical Outcomes in the Cerebral Circulation Using MR Flow Measurements 368
M. E. Clark, M. Zhao, F. Loth, N. Alperin, L. Sadler, K. Guppy and F. T. Charbel

Exploratory Factor Analysis in Morphometry 378
A. M. C. Machado, J. C. Gee and M. F. M. Campos

Potential Usefulness of Curvature based Description for Differential Diagnosis of Pulmonary Nodules 386
Ivar Ekeland, Jeffrey Dean, David Grove, Craig Chambers, Kim B. Bruce and Elisa Bertino

Pulmonary Organs Analysis Method and Its Evaluation Based on Thoracic Thin-section CT Images 394
T. Tozaki, A. Tanaka, Y. Kawata, N. Niki, H. Ohmatsu, R. Kakinuma, K. Eguchi, M. Kaneko and N. Moriyama

An Automatic Approach for 3-D Facial Shape Change Analysis by Combination of ASM and Morphometric Tools 402
Z. Mao and A. J. Naftel

Spatiotemporal and Diffusion Tensor Analysis

Segmentation of Echocardiographic Image Sequences Using Spatio-temporal Information 410
Einar Brandt, Lars Wigström and Bengt Wranne

3D Cardiac Deformation from Ultrasound Images 420
Xenophon Papademetris, Albert J. Sinusas, Donald P. Dione and James S. Duncan

Directional Representations of 4D Echocardiography for Temporal Quantifications of LV Volume 430
E. Angelini, A. Laine, S. Takuma and S. Homma

Image Processing for Diffusion Tensor Magnetic Resonance Imaging 441
C.-F. Westin, S.E. Maier, B. Khidhir, P. Everett, F.A. Jolesz, and R. Kikinis

Inferring the Brain Connectivity from MR Diffusion Tensor Data 453
C. Poupon, C.A. Clark, V. Frouin, D. LeBihan, I. Bloch, J.-F. Mangin

Strategies for Data Reorientation during Non-Rigid Warps of Diffusion Tensor Images 463
D. C. Alexander, J. C. Gee and R. Bajcsy

Analysis of Functional MRI Data Using Mutual Information 473
A. Tsai, J.W. Fisher, C. Wible, W.M. Wells, J. Kim and A.S. Willsky

Statistical Segmentation of fMRI Activations Using Contextual Clustering 481
E. Salli, A. Visa, H. J. Aronen, A. Korvenoja and T. Katila

Using Sulcal Basins for Analyzing Functional Activations Patterns in the Human Brain 489
G. Lohmann and D.Y. von Cramon

Comparison of Land-Mark-Based and Curve-Based Thin-Plate Warps for Analysis of Left-Ventricular Motion from Tagged MRI 498
A. A. Amini, Y. Chen, and D. Abendschein

Contour Tracking in Echocardiographic Sequences without Learning Stage: Application to the 3D Reconstruction of the Beating Left Ventricule 508
M.O. Berger, G. Winterfelft and J.P. Lethor

Segmentation of Echocardiographic Data. Multiresolution 2D and 3D Algorithm Based on Grey Level Statistics 516
D. Boukerroui, O. Basset, A. Baskurt and A. Noble

Registration and Fusion

Locating Motion Artifacts in Parametric fMRI Analysis 524
A.J.Lacey, N.A.Thacker, E. Burton, and A.Jackson

Non-rigid Registration by Geometry-Constrained Diffusion 533
Per Rønsholt Andresen and Mads Nielsen

Wavelet Compression of Active Appearance Models 544
C. B. H. Wolstenholme, C. J. Taylor

Towards a Better Comprehension of Similarity Measures used in Medical Image Registration 555
A. Roche, G. Malandain, N. Ayache and S. Prima

Entropy–Based, *Multiple*–Portal–to–3DCT Registration for Prostate Radiotherapy Using Iteratively Estimated Segmentation 567
R. Bansal, L. H. Staib, Z. Chen, A. Rangarajan, J. Knisely, R. Nath, J. S. Duncan

Registration of Video Images to Tomographic Images by Optimising Mutual Information using Texture Mapping 579
M. J. Clarkson, D. Rueckert, A. P. King, P. J. Edwards, D. L. G. Hill and D. J. Hawkes

Brain Atlas Deformation in the Presence of Large Space-occupying Tumours 589
B. M. Dawant, S. L. Hartmann and S. Gadamsetty

