Contents

1 Introduction 1
- 1.1 Basic Idea and Main Task of Photogrammetry 1
- 1.2 Why Photogrammetry? 3
- 1.3 Image Sources: Analogue and Digital Cameras 3
- 1.4 Digital Consumer Cameras 5
- 1.5 Short History of Photogrammetric Evaluation Methods 6
- 1.6 Geometric Principles 1: Camera Position, Focal Length 7
- 1.7 Geometric Principles 2: Image Orientation 9
- 1.8 Geometric Principles 3: Relative Camera Positions (Stereo) 11
- 1.9 Some Definitions 12
- 1.10 Length and Angle Units 13
- 1.11 A Typical Workflow in Photogrammetry 14

2 Included Software and Data 17
- 2.1 Hardware Requirements, Operating System 17
- 2.2 Image Material 18
- 2.3 Overview of the Software 18
- 2.4 Installation 19
- 2.5 General Remarks 20

3 Scanning of Photos 21
- 3.1 Scanner Types 21
- 3.2 Geometric Resolution 22
- 3.3 Some Practical Advice 23
- 3.4 Import of the Scanned Images 23

4 A Single Model 25
- 4.1 Project Definition 25
- 4.2 Orientation of the Images 26
  - 4.2.1 Camera Definition 26
  - 4.2.2 Interior Orientation 28
  - 4.2.3 Brightness and Contrast 31

4.2.4 Control Points . . . 32
4.2.5 Exterior Orientation . . . 34
4.2.6 Over-Determination and Error Detection . . . 37
4.3 Model Definition . . . 38
4.4 Stereoscopic Viewing . . . 40
4.5 Measurement of Object Co-ordinates . . . 42
4.6 Creation of DTMs via Image Matching . . . 44
4.6.1 Some Theory . . . 44
4.6.2 Practical Tests . . . 49
4.6.3 Additional Manual Measurements . . . 51
4.6.4 Quality Control . . . 51
4.7 Ortho Images . . . 52
4.7.1 Some Theory . . . 52
4.7.2 Resampling Methods . . . 54
4.7.3 Practical Tests . . . 55
4.7.4 Creation and Overlay of Contours . . . 56
4.7.5 Simple 3D Data Collection . . . 58

5 Aerial Triangulation . . . 61
5.1 Aerial triangulation measurement (ATM) . . . 61
5.1.1 Common Principles . . . 61
5.1.2 Interior Orientation . . . 62
5.1.3 Manual Measurement . . . 63
5.1.4 Automatic Measurement via Image Matching: Introduction . . . 67
5.1.5 Co-ordinate Input and Measurement of Ground Control Points . . . 67
5.1.6 Strip Definition . . . 68
5.1.7 Measurement of Strip Connections . . . 71
5.1.8 Automatic Image Co-ordinate Measurement (AATM) . . . 72
5.2 Block Adjustment with BLUH . . . 75
5.2.1 Introduction . . . 75
5.2.2 Running the Block Adjustment . . . 76
5.2.3 Discussion of the Results . . . 78
5.2.4 Improvement of Strip Connections . . . 83
5.2.5 Second Run of BLUH . . . 84
5.2.6 Additional Analysis of the Results . . . 84
5.3 Mosaics of DTMs and Ortho Images . . . 88
5.3.1 Model Definition . . . 88
5.3.2 Creation of a DTM Mosaic . . . 88
5.3.3 Creation of an Ortho Image Mosaic . . . 88
5.3.4 Shaded Relief . . . 89
5.3.5 Contour Lines Overlay . . . 90
5.3.6 3D View . . . 91

6 A Soil Erosion Experiment 93
6.1 The Situation 93
6.2 Interior and Exterior Orientation 94
6.3 Model Definition, Start Points 95
6.4 DTM Creation 96
6.5 Differential DTM 97

7 Wave Measurements 99
7.1 The Situation 99
7.2 Interior and Exterior Orientation 101
7.3 Model Definition 104
7.4 DTM Creation 104
7.5 Image Sequences 106

8 Lens Distortion and Calibration 109
8.1 Introduction 109
8.2 Lens Calibration 111
8.3 A Simple Self-made Model 113

9 Two Final Examples 115
9.1 Stereo Images from Satellites 115
9.2 Stereo Images from Flatbed Scanners 117
9.3 A View into the Future 119

