Guoyan Zheng · Wei Tian · Xiahai Zhuang Editors

Intelligent Orthopaedics

Artificial Intelligence and Smart Imageguided Technology for Orthopaedics



Contents

1	Computer-Aided Orthopaedic Surgery: State-of-the-Art and Future Perspectives	1
2	Computer-Aided Orthopedic Surgery: Incremental Shift or Paradigm Change?	21
3	CAMISS Concept and Its Clinical Application	31
4	Surgical Navigation in Orthopedics: Workflow and System	47
	Review	47
5	Multi-object Model-Based Multi-atlas Segmentation Constrained Grid Cut for Automatic Segmentation of Lumbar Vertebrae from CT Images Weimin Yu, Wenyong Liu, Liwen Tan, Shaoxiang Zhang, and Guoyan Zheng	65
6	Deep Learning-Based Automatic Segmentation of the Proximal Femur from MR Images	73
7	Muscle Segmentation for Orthopedic Interventions	81
8	3X-Knee: A Novel Technology for 3D Preoperative Planning and Postoperative Evaluation of TKA Based on 2D X-Rays Guoyan Zheng, Alper Alcoltekin, Benedikt Thelen, and Lutz-P. Nolte	93
9	Atlas-Based 3D Intensity Volume Reconstruction from 2D Long Leg Standing X-Rays: Application to Hard and Soft Tissues in Lower Extremity	105
10	3D Ultrasound for Orthopedic Interventions	113

vi Contents

11	A Novel Ultrasound-Based Lower Extremity Motion Tracking System	131
12	Computer-Assisted Planning, Simulation, and Navigation System for Periacetabular Osteotomy Li Liu, Klaus Siebenrock, Lutz-P. Nolte, and Guoyan Zheng	143
13	Biomechanical Optimization-Based Planning of Periacetabular Osteotomy	157
14	Biomechanical Guidance System for Periacetabular Osteotomy	169
15	Gravity-Assisted Navigation System for Total Hip Arthroplasty Guoyan Zheng	181
16	3D Visualization and Augmented Reality for Orthopedics Longfei Ma, Zhencheng Fan, Guochen Ning, Xinran Zhang, and Hongen Liao	193
17	Intelligent HMI in Orthopedic Navigation	207
18	Patient-Specific Surgical Guidance System for Intelligent Orthopaedics	225
19	Intelligent Control for Human-Robot Cooperation in Orthopedics Surgery	245
20	Multilevel Fuzzy Control Based on Force Information in Robot-Assisted Decompressive Laminectomy	263
21	Potential Risk of Intelligent Technologies in Clinical Orthopedics	281
22	Clinical Application of Navigation in the Surgical Treatment of a Pelvic Ring Injury and Acetabular Fracture	289

Contents

23	Patient-Specific Surgical Guide for Total Hip Arthroplasty Takashi Sakai	307
24	Computer Navigation in Orthopaedic Tumour Surgery Kwok-Chuen Wong, Xiaohui Niu, Hairong Xu, Yuan Li, and Shekhar Kumta	315
25	Sensor-Based Soft Tissue Balancing in Total Knee Arthroplasty	327
26	Implant Orientation Measurement After THA Using the EOS X-Ray Image Acquisition System	335
27	3D Printing in Spine Surgery	345