Understanding the "Demon's Algorithm": 3D Non-Rigid registration by Gradient Descent 597
Xavier Pennec, Pascal Cachier and Nicholas Ayache

Multi-variate Mutual Information for Registration 606
J. L. Boes and C. R. Meyer

Automatic Identification of a Particular Vertebra in the Spinal Column using Surface-Based Registration 613
J. L. Herring and B. M. Dawant

3-D Deformable Registration of Medical Images Using a Statistical Atlas . . 621
M. Chen, T. Kanade, D. Pomerleau and J. Schneider

Probabilistic Brain Atlas Construction: Thin-Plate Spline Warping via Maximization of Mutual Information 631
C. R. Meyer, J. L. Boes, B. Kim and P. H. Bland

Out-of-plane Non-linear Warping of a Slice into Volume 638
B. Kim, J. L. Boes, P.H. Bland and C. R. Meyer

Tree Representation and Implicit Tree Matching for a Coarse to Fine Image Matching Algorithm 646
J. Mattes and J. Demongeot

Gray-Value Based Registration of CT and MR Images by Maximization of Local Correlation 656
J. Weese, P. Rösch, T. Netsch, T. Blaffert and M. Quist

Fully Automatic 3D/2D Subtracted Angiography Registration 664
E. Kerrien, M-O. Berger, E. Maurincomme, L. Launay, R. Vaillant and L. Picard

Multi-modal Medical Volumes Fusion by Surface Matching 672
A. M. Eldeib, S. M. Yamany and A. A. Farag

Medical Image Registration with Robust Multigrid Techniques 680
Pierre Hellier, Christian Barillot, Etienne Mémin and Patrick Pérez

Camera-Augmented Mobile C-arm (CAMC) Application: 3D reconstruction using a low-cost Mobile C-arm 688
N. Navab, M. Mitschke and O. Schütz

Image Analysis of Nailfold Capillary Patterns From Video Sequences 698
P.D. Allen, C.J. Taylor, A. L. Herrick and T. Moore

Visualisation

Modeling Spectral Changes to Visualize Embedded Volume Structures for Medical Image Data 706
H.J. Noordmans, H.T.M. van der Voort and M.A. Viergever

Non-Planar Reslicing for Freehand 3D Ultrasound 716
A. Gee, R. Prager and L. Berman

The Perception of Transparency in Medical Images 726
Reza Kasrai, Frederick A. A. Kingdom and Terry M. Peters

Localisation of Subdural EEG Electrode Bundles in an Interactive Volume Rendering Framework 734
H. J. Noordmans, C. W. M. van Veelen and M. A. Viergever

System of Modeling and Visualization of Domain of the Heart Excitation . 742
D.I. Belov

A 3d Puzzle for Learning Anatomy 750
Bernhard Preim, Felix Ritter, Oliver Deussen

Image-guided Intervention

3D Functional Database of Subcortical Structures for Surgical Guidance in Image Guided Stereotactic Neurosurgery 758
K.W. Finnis, Y.P. Starreveld, A.G. Parrent, A.F. Sadikot, and T.M. Peters

Automated Registration of Ultrasound with *CT* Images: Application to Computer Assisted Prostate Radiotherapy and Orthopedics 768
G. Ionescu, S. Lavallée and J. Demongeot

A Robust 3-D Reconstruction System for Human Jaw Modeling 778
S. M. Yamany, A. A. Farag, D. Tasman and A. G. Farman

Level-set Surface Segmentation and Fast Cortical Range Image Tracking for Computing Intrasurgical Deformations 788
M.A. Audette, K. Siddiqi, and T.M. Peters

A Single Image Registration Method for CT Guided Interventions 798
R. C. Susil, J. H. Anderson and R. H. Taylor

An Integrated Visualization System for Surgical Planning and Guidance using Image Fusion and Interventional Imaging 809
David T. Gering, Arya Nabavi, Ron Kikinis, W. Eric L. Grimson, Noby Hata, Peter Everett, Ferenc Jolesz and William M. Wells

Exploiting 2-D to 3-D Intra-Operative Image Registration for Qualitative Evaluations and Post-Operative Simulations 820
André Guéziec, Kenong Wu, Bill Williamson, Peter Kazanzides, Robert Van Vorhis, and Alan Kalvin