10 Programme Description 121
10.1 Some Definitions 121
10.2 Basic Functions 121
10.3 Limitations 122
10.4 Operating the Programmes 122
10.5 Buttons in the Graphics Windows 123
10.6 LISA BASIC 123
10.6.1 File > Select Project 124
10.6.2 File > Define Project 124
10.6.3 File > Edit Project 124
10.6.4 File > Import 125
10.6.5 File > Export 126
10.6.6 Vector Data > Control Points 126
10.6.7 Vector Data > Define Symbols 126
10.6.8 Vector Data > Projections 127
10.6.9 Vector Data > Vector → Raster 127
10.6.10 Image Processing > Two-Dimensional Histogram 128
10.6.11 Image Processing > Rectification 128
10.6.12 Image Processing > Mosaic 131
10.6.13 Image Processing > Classification 131
10.6.14 Image Processing > Matching 131
10.6.15 Image Processing > Area Symbols 133

10.6.16 Terrain Models 133
10.6.17 Terrain Models > Interpolation 134
10.6.18 Terrain Models > Filtering 135
10.6.19 Terrain Models > Contour Lines Vector 135
10.6.20 Terrain Models > Numerical Evaluation 136
10.6.21 Terrain Models > Matching 136
10.6.22 Analysis 137
10.6.23 Data Base 137
10.6.24 Display Raster Image 137
10.6.25 Display Vector Graphics 142
10.6.26 Display Text 144
10.6.27 Display Attributes 144
10.7 LISA FOTO 145
10.7.1 File > Select, Define or Edit Project 145
10.7.2 File > Import 145
10.7.3 Pre Programmes > Camera Definition 146
10.7.4 Pre Programmes > Control Points 148
10.7.5 Pre Programmes > Strip Definition 148
10.7.6 Pre Programmes > Orientation > Measure > Interior Orientation 148
10.7.7 Pre Programmes > Orientation > Measure > Exterior Orientation 150
10.7.8 Pre Programmes > Orientation > Measure > Calibration Pattern 151
10.7.9 Pre Programmes > Parameters of the Exterior Orientation 152
10.7.10 Pre Programmes > Select Model 152
10.7.11 Pre Programmes > Define Model 152
10.7.12 Aerial Triangulation Measurement (ATM) 154
10.7.13 ATM > Manual Measurement 154
10.7.14 ATM > Calculate Strip Images 157
10.7.15 ATM > Measure Connections 157
10.7.16 ATM > Automatic Measurement (AATM) 159
10.7.17 ATM > Export > BLUH 160
10.7.18 Processing > Stereo Measurement 161
10.7.19 Processing > Stereo Correlation (Matching) 163
10.7.20 Processing > DTM Interpolation 164
10.7.21 Processing > Ortho Image 164
10.7.22 Processing > Camera Positions 165
10.7.23 Processing > Image Sequences 165
10.7.24 Display Raster Image 166
10.7.25 Display Text 166

10.8 Aerial Triangulation with BLUH 166
10.8.1 Pre Processing > Select Project, Define Project 166
10.8.2 Pre Processing > Control Point Editor 167
10.8.3 Pre Processing > Strip Definition 167
10.8.4 Pre Processing > Photo Co-ordinates Editor 167
10.8.5 Block Adjustment > Strategy 167
10.8.6 Block Adjustment > the Central BLUH Modules 168
10.8.7 Block Adjustment > All (Batch) 169
10.8.8 Block Adjustment > Analysis (BLAN) 169
10.8.9 Display Graphics 170
10.8.10 Display Text 170
10.8.11 Some More Theory 170
10.9 LISA FFSAT 172
10.9.1 Introduction 172
10.9.2 Image Sources 173
10.9.3 File > Select, Define or Edit Project 173
10.9.4 File > Import 173
10.9.5 Pre Programmes > Sensor Definition 174
10.9.6 Pre Programmes > Orientation Measurement 174
10.9.7 Processing > Stereo Measurement, Correlation, DTM Interpolation 175
10.9.8 Processing > Ortho Image 175

Appendix 177

Glossary 199

References 203

Index 207

http://www.springer.com/978-3-662-50462-8

Digital Photogrammetry
A Practical Course
Linder, W.
2016, XXIII, 209 p. 76 illus. With 3-D glasses. With online files/update., Hardcover
ISBN: 978-3-662-50462-8