

Contents

Acknowledgments	7
Introduction	9
Motivation	9
Chapter overview	11
List of own publications	12
1. Theory	15
1.1. Mobile C-Arm CBCT device	15
1.1.1. Basic unit	15
1.1.2. Flat-panel detector	16
1.2. Cone-beam computed tomography	19
1.2.1. Image acquisition	19
1.2.2. Reconstruction	20
1.2.3. Forward projection	23
1.2.4. Field of view (FOV)	24
1.3. Metal artifacts	26
1.3.1. Beam Hardening	26
1.3.2. Scatter	31
1.3.3. Exponential Edge-Gradient Effect	32
1.3.4. Noise	34
1.3.5. Motion and Aliasing	35
1.4. Image Processing	36
1.4.1. Bilateral Filter	36
1.4.2. Mutual Information	39
1.4.3. Erosion	40
2. Metal artifact reduction	41
2.1. Image acquisition	41
2.2. Method	42
2.2.1. Reconstruction and segmentation	43
2.2.2. Metal replacement	44
2.2.3. Forward projections and alignment	48

Contents

2.2.4. Truncation correction	50
2.2.5. Metal area replacement	52
2.2.6. Second reconstruction and metal transfer	55
2.3. Results	56
3. Segmentation of metal objects	81
3.1. Problems	81
3.2. Projective segmentation	84
3.3. Reliability	92
3.4. Results	93
Discussion and outlook	101
A. Stitching of 2D X-ray images	103
A.1. Image acquisition	103
A.2. Method	103
A.3. Results	105
A.4. Outlook and Discussion	106
B. Hounsfield scale	107
List of figures	111
References	118