LOCALITE - a Frameless Neuronavigation System for Interventional Magnetic Resonance Imaging Systems 832
K. Kansy, P. Wisskirchen, U. Behrens, T. Berlage, G. Grunst, M. Jahnke, R. Ratering, H.-J. Schwarzmaier and F. Ulrich

Design and Evaluation of a System for Microscope-Assisted Guided Interventions (MAGI) 842
Philip J. Edwards, Andrew P. King, Calvin R. Maurer, Jr., Darryl A. de Cunha, David J. Hawkes, Derek L. G. Hill, Ron P. Gaston, Michael R. Fenlon, Subhash Chandra, Anthony J. Strong, Christopher L. Chandler, Aurelia Richards and Michael J. Gleeson

Percutaneous Posterior Stabilization of the Spine 852
N. Glossop, R. Hu, D. Young, G. Dix, S. DuPlessis

Image-based Planning and Validation of C1-C2 Transarticular Screw Fixation Using Personalized Drill Guides 860
K. Martens, K. Verstreken, J. Van Cleynenbreugel, K. Van Brussel, J. Goffin, G. Marchal and P. Suetens

POP: Preoperative Planning and Simulation Software for Total Hip Replacement Surgery 868
C. Nikou, B. Jaramaz, A. M. DiGioia III, M. Blackwell, M. E. Romesberg, and M. M. Green

CupAlign: Computer-Assisted Postoperative Radiographic Measurement of Acetabular Components Following Total Hip Arthroplasty 876
B. Jaramaz, C. Nikou, T. J. Levison, A. M. DiGioia III, and R. S. LaBarca

Computer - Aided Implant Dentistry — An Early Report — 883
W. Birkfellner, P. Solar, A. Gahleitner, K. Huber, F. Kainberger, J. Kettenbach, P. Homolka, M. Diemling, G. Watzek, and H. Bergmann

Surface Registration for Use in Interactive Image-Guided Liver Surgery . . . 892
A. J. Herline, J. L. Herring, J. D. Stefansic, W. C. Chapman, R. L. Galloway and B. M. Dawant

Model-Updated Image-Guided Neurosurgery Using the Finite Element Method: Incorporation of the Falx Cerebri 900
M. I. Miga, K. D. Paulsen, F. E. Kennedy, A. Hartov, D. W. Roberts

Assessment of Intraoperative Brain Deformation Using Interventional MR Imaging 910
D. L. G. Hill, C. R. Maurer, Jr., A. J. Martin, S. Sabanathan, w. A. Hall, D. J. Hawkes, D. Rueckert and C. L. Truwit

Ultrasound Probe Tracking for Real-Time Ultrasound/MRI Overlay and Visualization of Brain Shift 920
David G. Gobbi, Roch M. Comeau and Terry M. Peters

A Volumetric Optical Flow Method for Measurement of Brain Deformation from Intraoperative Magnetic Resonance Images 928
N. Hata, A. Nabavi, S. Warfield, W. Wells, R. Kikinis and F.A. Jolesz

Spotlights: A Robust Method for Surface-Based Registration in Orthopedic Surgery 936
B. Ma, R. E. Ellis, and D. J. Fleet

Automated Registration and Fusion of Functional and Anatomical MRI for Navigated Neurosurgery 945
T. Rohlfing, J. Beier, J. B. West, U.-W. Thomale, T. Liebig and C. A. Taschner

AcouStick: A Tracked A-Mode Ultrasonography System for Registration in Image-Guided Surgery 953
C. R. Maurer, Jr., R. P. Gaston, D. L. G. Hill, M. J. Gleeson, M. G. Taylor, M. R. Fenlon, P. J. Edwards, and D. J. Hawkes

Synthetic Image Modalities Generated from Matched CT and MRI Data: A New Approach for Using MRI in Brachytherapy 963
R. Krempien, H. A. Grabowski, W. Harms, F. W. Hensley, S. Hassfeld, U. Mende, M. Treiber and M. Wannenmacher

3D Interventional Imaging with 2D X-Ray Detectors. 973
L. Desbat, G. Champleboux, M. Fleute, P. Komarek, C. Mennessier, T. Rodet, B. Monteil, P. Bessou and G.Ferretti

Reconstruction of 3D Catheter Paths from 2D X-ray Projections 981
H.-J. Bender, R. Männer, C. Poliwoda, S. Roth and M. Walz

Automatic Extraction of Implanted Electrode Grids 990
Oskar M. Škrinjar, James S. Duncan

