

Contents

1	Practical Matters in Computer Vision	1
	Lakhmi C. Jain and Margarita N. Favorskaya	
1.1	Introduction	1
1.2	Chapters Included in the Book	2
1.3	Conclusion	8
	References	9
2	Human Action Recognition: Contour-Based and Silhouette-Based Approaches	11
	Salim Al-Ali, Mariofanna Milanova, Hussain Al-Rizzo and Victoria Lynn Fox	
2.1	Introduction	12
2.2	Human Action Recognition in Videos	13
2.2.1	Human Object Tracking	14
2.2.2	Feature Extraction	14
2.2.3	Action Classification	15
2.2.4	Human Action Recognition in Weizmann Dataset: Literature Review	16
2.3	Human Object Tracking in Weizmann Dataset	18
2.3.1	Weizmann Human Action Dataset	18
2.3.2	Background Subtraction Process	19
2.3.3	Direction Detection Process	20
2.3.4	Horizontal Alignment Process	21
2.3.5	Computing Aligned Silhouettes Image Process	22
2.3.6	Unifying Direction Process	23
2.3.7	Cropping Bounding Box Process	23
2.4	Contour-Based Feature Extraction	24
2.4.1	Cartesian Coordinate Feature	24
2.4.2	Fourier Descriptor Feature	25
2.4.3	Centroid-Distance Features	27
2.4.4	Chord-Length Features	27

2.5	Silhouette-Based Feature Extraction	28
2.5.1	Histogram of Oriented Gradient Feature.	28
2.5.2	Histogram of Oriented Optical Flow Feature	29
2.5.3	Structural Similarity Index Measure Feature	29
2.6	Action Classification	30
2.6.1	K-Nearest Neighbor Classifier	31
2.6.2	Support Vector Machine Classifier	31
2.7	Human Action Recognition in Videos Algorithm	32
2.7.1	Training Mode	33
2.7.2	Testing Mode	33
2.8	Experimental Results	34
2.8.1	Cartesian Coordinate Feature Experiment.	36
2.8.2	Fourier Descriptor Feature Experiments	37
2.8.3	Centroid-Distance Feature Experiments	37
2.8.4	Chord-Length Feature Experiments	38
2.8.5	Histogram of Oriented Gradient Feature Experiments	39
2.8.6	Histogram of Oriented Optical Flow Feature Experiments	40
2.8.7	Structure Similarity Index Measure Feature Experiments	41
2.8.8	Experimental Results Discussion.	43
2.9	Conclusion.	44
	References.	45
3	The Application of Machine Learning Techniques to Real Time Audience Analysis System	49
	Vladimir Khryashchev, Lev Shmaglit and Andrey Shemyakov	
3.1	Introduction	49
3.2	Face Detection	53
3.3	Face Tracking	54
3.4	Gender Recognition	57
3.5	Age Estimation.	64
3.6	Conclusion.	67
	References.	67
4	Panorama Construction from Multi-view Cameras in Outdoor Scenes	71
	Lakhmi C. Jain, Margarita N. Favorskaya and Dmitry Novikov	
4.1	Introduction	72
4.2	Problem Statement	73
4.3	Related Work.	75

4.4	Intelligent Selection and Overlapping of Representative Frames	80
4.4.1	Selection of Representative Frames	80
4.4.2	Overlapping Analysis of Selected Frames	81
4.5	Stitching of Selected Frames	83
4.5.1	Feature Points Detection	84
4.5.2	Feature Points Matching	86
4.5.3	Feature Points Correspondence	87
4.5.4	Image Projection and Geometrical Improvement of Panorama.	88
4.5.5	Visualization of High Speed Objects in Panoramic Images	89
4.6	Lighting Improvement of Panoramic Images.	90
4.6.1	Application of Enhancement Multi-scale Retinex Algorithm	90
4.6.2	The Edges Smoothing Procedure	91
4.6.3	Blending Algorithm for Stitching Area	92
4.7	Discussion of Experimental Results.	94
4.8	Conclusion.	105
	References.	105
5	A New Real-Time Method of Contextual Image Description and Its Application in Robot Navigation and Intelligent Control	109
	Konstantin I. Kiy	
5.1	Introduction	110
5.2	Related Works and Main Ideas.	111
5.3	Geometrized Histograms of Color Images and Segmentation	112
5.3.1	The Geometrized Histogram of a Color Image and the Set of Color Bunches.	114
5.3.2	Preliminary Local Segmentation in Strips.	117
5.3.3	Partial Order Relation and Contrasts on the Set of Color Bunches	121
5.3.4	Structural Graph of Color Bunches and Continuous Left and Right Contrast Curves on It.	124
5.4	Construction of Global Contrast Objects in STG.	125
5.5	Applications to the Navigation of Robots in Indoor Environments.	127
5.6	Conclusion.	132
	References.	132

6	Perception of Audio Visual Information for Mobile Robot	
	Motion Control Systems	135
	Snejana Pleshkova, Alexander Bekiarski, Shima Sehati Dehkharghani and Kalina Peeva	
6.1	Introduction	136
6.2	Mobile Robot Audio and Visual Perception System	137
6.3	Sensor Calibration Using Mobile Robot Visual and Range Perceptions	138
6.3.1	Geometric Video Camera Calibration from Perceived Visual Information of Mobile Robot.	139
6.3.2	Camera-Laser Rangefinder Extrinsic Calibration	143
6.4	Navigation of Mobile Robot from Perception of Audio Visual Information	144
6.4.1	Robot Navigation Based on EKF-SLAM	144
6.4.2	Path Planning Based on Perceived Audio Information	150
6.4.3	Audio Sensor Model, Sound Source Localization, and Speech Recognition.	153
6.5	Algorithms for Quality Estimation of Perceived Speech Information	155
6.6	Experimental Results and Discussions	158
6.6.1	Sensor Calibration.	159
6.6.2	Robot Navigation Based on EKF-SLAM	161
6.6.3	Experimental Results from Simulations of the Proposed Objective Speech Quality Estimation	163
6.7	Conclusion.	164
	References.	165
7	Adaptive Surveillance Algorithms Based on the Situation	
	Analysis	169
	Nikolay Kim and Nikolay Bodunkov	
7.1	Introduction	169
7.2	Problems of Automatic Surveillance in Autonomous Robotic Systems.	170
7.2.1	Identification in Surveillance Tasks	171
7.2.2	Decision Making Using Statistical Methods of Identification	172
7.2.3	Information Description of Surveillance Process	177
7.2.4	Decrease of Initial Entropy of the OI Observation.	180
7.3	Complex Adaptive Surveillance Algorithm.	182
7.3.1	Structure of Complex Adaptive Surveillance Algorithm	182

7.3.2	Correlation Algorithms of Information Processing	184
7.3.3	Pair Criterion Functions	186
7.3.4	Characteristic Points of Images	187
7.4	Analysis of the Observed Situation	189
7.4.1	Creation of Descriptions for Navigation Tasks	189
7.4.2	Creation of Descriptions for Search Tasks	195
7.5	Conclusion.	199
	References.	199
8	Enhanced, Synthetic and Combined Vision Technologies for Civil Aviation	201
	Oleg Vygolov and Sergey Zheltov	
8.1	Introduction	201
8.2	EVS/SVS/CSV Survey	202
8.2.1	The Main Regulatory Documents	202
8.2.2	Enhanced Vision System Overview	203
8.2.3	Synthetic Vision System Overview	204
8.2.4	Combined Vision System Overview	205
8.3	Commercial EVS/SVS/CSV Systems and R&D Projects	205
8.4	The Main Principles of ESVS Prototype Development.	209
8.4.1	Computer Simulation and Its Role in the Development Process	210
8.4.2	Visual Programming Language Approach for Algorithms Development	211
8.4.3	Multi-spectral Data Acquisition Using Real Sensors	212
8.4.4	Testing ESVS Interaction with On-Board Systems . . .	213
8.5	Overview of ESVS Hardware Components and Platform	213
8.6	Image Processing Algorithms for Enhanced and Synthetic Vision Support	215
8.6.1	Image Enhancement	215
8.6.2	Image Fusion Based on Morphological Approach	216
8.6.3	Vision-Based Runway Detection.	218
8.6.4	Vision-Based Detection of Obstacle on a Runway. . . .	221
8.7	Prototype of Synthetic Vision Function	223
8.8	Combined Vision Algorithm Based on Photogrammetric Approach.	225
8.8.1	The Formal Statement of the Problem	225
8.8.2	Exterior Orientation Using the Runway Points	226
8.8.3	Experimental Results.	228
8.9	Conclusion.	228
	References.	229

9	Navigation of Autonomous Underwater Vehicles Using Acoustic and Visual Data Processing	231
	Igor Burdinsky and Anton Myagotin	
9.1	Introduction	231
9.2	Problem Statement	233
9.3	Acoustic Navigation	234
9.4	Vision-Based Homing	239
9.5	Numerical Experiments	243
9.6	Conclusion.	248
	References.	249
10	Efficient Denoising Algorithms for Intelligent Recognition Systems	251
	Andrey Priorov, Kirill Tumanov and Vladimir Volokhov	
10.1	Introduction	251
10.2	Two-Stage PCA Filtration Scheme	252
10.3	Sequential and Parallel Filtration Schemes Based on PCA and Non-local Processing	256
10.3.1	Sequential Filtration Scheme	256
10.3.2	Parallel Filtration Scheme	258
10.3.3	Applications of Filtration Methods	259
10.4	Image Filtration Using Non-local PCA	261
10.5	Bayer Patterns Filtration Based on Non-local PCA	266
10.6	Application of Denoising Algorithms to the Task of License Plate Recognition	269
10.6.1	Preliminary Image Processing.	269
10.6.2	License Plate Detection	270
10.6.3	License Plate Segmentation	272
10.6.4	Symbols Recognition	273
10.7	Conclusion.	274
	References.	274
11	Image Segmentation Based on Two-Dimensional Markov Chains.	277
	Elena Medvedeva and Ekaterina Kurbatova	
11.1	Introduction	277
11.2	Image Segmentation Method Based on Contours Detection	278
11.3	Combined Segmentation Method for Noisy Images.	286
11.4	Method for Texture Image Segmentation	290
11.5	Conclusion.	294
	References.	294

Computer Vision in Control Systems-2

Innovations in Practice

Favorskaya, M.N.; Jain, L.C. (Eds.)

2015, XVI, 295 p. 139 illus., 72 illus. in color., Hardcover

ISBN: 978-3-319-11429-3