The Potential Use of An Autostereoscopic 3D Display in Microsurgery 998
P. Chios, A. C. Tan, A. D. Linney, G. H. Alusi and A. Wright

Robotic Systems

A Progressive Cut Refinement Scheme for Revision Total Hip Replacement Surgery Using C-arm Fluoroscopy 1010
J. Yao, R. H. Taylor, R. P. Goldberg, R. Kumar, A. Bzostek, R. Van Vorhis, P. Kazanzides, A. Gueziec and J. Funda

MR Compatibility of Mechatronic Devices: Design Criteria 1020
K. Chinzei, R. Kikinis, and F.A. Jolesz

A Steady-Hand Robotic System for Microsurgical Augmentation 1031
R. Taylor, P. Jensen, L. Whitcomb, A. Barnes, R. Kumar, D. Stoianovici, P. Gupta, Z. X. Wang, E. deJuan and L. Kavoussi

Optimising Operation Process for Computer Integrated Prostatectomy . . 1042
Q. Mei, S. J. Harris, R. D. Hibberd, J. E. A. Wickham and B. L. Davies

A Passive Positioning and Supporting Device for Surgical Robots and Instrumentation 1052
A. G. Lerner, D. Stoianovici, L. L. Whitcomb and L. R. Kavoussi

Robot-assisted Diagnostic Ultrasound - Design and Feasibility Experiments 1062
S.E. Salcudean, G. Bell, S. Bachmann, W.H. Zhu, P. Abolmaesumi, P.D. Lawrence

Accuracy and Repeatability of Joint Centre Location in Computer-Assisted Knee Surgery 1072
K. B. Inkpen and A. J. Hodgson

Microscale Tracking of Surgical Instrument Motion 1080
C. N. Riviere and P. K. Khosla

On the Feasibility of a Moving Support for Surgery on the Beating Heart 1088
A. L. Trejos, S. E. Salcudean, F. Sassani and S. Lichtenstein

A Testbed System for Robotically Assisted Percutaneous Pattern Therpay 1098
A. Bzostek, A. C. Barnes, R. Kumar, J. H. Anderson, R. H. Taylor

Performance of Robotic Augmentation in Microsurgery-Scale Motions . . . 1108
R. Kumar, T. M. Goradia, A. C. Barnes, P. Jensen, L. L. Whitcomb, D. Stoianovici, L. M. Auer and R. H. Taylor

Intra-operative Application of a Robotic Knee Surgery System 1116
S.J.Harris, M.Jakopec, J.Cobb and B.L.Davies

Image-based Control of Interactive Robotics Systems 1125
A. Hein and T.C. Lueth

Biomechanics and Simulation

Extracting Features from Tactile Maps 1133
P. S. Wellman and R. D. Howe

Finite Element Model of a Fetal Skull Subjected to Labour Forces 1143
R. J. Lapeer and R. W. Prager

Modeling the Dynamics of a Human Liver for a Minimally Invasive Surgery Simulator 1156
F. Boux de Casson, C. Laugier

EyeSi – A Simulator for Intra-ocular Surgery 1166
C. Wagner, M. Hennen, H.-J. Bender and R. Männer

The Mesh-matching Algorithm : A New Automatic 3D Mesh Generator for Finite Element Analysis 1175
Béatrice Couteau, Yohan Payan, Stéphane Lavallée and Marie-Christine Hobatho

Optimization Approaches for Soft–Tissue Prediction in Craniofacial Surgery Simulation 1183
M. Teschner, S. Girod and B. Girod

Modeling the Dynamics of the Human Thigh for a Realistic Echographic Simulator with Force Feedback 1191
D. d'Aulignac, M. C. Cavusoglu and C. Laugier

Visualization for Planning and Simulation of Minimally Invasive Neurosurgical Procedures 1199
L. M. Auer, A. Radetzky, C. Wimmer, G. Kleinszig, F. Schroecker, D. P. Auer, H. Delingette, B. Davies and D. P. Pretschner

A Simulation Environment for Maxillofacial Surgery Including Soft Tissue Implications 1210
F. Schutyser, J. Van Cleynenbreugel, J. Schoenaers, G. Marchal and P. Suetens

Surgical Forces and Tactile Perception During Retinal Microsurgery 1218
P. K. Gupta, P. S. Jensen and E. de Juan

A Novel Technique for Simulating Transcranial Doppler Examinations In Vitro 1226
R. Hart, P. D. Hart and S. Bunt